

**SECTION 02235
HORIZONTAL DIRECTIONAL DRILLING (HDD)**

PART 1 GENERAL

1.01 SCOPE

The work specified in this section consists of 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. This work shall include all services, equipment, materials, and labor for the complete and proper installation, testing, restoration of underground utilities and environmental protection and restoration.

1.02 QUALITY ASSURANCE

These requirements specify a wide range of procedural precautions to insure the essential aspects of a directional bore installation are adequately controlled. Adherence to the specifications contained herein shall in no way relieve the contractor of the ultimate responsibility for the satisfactory completion of the work.

1.03 PROJECT SCHEDULE AND COOPERATION

The project schedule shall be established on the basis of working a normal work schedule including five days per week, single shift, and eight hours per day or four days per week, single shift, ten hours per day. General items of work, such as bacteriological testing, leakage and pressure testing, density testing and final inspections, shall be scheduled during the normal work schedule.

1.04 WARRANTY

The contractor shall supply to the City an 18-month unconditional warranty. The warranty shall include materials and installation and shall constitute complete replacement and delivery to the site of materials and installation of same to replace defective materials or defective workmanship with new materials/workmanship conforming to the specifications.

1.05 REFERENCED STANDARDS

The work shall conform to applicable provisions of applicable AWWA standards and of the City Water, Sewer & Natural Gas Design Guidelines.

1.06 PERMITS

Permits for all work shall be obtained by the owner. The contractor shall verify the existence of all permits before commencing any work on the project.

1.07 NOTIFICATION

The City of Thomasville shall be notified 48-hours (minimum) in advance of starting the drilling work. The Directional Bore procedure shall not begin until the proper

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preparations (see work plan) for the operation have been completed.

1.08 SUBMITTALS

A. Work Plan

Prior to beginning work, the contractor shall submit to the City of Thomasville a work plan detailing the procedure and schedule to be used to properly execute the project.

B. Shop Drawing Submittals

Actual catalog data, brochures and descriptive literature shall not be required for items of standard usage which meet the requirements of the City Water, Sewer & Natural Gas Design Guidelines and Specifications. Any specialty item not shown in this manual shall require a complete shop drawing submittal for any material which may, in the opinion of the Engineer, not be in compliance with the City Water, Sewer & Natural Gas Design Guidelines & Specifications.

C. Record Drawing

The contractor shall submit as-built records in duplicate to the City within five days after completing the pull back, the as-built records shall include a plan, profile, and all information recorded during the progress of the work, including all subsurface anomalies identified by Ground Penetrating Radar (GPR) or vacuum excavation.

1.09 SITE PREPARATION

A. Prior to any alterations to worksite, the contractor shall video tape entire work area, one copy of which shall be given to the City and one copy to remain with the contractor.

B. The contractor shall coordinate utilities locates with the Utilities Protection Center of Georgia (1-800-282-7411). Once the locate service has field marked all utilities, the contractor shall verify each utility (including any service laterals, i.e. water, sewer, cable, gas, electric, phone, etc.) and those within each paved area. Verification may be performed utilizing GPR, hand dig, or vacuum excavation. Prior to initiating drilling, the contractor shall record on the drawings both the horizontal and vertical location of the utilities off of a predetermined baseline. The contractor shall utilize the GPR over the projected bore path whether utilities are located in the horizontal drill pathway or not, in order to reduce the opportunity of conflicting with any unforeseen obstructions.

C. Work site shall be graded and filled to provide a level working area. No alterations beyond what is required for operations are to be made. The contractor shall confine all alteration activities to designated work areas.

D. Following drilling operations, the contractor shall demobilize equipment and restore the work-site to original condition. All excavations shall be backfilled and compacted to a minimum of 95% of original density.

1.10 ENVIRONMENTAL PROTECTION

The contractor shall provide and install silt fencing between all drilling operations and

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any drainage, wetland, waterway or other area designated for such protection by state, federal and local regulations. The contractor shall place hay bales, or approved protection, to limit intrusion upon project area. 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. The contractor shall adhere to all applicable environmental regulations including environmental condition stated in local, state and federal permits.

1.11 SAFETY

The contractor shall adhere to all applicable state, federal and local safety regulations and all operations shall be conducted in a safe manner.

1.12 PERSONNEL QUALIFICATIONS CERTIFICATION-DIRECTIONAL BORING:

All personnel shall be fully trained in the respective duties as part of the directional drilling crew and in safety. A supervisor thoroughly familiar with the equipment and type of work to be performed shall be in direct charge and control of the operation at all times. The supervisor shall be present at the job site during the actual directional bore operation. The contractor shall have a sufficient number of competent workers on the job at all times to insure the directional bore procedure shall be made in a timely and satisfactory manner.

PART 2 PRODUCTS & EQUIPMENT

2.01 DRILLING FLUIDS

Drilling Fluids shall be an environmentally safe product approved by the City.

2.02 DELIVERY, STORAGE AND HANDLING OF MATERIALS

- A. The contractor shall inspect materials delivered to the site for damage. All materials found during inspection or during the progress of work to have cracks, flaws, cracked linings, or other defects shall be rejected and removed from the job site without delay.
- B. The contractor shall unload and store materials as near the place where the work shall be performed, allowing for minimum handling. Material shall be stored under cover or out of direct sun light. Do not store materials directly on the ground. Keep all materials free of dirt, debris and vermin.
- C. The contractor is responsible for obtaining, transporting and sorting any fluids, including water, to the work site.
- D. Disposal of fluids shall be the responsibility of the contractor. Disposal of fluids shall be done in a manner that is in compliance with all permits and applicable federal, state, or local environmental regulations. The contractor shall thoroughly clean entire area of any fluid residue upon completion of installation, and replace any and all plants and sod damaged, discolored or stained by drilling fluids.

2.03 ELECTRONIC LOCATOR WIRE (ELW) AND INSTALLATION

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The contractor shall furnish and install two (2) ELWs with the HDPE horizontal directional drilled mains. ELWs shall be 12-gauge (AWG) strand copper wire with 30-mils (minimum) insulation. The exterior color shall be blue, green, or yellow (dependant upon type of utility). The Locate wire shall be brought to grade within a valve box or locate station box at all “entry point locations: and all “exit point locations”. There shall be a maximum length or interval of 500-feet between locate wire stations. No splices or connections shall be allowed underground. Wire shall be spliced together using DRYCONN waterproof connectors. After installation, the contractor shall perform a wire continuity test in the presence of the City Inspector.

2.04

EQUIPMENT

A. General

The directional drilling equipment shall consist of a safe directional drilling rig of sufficient capacity to perform the bore and pullback the pipe, a drilling fluid mixing, delivery and recovery system of sufficient capacity to successfully complete the drill, a drilling fluid recycling system to remove solids from the drilling fluid so that the fluid can be re-used, a guidance system to accurately guide boring operations, a vacuum truck of sufficient capacity to handle the drilling fluid volume, trained and competent personnel to operate the system.

B. Drilling System

1. Drilling Rig: The directional drilling machine shall consist of a safe power 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.
2. Drill Head: The drill head shall be steerable by changing its rotation and shall provide the necessary cutting surfaces and drilling fluid jets.
3. Mud Motors (if required): Mud motors shall be of adequate power to turn the required drilling tools.
4. Drill Pipe: Shall be constructed of high quality 4130 seamless tubing, grade D or better.

C. Guidance System

A Magnetic Guidance System (MGS) or proven gyroscopic system shall be used to provide a continuous and accurate determination of the location of the drill head during the drilling operation. The guidance shall be capable of tracking at all depths up to eighty feet and in any soil condition, including hard rock. It shall enable the driller to guide the drill head by providing immediate information on the tool face, azimuth (horizontal direction), and inclination (vertical direction) The guidance system shall be accurate to +/-2% of the vertical depth of the borehole at sensing position at depths up to one hundred feet and accurate within 1.5 meters horizontally.

D. Drilling Fluid (Mud) System

1. Mixing System: A self-contained, closed, drilling fluid mixing system shall be of

sufficient size to mix and deliver drilling fluid. Mixing system shall continually agitate the drilling fluid during operations.

2. **Drilling Fluids:** Clean and safe drilling fluid shall be composed of clean water, appropriate additives and clay. No potentially hazardous material shall be used in drilling fluid.
3. **Delivery System:** 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. A berm, minimum of 12-inches high, shall be maintained around drill rigs, entry and exit pits to prevent spills into the surrounding environment.
4. **Drilling Fluid Recycling System:** The drilling fluid recycling system shall separate sand, dirt and other solids from the drilling fluid to render the drilling fluid re-usable. Spoils separated from the drilling fluid shall be stockpiled for later use or disposal.

PART3 EXECUTION

3.01 DRILLING PROCEDURES

A. **Drill Path**

Prior to drilling, the contractor shall mark up drawings to determine the drill pathway. The drawings shall be on site at all times during the drill operation.

B. **Guidance System**

The contractor shall provide and maintain instrumentation necessary to accurately locate the pilot hole (both horizontal and vertical displacements), measure pilot string torsional and axial and measure drilling fluid discharge rate and pressure. The City shall have access to instrumentation and readings at all times during operation.

C. **Pilot Hole**

The pilot hole shall be drilled along the path shown on the plans and profile drawings or as directed by the City Engineer in the field. Unless approved otherwise, the pilot-hole tolerances shall be as follows:

1. **Elevation:** As shown on the plans.
2. **Alignment:** +5-Feet and within 3-feet of right-of-way or easement boundary.
3. **Curve Radius:** The pilot hole radius shall be no less than 75% of the maximum bending radius of the pipe being installed.
4. **Entry Point Location:** The exact pilot hole entry point shall be within +5-feet of the location shown on the drawing or as directed by the engineer in the field.
5. **Exit Point Location:** The exit point location shall be within + 5-feet of the location shown on the drawing or as directed by the EOR in the field.

6. Limitations on Depth: If not noted on the plans, 6" HDPE pipe and smaller shall be installed with a depth of 3 to 5-feet and 8-inches HDPE pipe thru 12-inches pipe shall be installed with a depth of 3 to 6-feet unless required to install the pipe deeper due to utility conflicts. HDPE pipe larger than 12-inches shall be specifically required by the engineer and approved by the City of Thomasville. Where utilities cross under GDOT roads, the depth of cover shall comply with applicable GDOT permit.
7. Water Main and Non-Water Main Separation Requirements: The minimum separation requirements between HDPE water main and a non-water main shall be as per Georgia Environment Protection Division regulations.

D. Pull Back

After successfully reaming bore hole, the contractor will pull the pipe through the bore hole. In front of the pipe shall be a swivel and reamer to compact bore hole walls. Once pull-back operations have commenced, operations shall continue without interruption until pipe is completely pulled into bore hole. In the event that pipe becomes stuck, the contractor shall cease pulling operations to allow any potential hydro-lock to subside. If pipe remains stuck, the contractor will notify the City to discuss options and before work shall proceed.

3.02 PIPE ASSEMBLY AND INSPECTION

A. General

Pipe shall be welded/fused together in one length, if space permits. Pipe shall be placed on pipe rollers before pulling into bore hole to minimize damage to the pipe. For pipes 16-inch and larger, a re-rounding clamp tool shall be utilized during the electro-fusion process to ensure pipe roundness. For pipe sizes larger than 12-inch mechanical scrapers shall be used.

B. Pipe Inspection

Cuts, gouges or holes that penetrate the pipe wall thickness by more than 10 percent shall not be acceptable and shall be cut out and discarded. Before pipe installation, the contractor shall be responsible for carefully inspecting the assembled pipeline to insure that no vandalism or improper acts have occurred to render the new pipeline defective. Any pipeline that has been installed and has failed the required pressure test procedure and upon investigation was found to be defective because of cuts or holes drilled through the pipe walls, shall be removed and/or repaired at expense to the contractor.

C. Mechanical Joining

Polyethylene pipe and fittings may be joined together or to the materials by means of flanged connections (flange adapters, electrofused couplings, and back-up rings) or mechanical couplings designed for joining polyethylene pipe or for joining polyethylene pipe to another material. Mechanical couplings shall be fully pressure rated and fully thrust restrained such that when installed in accordance with manufacturer's recommendations, a longitudinal load applied to the mechanical coupling will cause the

pipe to yield before the mechanical coupling disjoins. External joint restraints shall not be used in lieu of fully restrained mechanical couplings.

D. Mechanical Joint and Flange Installation

Mechanical joints and flange connections shall be installed in accordance with the Manufacturer recommended procedure. Flange faces shall be centered and aligned to each other before assembling and tightening bolts. In no case shall the flange bolts be used to draw the flanges into alignment. Bolt threads shall be lubricated, and flat washers shall be fitted under the flange nuts. Bolts shall be evenly tightened according to the tightening pattern and torque step recommendations of the Manufacturer. At least 1-hour after initial assembly, flange connections shall be re-tightened following the tightening pattern and torque step recommendations of the Manufacturer.

3.03 TESTING

A. Disinfection Tests

1. All water pipe and fittings shall be thoroughly disinfected prior to being placed in service. Disinfection shall follow the applicable provisions of the procedure established for the disinfection of water mains as set forth in AWWA - Standard C651 entitled "AWWA Standard for Disinfecting Water Mains". Bacteriological testing on the water main shall be scheduled with the City Inspector by the contractor. The City shall collect the water samples and shall complete the water samples and be responsible for completing the water analysis (lab testing).
2. Temporary blow-offs shall be installed for the purpose of cleaning the main pipe line. Blow-offs installed on mains up to and including 12-inches shall be the same diameter as the water main. Blow-offs installed on 16-inch mains and larger shall be the next smaller size, in diameter, than the main being tested. Temporary blow-offs shall be removed and plugged after the main is cleared. The City shall be present prior to and during the operation of blow-offs. The main shall be pigged and flushed prior to disinfection.
3. A new water main shall be connected to the existing water main at one point only for flushing purposes. The new main shall have a blow off assembly on the end. After the new main is pigged and thoroughly flushed, the open end shall be sealed and restrained and the main shall be pressure tested. Anytime the new line is reopened (to repair defective joints or pipe, defective fitting or valve) the complete testing process shall be repeated. After successful testing and once bacteriological clearance has been received from the regulatory authority, the new main shall be placed into service.

B. Pressure and Leakage Tests

1. The contractor shall test installed pipelines in accordance with these specifications prior to acceptance of the pipeline by the City. All field tests shall be made in the presence of the engineer and the City Inspector. Except as otherwise directed, all pipelines shall be tested. All piping to operate under liquid pressure shall be tested in sections of approved length. The pressure testing of an HDPE line section shall be tested separately from the PVC and DIP line sections.

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Where impractical, the HDPE test section shall include only a minimum amount of PVC and ductile iron pipe within the test section. If at all possible, the PVC and DIP, test sections shall be left exposed during the pressure test for visual leakage observation. For these tests, the contractor shall furnish clean water, suitable temporary testing plugs or caps, and other necessary equipment, and all labor required: If the contractor chooses to pressure test against an existing City water main valve, the new water main must be disinfected prior to connection to the City line. The City will not be responsible for failure of the pressure test due to the existing valve leaking. The contractor shall furnish suitable pressure gauges, calibrated by an approved testing laboratory, which increments no greater than 2 PSIG, gauges used shall be of such size that pressures tested will not register less than 10% or more than 90% of the gauge capacity. All valved sections shall be hydrostatic tested to insure sealing (leak allowance) of all line valves.

2. The section of pipe to be tested shall be filled with potable water and air shall be expelled from the pipe. If blow offs or other outlets are not available at high points for releasing air, the contractor shall provide 1-inch (minimum taps and blow-off valves (at the 12:00 position), as necessary. The cost of constructing blow-off valves and plugging them, after a successful pressure test, shall be included in the unit price bid amount for the HDPE pipe.
3. Hydrostatic testing shall consist of a 150 PSIG test pressures, based on the elevation of the highest point of the line or section under tests. Pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the engineer. The pump, pipe connection and all necessary apparatus shall be furnished by the contractor and shall be subject to the approval of the engineer.
4. Maximum duration for pressure test, including initial and final phase of the test, shall not exceed 8-hours. If the test is not completed (due to leakage, equipment failure, etc.), depressurize the test section, and then allow it to ‘relax’ for at least 8-hours before bringing the test section back up to test pressure again.

C. Initial Phase of Pressure Testing

All air shall be removed from the test section. If possible, all flanged or mechanical joint valves and fittings shall be left exposed for visual leak inspection. The pressure within the test section should be raised to approximately 160 PSIG and then allowed to be idle for approximately 3-hours. During this 3-hour period, the test section shall be allowed to stabilize and come to an equilibrium stage. No additional make-up water/pressure shall be applied to the test section during this 3-hour stabilization period unless the line pressure drops below 140 PSIG. Make-up water/pressure shall only be applied to the test section to maintain a minimum of 140 PSIG (during the 3-hour stabilization period).

D. Final Phase of Pressure Testing

1. The final phase of the pressure test shall involve applying make-up water/pressure to achieve an “initial test pressure” of 150 PSIG (minimum) / 155 PSIG (maximum). The test section is then allowed to be idle (no make-up water/pressure is added) for a period of 2-hours. After this 2-hour period, make-up water/pressure is applied and measured to reestablish the “initial test

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pressure”. The quantity of water utilized to re-pump the line shall be measured and compared to the allowable quantities as determined by the Table SB-2 -1 below. If the make-up water quantity is equal to or less than the allowable amount, the pressure test passes. If the make-up water quantities are greater than the allowable amount, the pressure test fails.

TABLE SB-2 -1

ALLOWABLE MAKE-UP AMOUNT

<u>Nominal Pipe Size (inches)</u>	<u>Make-UP Water Allowance (U.S. Gallons/100 ft. of Pipe) 2-Hour Test</u>
6	0.30
8	0.50
10	0.65
12	1.15
14	1.40
16	1.65
18	2.15
20	2.75
22	3.50
24	4.40

2. In the event a section fails to pass the tests, the contractor shall do everything necessary to locate, uncover (even to the extent of uncovering the entire section), and replace the defective pipe, valve, fitting or joint. Visible leaks shall be corrected regardless of total leakage. Lines which fail to meet these tests shall be retested as necessary until test requirements are complied with. All testing shall be performed at the contractor’s expense.
 3. If, in the judgment of the City, it is impracticable to follow the foregoing procedures exactly modifications in the procedure shall be made. Re-disinfection shall be required if the line is de-pressurized for repairs.
- E. Natural Gas mains shall be tested in accordance with Section 02685, Gas Mains and Accessories.

END OF SECTION