

SECTION 13 70 00
UTILITY HORIZONTAL DIRECTIONAL DRILLING

PART 1 - GENERAL**1.1 DESCRIPTION**

- A. Furnishing and installing underground utilities using the horizontal directional drilling (HDD) method of installation, also commonly referred to as directional boring or guided horizontal boring.
- B. This work shall include all services, equipment, materials, and labor for complete and proper installation in accordance with these Specifications and as shown on the Contract Drawings.

1.2 RELATED WORK

- A. Maintenance of Existing Utilities: Section 01 00 00, GENERAL REQUIREMENTS.
- B. Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing: Section 31 20 11, EARTH MOVING.
- C. Protection of Materials and Equipment: Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- D. Sanitary Sewer Pumping Facilities, Division 22, PLUMBING.
- G. Underground piping: Section 33 30 00, Sanitary Sewerage Utilities.

1.3 QUALITY ASSURANCE

- A. The requirements set forth in this document specify a wide range of procedural precautions necessary to ensure that the very basic, essential aspects of a proper directional bore installation are adequately controlled. Strict adherence shall be required under specifically covered conditions outlined in this specification. Adherence to the specifications contained herein, or the Contracting Officer's Representative's (COR) approval of any aspect of any directional bore operation covered by this specification, shall in no way relieve the Contractor of their ultimate responsibility for the satisfactory completion of the work authorized under the Contract.
- B. Directional drilling and pipe installation shall be done only by an experienced Contractor whose key personnel have at least five (5) years experience in this work.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturers' Literature and Data: Submit the following as one package:
 - 1. HDPE Pipe, Fittings, Appurtenances, and any other item which is to be an installed component of the project.

- C. WORK PLAN: At least thirty (30) days prior to beginning work, the Contractor shall submit to the Contracting Officer's Representative a general Work Plan outlining the procedure to be used to execute HDD. Plan should document the thoughtful planning required to successfully complete the project. The Plans shall include:
1. Work Schedule.
 2. Detailed Plan and Profile of the bores plotted at a scale no smaller than 1 inch equals 20 feet horizontal and vertical.
 3. Listing of major equipment.
 4. Listing of supervisory personnel (including experience with HDD).
 5. Description of methods to be used.
- D. AS-BUILT DRAWING.
- E. Drilling logs.
- F. Upon request, pre-project photographs and/or video.

1.5 REFERENCES

- A. American Association of State Highway and Transportation Officials (AASHTO)
1. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in) Drop.
- B. U.S. National Archives and Records Administration (NARA)
1. 29 CFR 1926.652 - Safety and Health Regulations for Construction; Subpart P, Excavations; Requirements for Protective Systems.

1.6 CHANGES IN LAYOUT

- A. Contractor may request changes to the proposed horizontal and vertical alignment of the installation and the location of the entry and exit points. Proposed changes shall be submitted in writing to the Contracting Officer's Representative and include a Work Plan as described in 1.4 above and the reasons for the proposed changes. All proposed changes must receive the approval of the Contracting Officer's Representative prior to construction.

PART 2 - PRODUCTS

2.1 HIGH DENSITY POLYETHYLENE (HDPE) PIPE & FITTINGS

- A. HDPE pipe and fittings for sanitary force main sewer systems shall be as specified in Section 33 30 00, SANITARY SEWERAGE UTILITIES.

2.2 DUCTILE IRON (D.I.) FITTINGS

- A. D.I. fittings for sanitary force main sewer systems shall be as specified in Section 33 30 00, SANITARY SEWERAGE UTILITIES.

2.3 DRILLING EQUIPMENT

- A. The directional drilling equipment shall consist of a directional drilling rig of sufficient capacity to perform the bore and pullback the

pipe, a drilling fluid mixing and delivery system of sufficient capacity to successfully complete the drilling, a guidance system to accurately guide boring operations, and trained and competent personnel to operate the system. All equipment shall be in good, safe operating condition with sufficient supplies, materials, and spare parts on hand to maintain the system in good working order for the duration of the project.

- B. Include in directional drilling equipment machine safety requirements a common grounding system to prevent electrical shock in the event of underground electrical cable strike. Ensure the grounding system connects all pieces of interconnecting machinery; the drill, mud mixing system, drill power unit, drill rod trailer, operator's booth, worker grounding mats, and any other interconnected equipment to a common ground. Equip the drill with an "electrical strike" audible and visual warning system that notifies the system operators of an electrical strike.

2.4 DRILLING SYSTEM

- A. The directional drilling machine shall consist of a hydraulically powered system to rotate, push, and pull hollow drill pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill (bore) head. The machine shall be anchored to the ground to withstand the pulling, pushing, and rotating pressure required to complete the bore.
- B. The hydraulic power system shall be self-contained with sufficient pressure and volume for power drilling operations. Hydraulic system shall be free of leaks.
- C. Rig shall have a system to monitor and record maximum pullback pressure during pullback operations.
- D. The drill head shall be steerable by changing its rotation and shall provide the necessary cutting surfaces and drilling fluid jets.
- E. If required, mud motors shall be of adequate power to turn the required drilling tools.

2.5 DRILL ROD

- A. Select the appropriate drill rod to be used. Submit certified statement that the drill rod has been inspected and is in satisfactory condition for the intended use to the Contracting Officers Representative.

2.6 GUIDANCE SYSTEMS

- A. The Guidance system shall be of a proven type and shall be set up and operated by personnel trained and experienced with the system.

- B. Walkover guidance systems are not acceptable for this project; use a magnetic survey tool locator installed behind the pilot string cutting head and an electric grid (e.g., TruTracker®) system for this project.
- C. The operator shall be aware of any magnetic anomalies and shall consider such influences in the operation of the guidance system.

2.7 DRILLING FLUID (MUD) SYSTEM

- A. A self-contained, closed drilling fluid mixing system shall be of sufficient size to mix and deliver drilling fluid composed of bentonite clay, potable water, and appropriate additives. Mixing system shall be able to molecularly shear individual bentonite particles from the dry powder to avoid clumping and ensure thorough mixing. The drilling fluid reservoir tank shall be of adequate volume. Mixing system shall continually agitate the drilling fluid during drilling operations.
- B. The mud pumping system shall have a flow capacity and constant minimum discharge pressure to adequately deliver the drilling fluid. The delivery system shall have filters in-line to prevent solids from being pumped into the drill pipe. Connections between the pump and drill pipe shall be relatively leak free. Used drilling fluid and drilling fluid spilled during drilling operations shall be contained and properly disposed of. A berm, minimum 12 inches high, shall be maintained around drill rigs, drilling fluid mixing system, entry and exit pits, and drilling fluid recycling system (if used) to prevent spills into the surrounding environment. Pumps and/or vacuum truck(s) of sufficient size shall be in place to convey excess drilling fluid from containment areas to storage facilities.
- C. Use a high quality bentonite drilling fluid to ensure hole stability, cuttings transport, bit and electronics cooling, and hole lubrication to reduce drag on the drill pipe and product pipe. Use only fluid with a composition that complies with all federal, state, and local environmental regulations.
- D. Mix the bentonite drilling fluid with potable water with a pH of 8.5-10 and appropriate additives to ensure no contamination is introduced into the soil during drilling, reaming, or pipe installation process. The Contractor is responsible for any required pH adjustments.
- E. Collect drilling fluid returns in the entrance pit, exit pit, or spoils recovery pit. Immediately clean up any drilling fluid spills or overflows from these pits.
- F. Disposal of the drilling fluids is the responsibility of the Contractor. Conduct disposal in compliance with all relevant environmental

regulations, right-of-way and work space agreements, and permit requirements.

2.8 PIPE ROLLERS

- A. Pipe rollers, if required, shall be of sufficient size to fully support the weight of the pipe during pullback operations. Sufficient number of rollers shall be used to prevent excess sagging of pipe.

PART 3 - EXECUTION

3.1 GENERAL

- A. The COR must be notified 48 hours in advance of starting work. The Directional Bore shall not begin until the COR is present at the job site and agrees that proper preparations for the operation have been made. The COR approval for beginning the installation shall in no way relieve the Contractor of the ultimate responsibility for the satisfactory completion of the work as authorized under the Contract.
- B. All personnel shall be fully trained in their respective duties as part of the directional drilling crew and in safety procedures. Contractor shall adhere to all applicable state, federal and local safety regulations and all operations shall be conducted in a safe manner.
- C. Prior to any alterations to work-site, contractor shall photograph or video tape entire work area, including entry and exit points. One copy of which shall be given to COR upon request and one copy to remain with contractor for a period of one year following the completion of the project. No alterations beyond what is required for operations are to be made. Contractor shall confine all activities to designated work areas.
- D. DRILL PATH SURVEY: Entire drill path shall be accurately surveyed with entry and exit stakes placed in the appropriate locations within the areas indicated on the drawings. If Contractor is using a magnetic guidance system, drill path will be surveyed for any surface geo-magnetic variations or anomalies.
- E. ENVIRONMENTAL PROTECTION:
 - 1. Contractor shall protect from drilling operations all drainage, wetland, waterway or other area designated for such protection by contract documents, state, federal and local regulations. Additional environmental protection necessary to contain any hydraulic or drilling fluid spills shall be put in place, including berms, liners, turbidity curtains and other measures. Contractor shall adhere to all applicable environmental regulations. Fuel or oil may not be stored in bulk containers within 200' of any water-body or wetland.

2. Equipment (graders, shovels, etc.) and materials (such as groundsheets, hay bales, booms, and absorbent pads) for cleanup and contingencies shall be provided in sufficient quantities by the Contractor and maintained at all sites for use in the event of inadvertent leaks, seeps or spills.

- F. The required piping shall be assembled in a manner that does not obstruct adjacent roadways or public activities.
- G. All HDPE pipe shall be cut, fabricated, and installed in strict conformance with the pipe manufacturer's recommendations. Joining, laying, and pulling of HDPE pipe shall be accomplished by personnel experienced in working with polyethylene pipe.
- H. Care shall be taken during transportation of the pipe to ensure that it is not cut, kinked, or otherwise damaged.
- I. The handling of the joined pipeline shall be in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. Ropes, fabric, or rubberprotected slings and straps shall be used when handling pipes. Chains, cables, or hooks inserted into the pipe ends shall not be used.

3.2 DRILL ENTRANCE AND EXIT PITS

- A. The Contractor is responsible for design, final location, and construction of the drill entrance and exit pits.
- B. Drill entrance and exit pits are required. Maintain at minimum size to allow only the minimum amount of drilling fluid storage prior to transfer to mud recycling or processing or removal from the site.
- C. Do not allow drilling mud to flow freely on the site or around the entrance or exit pits. Remove spilled mud and restore ground to original condition. Provide shore pits in compliance with OSHA Standards, 29 CFR 1926.652.
- D. When drilling near wetlands or water courses, provide secondary containment to prevent drilling fluids from entering the wetlands or water course, and secure written approval of secondary containment plan from the Contracting Officer's Representative.

3.3 DRILL ENTRANCE AND EXIT ANGLE

- A. Ensure entrance and exit angles and elevation profile maintains adequate cover to reduce risks of drilling fluid breakouts and ground exit occurs as specified herein. Ensure that the entrance and exit angles ensure pullback forces do not exceed 5 percent strain on the polyethylene pipe.

3.4 PILOT HOLE

- A. The type and size of the pilot string cutting head and the diameter of the drill pipe is at the Contractor's discretion.
- B. Drill the pilot hole along the path shown on the plan and profile drawings. Pilot hole tolerances are as follows:
 - 1. Vertical Tolerance: Provide minimum cover and clearance below crossing utilities as shown on the plans. The Contractor may go deeper if necessary to prevent breakout or conflicts.
 - 2. Horizontal Tolerance: Plus/minus - 36 inches from the centerline of the product pipe.
 - 3. Curve Radius: No curve is acceptable with a radius less than 400 feet.
 - 4. Entry Point Location: Make pilot hole entry point within plus/minus - 60 inches of the location shown on the drawings or as directed by the Contracting Officer's Representative.
 - 5. Exit Point Location: Make pilot hole exit point within plus/minus - 60 inches of the location shown on the drawings or as directed by the Contracting Officer's Representative.
 - 6. The installed pipeline cover and clearance requirements as shown on the drawings or as specified are mandatory.

3.5 REAMING

- A. Conduct reaming operations at the Contractor's discretion. Determine the type of back reamer to be utilized by the type of subsurface soil conditions that are encountered during the pilot hole drilling operation. The reamer type is at the Contractor's discretion.

3.6 PULLBACK

- A. Fully assemble the entire pipeline to be installed via directional drill prior to commencement of pullback operations.
- B. Support the pipeline during pullback operations in a manner to enable it to move freely and prevent damage. Install pipeline in one continuous pull.
- C. Minimize torsion stress by using a swivel to connect the pull section to the reaming assembly.
- D. Maximum allowable tensile force imposed on the pull section is not to exceed 90 percent of the pipe manufacturer's safe pull (or tensile) strength. If the pull section is made up of multiple pipe size or materials, the lowest safe pull strength value governs and the maximum allowable tensile force is not to exceed 90 percent of this value.
- E. Minimize external pressure during installation of the pullback section in the reamed hole. Replace damaged pipe resulting from external

pressure at no cost to the Government. Buoyancy modification is at the discretion of the Contractor.

3.7 CONNECTION OF PRODUCT PIPE TO SANITARY SEWER

- A. After the product pipe has been successfully installed, allow product pipe to recover for at least 24 hours prior to connection to the forcemain and prior to installing any cleanouts. The Contractor is responsible for ensuring that a sufficient length of the product pipe has been pulled through the hole so that the pull-nose is not pulled back into bore hole due to stretch recovery of the product pipe.

3.8 DOCUMENTATION

- A. Maintain drilling logs that accurately provide drill bit location (both horizontally and vertically) at least every 2 inches along the drill path. In addition, keep logs that record, as a minimum the following, every 15 minutes throughout each drill pass, back ream pass, or pipe installation:
 - 1. Drilling Fluid Pressure
 - 2. Drilling Fluid Flow Rate
 - 3. Drill Thrust Pressure
 - 4. Drill Pullback Pressure
 - 5. Drill Head Torque
- B. Make all instrumentation, readings, and logs available to the Contracting Officer's Representative at all times during operation.
- C. Submit an electronic copy and three hard copies of the record drawings to the Contracting Officer's Representative within five days after completing the pullback. Include in the record drawings a plan, profile, and all information recorded during the progress of the work. Clearly tie the record drawings to the project's survey control. Maintain and submit upon completion complete, signed final logs of guided directional drill operations.

3.9 UTILITY LOCATING AND MARKING

- A. Locate and clearly mark all utilities prior to start of excavation or drilling. The Contractor is responsible for damage to utilizes, and repairs for such damages, at no cost to the Government.

3.10 CLEANUP AND FINAL CLOSEOUT

- A. Immediately upon completion of work of this Section, remove all rubbish and debris from the job site. Remove all construction equipment and implements of service leaving the entire area involved in a neat condition acceptable to the Contracting Officer's Representative.
- B. Immediately clean "blow holes" or "breakouts" of drilling fluid to the surface and return the surface area to its original condition. Dispose

of all drilling fluids, soils, and separated materials in compliance with federal, state, and local environmental regulations.

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