

## **SECTION 605 –DIRECTIONAL BORING FOR FORCE MAINS**

### **1. GENERAL**

Directional boring operations shall conform to the following specifications.

### **2. CONTRACTOR RESPONSIBILITIES.**

The Contractor shall supply all labor, supervision, tools, equipment, and materials necessary to install pipe by directional bore method. The items include the following:

- Tracer wire for carrier pipe
- Site preparation and excavation
- Dewatering
- Sheeting and shoring, as necessary
- All fusion welding, if required
- Site clean up including removal and disposal of drilling fluid
- Vacuum truck on job site for clean up of drilling fluid
- All pipe, fittings, and couplings
- Final site restoration (sod, seed, mulch, concrete/asphalt repair)
- Required Right-Of-Way Permits

The Contractor shall provide experienced operators to perform directional boring. The operator shall have performed at least three directional bores of similar pipe diameter and bore length.

The Contractor shall be fully responsible for placement of the pipe per the Utility Engineer's specifications.

The Contractor shall record data on a bore log and shall also ensure the following items are monitored and controlled:

- Calibrate locator/tracking system
- Field verify calibration by field measurement of actual location of first rod
- Ensure that the flow of bentonite is continuous
- Ensure pulling pressure does not exceed pipe manufacturer's specification
- Utilization of specified materials

The Contractor shall record location and depth measurements every ten (10) feet over the course of the bore and provide that data to the City. The Contractor shall log all necessary data from the locator tracking system:

- Position
- Roll angle
- Tilt angle

Depth every ten (10) feet  
Temperature of Data Transmitter  
Remaining Battery life  
Pull back force (record maximum pull back force)  
Drilling fluid pressure

The Contractor shall notify all involved agencies prior to start of construction. The Contractor is responsible for verifying that all permits are current and not expired.

The Contractor shall call Kansas One-Call and the City of Salina (785) 826-7305, 2 full days prior to performing any excavation or boring.

The Contractor shall perform directional bore in accordance with the approved project plans or as directed and allowed by the Utility Engineer. In no case shall the bore extend into private property unless an easement is provided prior to start of construction. Vertical tolerances shall be plus or minus 0.5 foot of elevations shown on the drawings or as per City of Salina specifications. Horizontal tolerances shall be plus or minus 1 foot of horizontal alignment shown on drawings. Failure to meet tolerances, if not pre-approved by the Utility Engineer, may be grounds for rejecting the bore.

The Contractor shall provide all structures, safety equipment, and professional services required for the health and safety of the general public and of personnel involved in directional boring work in accordance with the requirements of the Federal, State, and Local Authorities.

The Contractor shall take all measures necessary to protect surrounding public and private property, adjacent buildings, roads, drives, sidewalks, drains, sewers, utilities, trees, structures, and appurtenances from damage due to directional bore work.

The Contractor shall not apply more than the safe pull force to the carrier pipe. This shall be accomplished using an approved breakaway connector between the reamer and the pulling eye.

The Contractor shall install a green coated tracer wire on all wastewater force main carrier pipe.

### 3. EQUIPMENT

The directional drilling equipment shall consist of a directional-drilling rig of sufficient capacity to perform the bore and pull back the pipe. The steerable, directional-boring equipment shall produce a stable fluid-lined tunnel with a minimum burial depth of 4'- 6" for the carrier pipe installation.

The tunneling equipment shall employ a fluid cutting technique. The hydraulic power system shall be self-contained and free of leaks, with sufficient pressure and volume to power the drilling operation.

Calibration of the electronic detection system shall be verified by uncovering the tool head at the first ten (10) foot point.

The boring tool head shall be remotely steerable by means of an electronic detection system. The tool head location shall be monitored in three dimensions and logged every 10-feet from the drilling rig. The boring tool shall pull the carrier pipe through the fluid lined tunnel.

The rig shall have means to monitor and record the maximum pullback during the pullback operation. The pulling strength of the boring equipment shall not exceed the pipe safety pull strength as per manufacturer's recommendation.

#### 4. DIRECTIONAL BORE PIPE

##### A. Polyvinyl Chloride Pipe:

Polyvinyl Chloride Pipe shall be CertainTeed C900/RJ PVC Pipe Manufactured by the CertainTeed Corporation; Eagle Loc 900 PVC Pipe Manufactured by JM Eagle, or approved equal by the Utility Engineer. The pipe is a restrained joint Polyvinyl Chloride Pipe, sizes 4-inch to 12-inch, with cast-iron pipe (CI) outside diameters. Pipe is intended for use in pressure-rated potable water delivery systems, as well as in sewer and fire protection piping systems. The pipe shall be Class 200 (cast iron O.D.) suited for a working pressure of 200 p.s.i. at 73°F and shall be dimension requirements of **DR14**. Pipe shall be manufactured from clean, virgin, NSF approved Class 12454-A or 12454-B PVC conforming to requirements of ASTM D1784 (latest revision).

Pipe and couplings shall be made from unplasticized PVC compounds having a minimum cell classification of 12454, as defined in ASTM D1784. The compound shall qualify for a Hydrostatic Design Basis (HDB) of 4000 psi for water at 73.4 degrees F., in accordance with the requirements of ASTM D 2837.

Restrained joint PVC pipe products shall have been tested and approved by Underwriters Laboratories for continuous use at rated pressures. Copies of agency approval reports or products listings shall be provided to the Utility Engineer. Products intended for contact with potable water shall be evaluated, tested, and certified for conformance with NSF 61 by an acceptable certifying organization.

Nominal outside diameters and wall thicknesses of restrained joint pipe shall conform to the requirements of AWWA C900. Restrained joint pipe shall be furnished in 4", 6", 10", 12" sizes, in Class 305 (DR14). Pipe shall be furnished in standard lengths of 20-feet.

Pipe shall be joined using non-metallic couplings to form an integral system for maximum reliability and interchangeability. High-strength, flexible thermoplastic splines shall be inserted into mating, precision machined grooves in the pipe and coupling to provide full 360-degree restraint with evenly distributed loading. Couplings shall be designed for use at or above the pressure class of the pipe with which they are utilized, and shall incorporate twin elastomeric sealing gaskets meeting the requirements of ASTM F 477. Joints shall be designed to meet the zero leakage test requirements of ASTM D 3139.

Pipe and couplings shall be homogeneous throughout and free from voids, cracks, inclusions and other defects, and shall be as uniform as commercially practicable in color, density and other physical characteristics.

Every pipe and machined coupling shall pass the AWWA C900 hydrostatic proof test requirements of 2 times the pressure class for 5 seconds. Until such time as UL standards are harmonized with AWWA, UL requirements shall be used, which are 4 times the UL pressure class for 5 seconds.

Each length of pipe and couplings shall have marked on the exterior the appropriate manufacturer and pipe specification information. Prior to installation of any pipe on the project, the Contractor shall be required to furnish in writing the proper certification from the manufacturer or a recognized testing agency that the pipe fulfills every requirement of the specifications set forth above.

B. HDPE Pipe:

All sanitary sewer system HDPE pipelines, joints, fittings, shall be in accordance with Section 603 (SANITARY SEWER FORCE MAINS).

5. DRILLING FLUID (“MUD”)

All drilling fluid must be homogenous in nature and must have a pH of 8.5 to 10.0. “Mud” viscosity must meet minimum viscosity as set by the manufacturer for soil conditions expected to be encountered and the contractor shall have appropriate additives for drilling fluid available for different soil conditions (clay, sand, silt, etc.) that may be encountered. The drilling fluid must not have any additives that are hazardous materials.

6. TRACER WIRE

All sanitary sewer system pipelines shall have tracer wire installed in accordance with Section 603 (SANITARY SEWER FORCE MAINS).

7. CONSTRUCTION REQUIREMENTS

All directional bore operations shall be contained within right-of-way and/or easements, or if approved, City of Salina owned property.

Work shall not start until the Contractor has all necessary permits from the appropriate governing regulatory agencies, including the City of Salina.

Contractor shall not begin drilling operation until the inspector is present. The bore shall be scheduled to be completed by 4:00 PM and shall not start after 1:00 PM unless approved by the Utility Engineer.

8. DRILLING REQUIREMENTS

The horizontal alignment shall be as shown on the plans, plus or minus 1 foot. The vertical alignment shall be as shown on the plans, plus or minus 0.5 foot.

The pipe shall have a minimum cover of 54-inches unless specified differently on the plans.

The entry angle shall be 12 degrees to 14 degrees ideally (not to exceed 20 degrees). Exit angle should be 6 degrees to 12 degrees to facilitate the pullback operation and minimize capstan effect tensile stresses on the pipe, unless specified differently on the plan and profile document or in the special provisions.

Drilling mud shall be disposed off-site in accordance with applicable local, state, and federal requirements and/or permit conditions.

All bore pipe to be pulled back on final pass shall have a “breakaway” device installed. The pipe manufacture will have specifications for the breakaway limit for their difference size pipe.

The Contractor shall not attempt to ream at a rate greater than the drilling equipment and mud system are designed to safely handle. Normal rate of drilling should be between one and two feet per minute.

In the event of a drilling hole blowout, the Contractor shall be responsible for restoring to original condition, any damaged property and cleaning up the environment in the vicinity of the blowout.

## 9. PIPE INSTALLATION

### A. Boring:

Once pullback operations have commenced, the operation shall continue without interruption until the pipe is completely pulled into the borehole. The frictional resistance is the highest just prior to movement and decreases with movement. The mud starts to gel when it is undisturbed. Therefore, pullback shall never be stopped, except for drilling rod removal, until the pipe is completely pulled into its permanent position.

Adequate lengths of pipe shall be provided at both the launching and the receiving ends to facilitate service connection assemblies.

After pullback, pipe may take several hours to recover from the axial strain. When pulled from the reamed borehole, the pull-nose should be pulled out 3 to 4 percent longer than the total length of the pull to avoid having the pull-nose sucked back below the borehole exit level due to stretch recovery and thermal contraction to an equilibrium temperature.

The pipe entry and exit area shall be graded as needed (by the Contractor) to provide support for the pipe and to allow free movement into the borehole. The pipe shall be guided into the borehole to avoid deformation of, or damage to, the pipe.

If the final grade of the finished bore is not satisfactory to the Utility Engineer, the pipe shall be abandoned, and fully pressure grouted in place, and an alternate installation shall be made. The abandoned pipe shall also be shown on the “as-built” drawings to be submitted.

The Utility Engineer shall inspect the installed pipe for roundness and/or damage. Deformations of more than 10% may be grounds to abandon the bore and the Contractor shall re-drill another line.

10. QUALIFICATIONS FOR REJECTION OF DIRECTIONAL BORE

If the installed “Breakaway” devices should fail during pull back.

If the pipe shall fail a hydraulic pressure test as specified by the manufacturer.

If at any time when the pipe is pulled back and any exposed areas have a greater than allowable “gouging” or visible marring of the pipe.

If the vertical and/or horizontal limits are not within tolerances, this may be cause for rejection of the bore.

11. POST CONSTRUCTION

The as-built variance from the specified bore path shall not exceed plus or minus 0.5 feet in the vertical plane and plus or minus 1 foot in the horizontal plane.

Pressure testing and leakage testing shall be per SECTION 603 – SANITARY SEWER FORCE MAINS.

When the directional bore is completed, the Contractor shall provide data log sheets and as-built drawings to the Utility Engineer.