**SECTION 33 05 23.13**

**UTILITY HORIZONTAL DIRECTIONAL DRILLING**

**BASED ON DFD MASTER SPECIFICATION DATED 09/01/2015**

This section has been written to cover most (but not all) situations that you will encounter. Depending on the requirements of your specific project, you may have to add material, delete items, or modify what is currently written. The Division of Facilities Development expects changes and comments from you.

# PART 1 - GENERAL

**SCOPE**

The work under this section shall consist of providing all work, materials, labor, equipment, and supervision necessary to complete directional drilling, testing and other work, as required in these specifications, on the drawings, and as otherwise deemed necessary to complete the work. Included are the following topics:

PART 1 - General

Scope

Related Work

Submittals

Quality Assurance

As-Built Documents

PART 2 - Materials

Polyethylene Resin

Polyethylene Piping

Polyethylene Fittings

Pipe Marking

Tracer Wire

Drilling Fluid

PART 3 - Execution

General

Excavation, Backfill, and Compaction

Handling Pipe

Drilling

Joining Pipe  
Ream and Pullback

#### RELATED WORK

Applicable provisions of Division 1 govern work under this Section.

***Note to the Designer: Include any additional related work sections***

Section 02 32 00 – Geo Technical Investigation

Section 30 05 00 – Common Work Results for All Exterior Work

Section 31 25 00 – Erosion Control

Section 31 20 00 – Earthmoving

Section 31 23 16.13 – Trenching

Section 33 11 00 – Water Utility Distribution Piping

Section 33 30 00 – Sanitary Sewerage Utilities

Section 33 40 00 – Storm Drainage Utilities

#### submittals

Submit shop drawings, catalog data, and manufacturer’s technical data showing complete information on resin, pipe and fittings material composition, physical properties, and dimensions of the new pipe and fittings. Include manufacturer’s recommendations for handling, storage, and repair of pipe and fittings if damaged. Furnish a certificate of compliance with specified pipe material requirements.

Provide written drilling plan outlining proposed equipment and construction methods, including the following:

* Detailed description of the procedures including construction techniques to provide the access required to install the pipeline
* Dimensioned drawings of any proposed changes in the pipe alignment or profile
* Literature describing in detail the drilling system to be used, including drill steering and locating system.
* Certification by the machine manufacturer that the drilling equipment has been successful in installing similar size pipe in similar soil and groundwater conditions.
* Drawings showing: Layout of boring and receiving locations and associated equipment at each location, grade and alignment control system details, groundwater control provision of drilling equipment.
* Calculations demonstrating that the pipe selected has been designed to support the maximum anticipated earth loads and superimposed live loads, static and dynamic, which may be imposed on the pipe. Determine the additional stresses imposed on the pipe during drilling operations and upgrade the quality and strength of the pipe and pipe joints to the extent necessary.
* Certification from the pipe manufacturer that the pipe and pipe joints are manufactured for drilling installation and conform to current specifications.
* Qualifications and experience record of the drilling superintendent and machine operators.
* Drilling fluid generation and management

Provide a directional drilling contingency plan that accounts for the following:

* Unforeseen obstructions that stop or delay the progress of drilling equipment
* Deviation from planned line and grade in excess of allowable tolerances
* Loss of drilling fluid
* Damage to other utilities
* Soil settlement or heaving

Provide a high density polyethylene (HDPE) fusion welding quality assurance plan.

Provide certifications of training by the polyethylene pipe fusing equipment manufacturer(s) stating that the operators of polyethylene fusion equipment have been fully trained in the use of the fusion equipment used on the project.

Provide written copies of quality assurance test results and reports performed by or for the contractor.

Within 48 hours of completing the pilot hole for each run of pipe, provide the log of the drilling operation and guidance system records documenting the line and grade of that pilot hole to the DFD Project Representative and the AE. Note the location of any utilities or difficult drilling that was encountered.

#### quality assurance

Note to the Designer: Edit quality assurance testing requirements as necessary to account for project specific requirements.

Provide additional quality assurance testing as required by applicable utility specification sections.

Provide quality assurance testing for HDPE welding as recommended by the manufacturer.

Pressure Testing:

Conduct tests in accordance with applicable utility specification sections. Allowable leakage for high density polyethylene pipe shall be zero. Testing shall be conducted in the presence of the DFD Project Representative or the A/E.

Tracer Wire Continuity Testing:

Continuity test shall be conducted using an ohmmeter. Resistance on tracer wire shall be no greater than 105% of the specified resistance of the tracer wire. Testing shall be conducted in the presence of the DFD Project Representative unless this requirement is waived. Provide a written report describing equipment used, test methods, and detailed test results. In the event of a failed test, Contractor shall make all necessary repairs required to provide a tracer wire system that complies with the testing requirements of this section.

Provide additional quality assurance testing as required by applicable utility specification sections.

**AS-BUILT DOCUMENTS**

Provide printed record of actual horizontal and vertical location of installed pipe from borehole survey instrumentation in addition to marked up drawings.

**PART 2 - MATERIALS**

Note to the Designer: Edit material specifications as necessary to account for project specific requirements. Comply with the substantive requirements of the materials described below. Alternatively, pipe and fitting specifications may also be included in applicable utility specification sections.

***Fusible PVC Pipe may be considered if AE has experience with fusible PVC pipe. Discuss with DFD PM and DFD technical reviewer before specifying.***

**Polyethylene RESIN**

Polyethylene resin used for manufacturing piping and fittings shall meet ASTM D1248 for Type III, Class C, Grade P34, Category 5, with a PPI recommended designation of PE3408 and a minimum cell classification of PE 345434C in accordance with ASTM D3350. The polyethylene compound shall be combined with carbon black to provide protection against degradation by ultraviolet light. Pipe shall be made from virgin material with no rework compound, except that obtained from the manufacturer’s own production of the same formulation.

**POLYETHYLENE PIping**

High density polyethylene (HDPE) piping, shall meet the requirements of AWWA C906, current version. Pipe dimensions and workmanship shall be in accordance with ASTM F714 and ASTM D2122. Pipe shall be of diameter shown on the drawings, with dimension ratio (DR) of DR11, unless otherwise noted.

Pipe, fittings, and joints shall meet or exceed the following physical properties:

|  |  |  |
| --- | --- | --- |
| Property | ASTM Test method | Value |
| Density, gm/cc | D1505 | 0.955 |
| Melt Index, gm/10 min | d1238-e | 0.10 |
| High Load Melt Index, gm/10 min | D1238-F | 12.0 |
| Tensile Strength @ Break, psi | d638 | 4,500 |
| Tensile Strength @ Yield, psi | d638 | >3,200 |
| Elongation, % | d638 | >800 |
| Flexural Modulus, psi | d790 | 136,000 |
| Environmental Stress Cracking Resistance F20’ Hours (100°c) | d1693 (Cond. C) | >5,000 |
| Brittleness Temperature, °f | d746 | <-180 |
| Melting Point, °f | d789 | 261 |
| Vicat Softening Temperature, °f | d1525 | 255 |
| Hardness, Shore D | D2240 | 66 |
| Volume Resistivity, ohm-cm | D991 | 2.6 1016 |
| Recommended Hydrostatic Design Stress: |  | 1600 psi @ 73.4°F 800 psi @ 140°F |

**polyethylene fittings**

HDPE fittings manufactured in accordance with ASTM D2683 (socket fused) or ASTM D3261 (butt fused). Fittings shall be supplied by the HDPE piping manufacturer. Butt fusion outlets shall be made to the same dimensional characteristics and tolerances as the mating pipe. All fittings and custom fabrications shall be fully rated for the same internal pressure as the mating pipe. Pressure de-rated fabricated fittings are prohibited.

**PIPE MARKING**

Each length of straight and special pipe and each fitting shall be plainly marked on the outside to identify the design pressure or class of pipe, proper location of the pipe or fitting in the pipeline, and the date of manufacture.

**tracer wire**

Tracer wire shall be #10 stainless steel wire with 45 mil HDPE jacket.

**drilling fluid**

ANSI/NSF 60 (Drinking Water Treatment Chemicals – Health Effects) certified bentonite-based drilling fluid.

**PART 3 - EXECUTION**

**General**

Comply with the requirements of applicable specification sections for the utility line being installed.

Conduct any necessary field surveys, subsurface investigations and geotechnical investigations necessary to complete the work.

Locate all known utilities located adjacent to or crossing the utility line being installed. Excavate to expose utilities prior to initiating drilling and verify applicable clearances. Clearance shall meet applicable code requirements and the requirements of the directional drilling process.

Locate and verify the clearance of known structures and foundations/footings located adjacent to or crossing the utility line being installed.

#### excavation, BACKFILL, AND COMPACTION

Excavate insertion and receiving pits, and other access points as necessary to complete the work.

Comply with applicable requirements of Section 31 23 16.13, Trenching.

#### handling pipe

Storage and handling of polyethylene pipe shall not result in damage to or deformation of the pipe. Protect polyethylene pipe from long-term exposure to temperature fluctuations and sunlight.

Prepare pipe on a relatively smooth surface, free of sharp rocks, sticks, or debris. Utilize cribbing, pipe stands, rollers, or other equipment as necessary to support the pipe.

Lift and move piping using ropes, slings, or straps. Do not use unprotected chains, hooks, or clamps to lift pipe.

When lifting and moving pipe, provide a minimum of two points of support. Do not support pipes at butt-fused joints.

Sections of pipes with cuts and gouges exceeding 10 percent of the pipe wall thickness or kinked sections shall be removed and rejoined at the Contractor’s expense.

Plug all pipes at end of each workday. Provide a watertight plug to prevent entry of foreign materials into the pipe.

**dRILLING**

Drilling methods shall generally consist of drilling a pilot hole the length of the bore, followed by reaming and pullback of the pipeline. Ream borehole multiple times, as necessary. The equipment and methods used to complete the bore and install piping shall be determined by the Contractor, but subject to the Contract Documents.

The drill staging area shall be kept neat and orderly and disturb as little area as possible. The pipe staging area shall disturb as little area as needed to accommodate workers and equipment, and to string, fuse, and inspect the pipe.

Install all pulleys, rollers, bumpers, alignment control devices and other equipment required to support and protect the new pipe from damage during installation.

Utilize a drilling fluid cleaning/recycling system. Entry and exit pits shall be sized and constructed to completely contain drilling fluid.

Install boring to line and grade shown on drawings. Alignment shall be within tolerances specified in applicable utility specification sections.

Borehole survey instrumentation shall be used to monitor line and grade of the pilot hole. Contractor shall maintain records documenting the line and grade of the pilot hole.

Contractor shall notify the DFD Project Representative upon completion of the pilot hole to observe alignment prior to reaming and pullback.

**joining pipe**

At start of each day, complete fusion weld tests in accordance with manufacturer’s recommendations to verify that fusion equipment is operating properly.

Polyethylene pipe ends shall be joined using butt fusion methods. Join polyethylene pipe to polyethylene fittings using butt fusion or socket or saddle fusion methods. Fusion methods shall comply with both pipe and fusion equipment manufacturers’ requirements and ASTM F2620.

The tensile strength at yield of the butt-fusion joints shall not be less than the pipe. A specimen of pipe cut across the butt-fusion joints shall be tested in accordance with ASTM D638.

Join polyethylene pipe to mechanical joint or flanged fittings in accordance with both fitting and pipe manufacturers’ requirements. Provide HDPE pipe stiffeners, wedge type retainer glands, and clamp type joint restraint system.

### Connect terminal sections of pipe that are joined within excavations with electrofusion couplings. Couplings shall be as manufactured by Central Plastics, Inc., Integrity Fusion Products, Inc., IPEX USA, or equal

### ream and pullback

Pilot hole shall be back-reamed to accommodate pipe. Contractor shall select the reamer size and number of passes required.

Pull pipe back using swivel to prevent torsion of pipe.

Monitor tension forces on pipe during pullback. Do not exceed maximum stresses recommended by the pipe supplier.

Support pipeline during pullback operations. Provide supports/rollers in accordance with manufacturer’s recommendations. Supports and rollers shall allow for free movement of the pipeline and prevent damage to the pipe.

Use a drilling fluid in conjunction with the installation of the pipe to fill the annular space around the installed pipeline. The Contractor shall be responsible for determining the type of fluid to use, and for properly disposing of all excess drilling fluid and slurry material recovered from the hole during drilling operations and displaced by the pipe during installation.

Unless otherwise noted on the drawings, terminate and cap carrier pipe 5’ above the proposed ground surface.

Install tracer cable during pullback operations. Extend tracer cable to end of carrier pipe and secure. Test continuity of the tracer cable prior to demobilizing.

Allow the manufacturer’s recommended amount of time for cooling and relaxation due to tensile stressing prior to connecting pipe to adjacent pipe sections, fittings, or structures, or backfilling of the insertion pit. Provide sufficient excess length of new pipe at insertion pits to allow for cooling and relaxation.

**END OF SECTION**