

SECTION 31 78 00

PIPE BORING, JACKING, TUNNELING AND ENCASEMENT**PART 1 - GENERAL****1.1 DESCRIPTION**

- A. The work to be performed under this Specification shall consist of furnishing and installing all materials and equipment and performing all labor required to install pipelines crossing under highways, railroads, and streets by boring, jacking, and tunneling, as specified herein. **All sewer bores will be accomplished by dry mechanical bore unless otherwise pre-approved by the Engineer.** Water line bores may utilize the wet boring technique. All carrier pipes within the encasement conduit shall be restrained joint pipe of the type specified on the plans, or pre-approved by the Engineer.
- B. When the work per this item falls within a TxDOT or Railroad right of way, the stricter of the applicable standards apply. This requirement includes all insurance, notification, permitting, signage, etc. required by the right of way owner.

1.2 MEASUREMENT AND PAYMENT**A. MEASUREMENT**

- 1. Openings provided by boring, jacking, and tunneling (including carrier pipe) will be measured by the linear foot along the centerline of the opening, as measured from end of pipe to end of pipe placed by boring, jacking and tunneling. There will not be any classification for payment according to depth.
- 2. Concrete support slab in the pits and all other work necessary to meet the requirements of the Texas Department of Transportation, railroad company, County, and City will not be measured.
- 3. Openings provided by boring, jacking and tunneling will be paid for at the unit price bid per linear foot. The unit price bid for boring jacking and tunneling shall be full compensation for furnishing and placing all materials, labor, tools, carrier pipe, carrier pipe restraint, casing spacers, equipment, pits, concrete support slabs and incidentals necessary to complete the work.

1.3 SUBMITTALS

- A. Submit manufacturer's product data on encasement pipe.
- B. Submit manufacturer's "Certificate of Compliance" to this part of the specifications for materials furnished for the project.
- C. The Contractor or subcontractor performing the work described under this section shall demonstrate technical skill and experience in previous work of this nature. Work experience shall be submitted to the Engineer.
- D. Casing spacer data sheets demonstrating compliance with this specification.

PART 2 – PRODUCTS

2.1 MATERIALS

Steel Pipe, Ductile Iron Pipe, Reinforced Concrete Pipe, and PVC Pipe may be used as encasement material, unless otherwise shown on the plans. The nominal inside diameter of the encasement pipe shall be as indicated below, unless otherwise shown on the plans.

A. STEEL PIPE

Encasement pipe shall conform to ASTM Specification A134, Mild Carbon Steel, A139, Grade A, or AWWA C200-91 Grade B, butt-welded joints with entire circumference welded by a certified welder shall be in accordance with AWWA C200-86 Section 3. All steel casing shall have a wall thickness as shown in the table below:

Carrier Pipe Nominal Diameter	Casing Pipe Nominal Diameter	Casing Pipe Minimum Thickness¹
6"	14"	3/8"
8"	16"	3/8"
10"	18"	3/8"
12"	20"	3/8"
16"	24"	3/8"
18"	30"	1/2"
24"	36"	1/2"

1. Casing Pipe Thickness for Railroad crossings shall be a minimum of 1/2-inch thick regardless of diameter.
2. Nominal diameter of casing pipe may be larger as needed for restrained joint pipe.

B. DUCTILE-IRON PIPE

Encasement pipe shall conform to the current AWWA C150 and C151 standards. Pipe shall be thickness Class 250 or greater, unless otherwise shown on the plans.

C. REINFORCED CONCRETE PIPE

Encasement pipe shall conform to the current ANSI C-76 standards. Pipe shall be Class III or IV, unless otherwise shown on the plans.

D. PVC PIPE

Encasement pipe shall conform to the current ASTM D2241 or AWWA C905 standards. Pipe shall be DR 26 or SDR 26, unless otherwise shown on the plans. PVC pipe shall be used only when specified on the plans.

E. GROUT

Grout shall be in accordance with SECTION 04 05 12 – MORTAR AND GROUT.

F. CASING SPACERS

Stainless Steel casing spacers shall be required in all casing pipes and shall be manufactured by Cascade Products, Advance Products & Systems, Inc model no. SSI8 or approved equal. The casing spacers shall be affixed to the carrier pipe at a spacing of 6'8" or per the manufacturers recommendations if less than 6'8".

G. END SEALS

End seals shall be 1/8” thick synthetic rubber secured with stainless steel banding straps. Other end seals shall be constructed only as pre-approved by the engineering inspector.

2.2 TESTING REQUIREMENTS**A. ALLOWABLE TOLERANCES**

Where grades or elevations are shown on the plans for the pipeline to be installed by boring, jacking, and tunneling operations, maximum deviation of plan elevation shall be 0.2 foot. The maximum deviation of alignment over the length of the bore shall be 0.2 foot. The Engineer shall determine the corrective action to be taken for tolerances above those stated in this specification.

PART 3 – EXECUTION**3.1 CONSTRUCTION METHODS****A. ENCASEMENT REQUIREMENTS**

Encasement pipe shall be required for all water mains crossing major collector and arterial street crossings. Encasement pipe for sewer mains shall be placed as required by the City Engineer. The casing pipe shall extend two feet (2’) beyond the back of curb. Encasement pipes may be installed by open cut with the approval of the engineer.

B. BORE AND TUNNEL PITS

Unless more stringent requirements regarding location of bore and tunnel pits are noted on the plans, or are required by TXDOT, Railroad, County, or City, to conform to the requirements that follow:

1. The Conduit to be installed by boring, jacking and tunneling shall extend to distances as shown in the Standard Details.
2. If necessary to prevent cave-ins, sheet, shore, or brace the pit in accordance with OSHA regulations. All pits shall be covered with 1/2” thick steel plates. Steel plates shall be on-site prior to excavating the pit. If bore pits are too big to cover with steel plates, Contractor shall install chain link fence, completely and securely, around exposed pit to a height of 6 feet.
3. General: Unless otherwise noted, extend auger hole 10 feet beyond edge of pavement, railroad tie, or other structure. The hole is to be bored mechanically, using a pilot hole. An approximate 2-inch hole shall be bored the entire length of the crossing and shall be checked for line and grade on the opposite end of the bore from the work pit. This pilot hole shall serve as the centerline of the larger diameter hole to be bored. The use of water or other fluids in connection with the boring operation will be permitted only to the extent to lubricate cuttings, jetting will not be permitted. In unconsolidated soil formations, a gel-forming colloidal drilling fluid consisting of at least 10 percent of high-grade carefully processed bentonite may be used to consolidate cuttings of the bit, seal the walls of the hole, and furnish lubrication for subsequent removal of cuttings and installation of the pipe immediately thereafter. Overcutting in excess of one inch shall be remedied by pressure grouting the entire length of the installation.

3.2 CONSTRUCTION METHODS FOR DRY BORING

- A. All sewer bores will be accomplished by dry mechanical bore unless otherwise pre-approved by the Engineer.
- B. Only workmen experienced in boring operations shall perform the work.
- C. The use of water or other fluids in connection with the boring operation will NOT be permitted except for a minor required amount of bentonite solution for cutting head.
- D. The casing pipe shall be placed in the bore hole simultaneously while boring is being performed. Installing the encasement conduit immediately by pulling it in place from opposite the boring machine or by jacking the conduit through the bore is not acceptable. Take proper care to secure the joints of the conduit as subsequent sections are installed by welding joints. Provide a steel rail or timber cradle in the pit to support and guide the conduit in its installation.
- E. If after completion of the installation of the conduit, there is more than one inch (1") clearance between the outside of the barrel of the conduit and the wall of the bore, grouting of these voids will be required. If during construction of the bore, a cave-in occurs within the bore, grouting of the voids between the conduit and the walls of the bore will be required throughout the length of the bore.
- F. Conform to the requirements of the Texas Department of Transportation, Railroad Company, County, or City having jurisdiction over the right-of-way involved, as to details of construction methods and time of construction. All work necessary to meet the requirements of the Texas Department of Transportation, Railroad Company, County, or City will be considered incidental to the installation of the pipeline in the right-of-way. The Contractor shall abide by the more stringent of these specifications, or the specifications of the regulatory agencies.

3.3 CONSTRUCTION METHODS FOR WET BORING

- A. All sewer bores will be accomplished by dry mechanical bore unless otherwise pre-approved by the Engineer. (see above)
- B. Only workmen experienced in boring operations shall perform the work. A pilot hole must be successfully completed to the satisfaction of the engineer prior back reaming the bore.
- C. The use of water or other fluids in connection with the boring operation will be permitted only to lubricate cuttings. Jetting will not be permitted. In consolidated soil formations, a gel-forming colloidal drilling fluid consisting of at least ten (10%) percent of high-grade bentonite may be used to consolidate cuttings of the bit, seal the walls of the hole, and lubricate removal of cuttings and installation of the pipe immediately thereafter.
- D. While boring is being performed, install the encasement conduit immediately by pulling it in place from opposite the boring machine or by jacking the conduit through the bore. Encasement conduit may be placed after the boring operation is complete, if permission is obtained from TXDOT, the railroad company, the City, or the County. Take proper care to secure the joints of the conduit as subsequent sections are installed, by use of cables or welding joints. Provide a steel rail or timber cradle in the pit to support and guide the conduit in its installation.

- E. If after completion of the installation of the conduit, there is more than one inch (1") clearance between the outside of the barrel of the conduit and the wall of the bore, grouting of these voids will be required. If during construction of the bore, a cave-in occurs within the bore, grouting of the voids between the conduit and the walls of the bore will be required throughout the length of the bore.
- F. Grouting material and equipment shall be on the jobsite before beginning installation of the conduit, in order that the grouting around the encasement conduit is to be started immediately after pipe is in place.
- G. Conform to the requirements of the Texas Department of Transportation, Railroad Company, County, or City having jurisdiction over the right-of-way involved, as to details of construction methods and time of construction. All work necessary to meet the requirements of the Texas Department of Transportation, Railroad Company, County, or City will be considered incidental to the installation of the pipeline in the right-of-way. The Contractor shall abide by the more stringent of these specifications, or the specifications of the regulatory agencies.

3.4 CONSTRUCTION METHODS FOR JACKING

- A. Unless otherwise specified, the methods and equipment used in jacking conduit shall be the Contractor's option, provided that the proposed method is pre-approved by the Engineer. Such approval, however, shall in no way relieve the Contractor of the responsibility for making a satisfactory installation meeting the criteria set forth herein.
- B. If, after completion of the installation of the conduit, there is more than one (1") inch clearance between the outside of the barrel of the conduit and the wall of the tunnel, the Contractor shall completely grout the conduit in place throughout its entire length. If, during the jacking operation, a cave-in occurs, the Contractor shall grout the entire conduit in place throughout its entire length.

3.5 CONSTRUCTION METHODS FOR TUNNELING

- A. Excavate the tunnel in such a manner and to such dimensions that will permit placing of the proper supports **in accordance with OSHA Regulations** necessary to protect the excavation. Make adequate provisions for the safety and health of the workmen. Use only air or electric powered equipment in the tunnel. Provide adequate illumination and ventilation.
- B. Excavate only enough earth to allow installation of the tunnel liner plate. Remove earth from within tunnel and install the next section of tunnel liner plates.
- C. After completion of the tunnel, or at intervals directed by the Engineer, grout the entire void between the tunnel lining. If after completion of the tunnel there are sags in invert of the liner that exceed 0.2 feet of a straight line projected through the tunnel, grout the invert to eliminate the sags.

3.6 SPECIAL PROVISIONS FOR BELL & SPIGOT ENCASEMENT PIPE

- A. Where pipe using bell and spigot joints is installed as encasement pipe, completely grout the voids between the outside of the encasement pipe and the inner wall of the bore or tunnel throughout the length of the pipe. If directed by the City Engineer, the joints shall be welded to prevent the joints from slipping with respect to each other.

3.7 SUPPORT OF PIPES ACROSS BORE OR TUNNEL PITS

- A. After completion of the bore or tunnel and installation of the carrier pipe with the bore or tunnel, remove all loose earth and debris from the pit down to undisturbed earth. Pour a continuous 2,000 psi concrete or cement stabilized sand support under the carrier pipe from the edge of the bore or tunnel to the first joint in the trench past the end of the pit. The concrete support shall be brought up to the horizontal centerline of the pipe.

3.8 CARRIER PIPE

- A. Carrier pipe may be pushed or pulled through the completed encasement pipe. Casing spacers by Cascade Waterworks or pre-approved equivalent should be placed on the carrier pipe to insure approximate centering within the encasement pipe and to prevent damage during installation. Care must be exercised in order to avoid metal-to-metal contact. The ends of the encasement pipe will be sealed with rubber seals and stainless steel bands. In order to avoid the transfer of earth and live loads to the carrier pipe, the space between the carrier pipe and encasement pipes shall not be filled completely.
- B. All carrier pipe installed within a casing shall be restrained. The restrained section shall extend at least five feet (5') beyond both ends of the casing pipe. Lock joint pipe, retainer glands, or restrainer gaskets may be used for this application.
- C. When ductile iron pipe is used for the carrier pipe, all ductile iron pipe shall be poly-wrapped per the specifications.

3.9 SPOILS

- A. Spoil locations shall be pre-approved by the engineering inspector. When no suitable location for spoil can be found on site, the contractor shall be required to haul and dispose of this material at no extra cost. Where spoils are to be placed on parking areas (asphalt or concrete), sidewalks, or other paved surfaces, the spoils shall be placed on a barrier to prevent the soil from embedding into the paved surface.

END OF SECTION