

SECTION 33 05 23.16 – UTILITY PIPE JACKING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work included:
 - 1. Provide and install casing pipes or tunnels under roadways or railways, where indicated, as specified herein, and as needed for a complete and proper installation.
 - 2. Disposal of surplus materials.
 - 3. Restoration of disturbed areas.
- B. Related Sections:
 - 1. Section 31 23 16.13 – Excavation, Trenching, and Backfilling for Utilities
 - 2. Section 33 31 00 – Gravity Sewers

1.2 UNIT PRICE – MEASUREMENT AND PAYMENT

- A. Pipe Casing:
 - 1. Basis of Measurement: Price per linear foot.
 - 2. Price shall include casing, casing spacers, and end seals.
 - 3. All labor and equipment costs required to complete the work, including installation of the utility, shall be included in the price.

1.3 REFERENCE STANDARDS

- A. All products, installation and testing of force mains and gravity sewers shall meet the requirements of Regulation 61-67, Standards for Wastewater Facility Construction or State Primary Drinking Water Regulations (R61-58).
- B. All products, installation and testing of force mains and gravity sewers shall meet the requirements of "Recommended Standards for Wastewater Facilities" (Ten State Standards), latest edition.
- C. Any reference to SCDOT standard specifications was obtained from "Standard Specifications for Highway Construction" published by the South Carolina Department of Transportation. Unless otherwise noted, the most current date published applies.
- D. American Association of State Highway and Transportation Officials:
 - 1. AASHTO M190 - Standard Specification for Asphalt-Coated Corrugated Metal Culvert Pipe and Pipe-Arches.
- E. American Society for Testing Materials:
 - 1. ASTM A36 - Standard Specification for Carbon Structural Steel.
 - 2. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

3. ASTM A139 - Standard Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over).
4. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
5. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.
6. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
7. ASTM A1011 - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
8. ASTM D1894 - Standard Test Method for Static and Kinetic Coefficients of Friction of Plastic Film and Sheeting.
9. Additional applicable ASTM standards which are not specifically stated.

1.4 SUBMITTALS

- A. Product data: Upon receiving Owner's Notice to Proceed, submit Manufacturer's specifications and other data needed to prove compliance with the specified requirements, including:
 1. Casing pipe showing sizes, thickness, and joints.
 2. End seals.
 3. Casing Spacers showing recommended spacing.
 4. Jack and bore plan for each Casing Pipe location.
 5. Dewatering plan.

1.5 COORDINATION

- A. Coordinate Work of this Section with utility owners and local authorities.
- B. Notify affected utilities at least 72 hours prior to construction.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- B. Storage and Handling: Comply with manufacturer's recommendations.
- C. Store materials to prevent damage to Owner's property or other public or private property.
- D. Store materials in a manner that does not block any access points, utilities, neighboring properties etc.

1.7 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years of experience.

- B. Installer: Company specializing in performing Work of this Section with minimum five years of documented experience involving work of equal or greater size and length.

1.8 CLOSEOUT SUBMITTALS

- A. Provide Record Drawings showing actual locations of casing pipe including invert elevations, pipe material, thickness, and diameter.

1.9 WARRANTY

- A. Provide a two-year materials and workmanship warranty. The contractor shall be responsible for correcting defects in the Work during the warranty period, including defective material and workmanship.

1.10 EXISTING CONDITIONS

- A. Field Measurements:
 - 1. Verify field measurements prior to fabrication.
 - 2. Indicate field measurements on Shop Drawings.
- B. Protection of other utilities:
 - 1. Approximate location of certain known underground lines are shown.
 - 2. Existing small lines not shown.
 - 3. Locate small and other possible utility lines using electronic pipe finder, or other approved method.
 - 4. Repair or replace any damaged utility line or structure at no additional cost to Owner.

1.11 JOB CONDITIONS

PART 2 - Work under this Section may require construction or work in areas with many variables such as utilities, traffic, etc. Contractor is responsible for creating a work plan to ensure the safety and proper installation with respect to the existing job site conditions. PRODUCTS

2.1 CASING PIPE

- A. All pipe shall be new, no used pipe will be accepted.
- B. Steel complying with ASTM A139 for Grade B with minimum yield strength of 35,000 psi.
- C. Steel plate shall comply with ASTM A36.
- D. Provide ends suitable for field welding.
- E. All utilities within casing pipe shall be restrained joint.
- F. Minimum wall thickness as follows:

Diameter of Casing (Inches)	Minimum Wall Thickness (Inches)
6 thru 14	1/4
16 and 18	5/16
20 and 22	3/8
24 and 26	7/16
28 thru 32	1/2
34 thru 38	9/16
40 thru 42	5/8
44 thru 52	3/4
54 thru 62	7/8
64 thru 72	1

2.2 CASING SPACERS

- A. For utilities installed in casing provide casing spacers.
- B. Provide casing spacers as required by manufacturer, with a minimum of 1 spacer per ten linear feet of pipe for ductile iron pipe and a minimum of 1 spacer per six linear feet for PVC pipe.
- C. Provide spacer with shell of 14-gauge T-304 stainless steel and shell liner of 0.090" thick PVC, 85-90 durometer.
- D. Provide a minimum of three (3) 5/16" stainless steel connecting bolts and lock nuts per flange.
- E. Runners from 2" wide ultra-high molecular weight polymer with a high resistance to abrasion and a coefficient of friction of 0.11 -0.13 in accordance with ASTM D1894.
- F. Provide 7" wide risers.
- G. Support runners on 14-gauge reinforced 1/2" wide T-304 stainless steel risers welded to shell.
- H. All metal surfaces to be fully passivated to resist corrosion
- I. The diameter as measured over the runners shall exceed the pipeline bell or coupling outside diameter.
- J. Provide adequate clearance between outside of casing spacer and interior of casing pipe.
- K. Provide pipeline casing spacers as manufactured by BWM Company, Cascade Manufacturing, or approved equal.

2.3 END SEALS

- A. Provide 3/16" thick rubber end seal to seal each end of the casing.
- B. Secure to casing and carrier pipe with 1/2" wide T-304 stainless steel bands.

- C. Provide end seals as manufactured by BWM Company, Cascade Manufacturing, or approved equal.

2.4 MISCELLANEOUS MATERIALS

- A. As required, provide all other materials for a complete and proper installation for products and installation as described here within.

PART 3 - WORK EXECUTION

3.1 GENERAL

- A. Comply with pertinent provisions of Section 31 23 16.13 – Excavation, Trenching, and Backfilling for Utilities.
- B. Confirm location of all utilities and structures within the work area prior to beginning jack and bore operations.
- C. Rock or water encountered shall not constitute additional compensation unless explicitly included in the Contract Documents.
- D. Thoroughly clean casing pipe after jack and bore operations are completed.
- E. Design of the bore pits is the responsibility of the Contractor.
- F. Lengths shown on the Contract Drawings are minimum and may be extended for the convenience of the Contractor at no additional cost to the Owner.
- G. Highway Crossings:
 - 1. Comply with any encroachment permit requirements.
 - 2. The Contractor shall be held responsible and accountable for the coordinating and scheduling of all construction work within the highway right-of-way.
 - 3. Work along or across the highway department rights-of-way shall be subject to inspection by such highway department.
 - 4. All installations shall be performed to leave free flows in drainage ditches, pipes, culverts or other surface drainage facilities of the highway, street or its connections.
 - 5. No excavated material or equipment shall be placed on the pavement or shoulders of the roadway without the express approval of the highway department.
 - 6. In no instance will the Contractor be permitted to leave equipment (trucks, backhoes, etc.) on the pavement or shoulder overnight. Construction materials to be installed, which are placed on the right-of-way in advance of construction, shall be placed in such a manner as not to interfere with the safe operation of the roadway.
 - 7. Blasting is not accepted unless approved otherwise. When blasting is necessary, the Contractor shall be responsible for obtaining a blasting permit in a timely manner. All blasting activities shall have an approved plan in place and coordinated with all required parties before any work can begin. Blasting shall follow in strict accordance with the Engineer's specifications and recommendations.

3.2 ENTRY AND EXIT PITS

- A. Locate to avoid interference with traffic, adjacent structures, etc.
- B. Excavate to required depth, providing sheeting and shoring necessary for protection of the Work and for safety of personnel.
- C. Dewater pits by use of pumps, drains or other approved method. No water may be discharged onto roadway surfaces.

3.3 SURFACE SETTLEMENT MONITORING

- A. Provide surface settlement markers, placed as specified and as directed by the Engineer. The Contractor shall place settlement markers outside of pavement area, along the centerline of the casing at 20-foot intervals and offset 10 feet each way from the centerline of the tunnel. Markers shall also be placed at each shoulder of the roadway, at each edge of pavement, at the centerline of the pavement and at 10 and 25 feet in each direction from the centerline of the casing. Tie settlement markers to benchmarks and indices sufficiently removed as not to be affected by the casing operations.
- B. Make observations of surface settlement markers, placed as required herein, at regular time intervals acceptable to the Engineer. In the event settlement or heave on any marker exceeds 1-inch, the Contractor shall immediately cease work and using a method approved by the Engineer and the authority having jurisdiction over the project site, take immediate action to restore surface elevations to that existing prior to start of casing operations.
- C. Take readings and permanently record surface elevations prior to start of dewatering operations and/or shaft excavation. The following schedule shall be used for obtaining and recording elevation readings: all settlement markers, once a week; all settlement markers within 50 feet of the casing heading, at the beginning of each day; more frequently at the Engineer's direction if settlement is identified. Make all elevation measurements to the nearest 0.01 foot.
- D. The Contractor shall cooperate fully with jurisdiction personnel. Any settlement shall be corrected by, and at the expense of, the Contractor.
- E. Promptly report any settlement and horizontal movement immediately to the Engineer and take immediate remedial action.

3.4 JACKING AND BORING

- A. Shaft
 1. Conduct jacking and boring operations from a shaft excavated at one end of the section to be bored. Where conditions and accessibility are suitable, place the shaft on the downstream end of the bore.
 2. The shaft shall be rectangular and excavated to a width and length required for ample working space. If necessary, sheet and shore shaft properly on all sides. Shaft sheeting shall be timber or steel piling of ample strength to safely withstand all structural loadings of whatever nature due to site and soil conditions. Keep preparations dry during all operations. Perform pumping operations as necessary.

3. The bottom of the shaft shall be firm and unyielding to form an adequate foundation upon which to work. In the event the shaft bottom is not stable, excavate to such additional depth as required and place a gravel sub-base or a concrete sub-base if directed by the Engineer due to soil conditions.
- B. Jacking Rails and Frame
1. Set jacking rails to proper line and grade within the shaft. Secure rails in place to prevent settlement or movement during operations. The jacking rails shall cradle and hold the casing pipe on true line and grade during the progress of installing the casing.
 2. Place backing between the heels of jacking rails and the rear of the shaft. The backing shall be adequate to withstand all jacking forces and loads.
 3. The jacking frame shall be of adequate design for the magnitude of the job. Apply thrust to the end of the pipe in such a manner to impart a uniformly balanced load to the pipe barrel without damaging the joint ends of the pipe.
- C. Jacking and boring of casing pipes shall be accomplished by the dry auger boring method without jetting, sluicing or wet boring.
- D. Auger the hole and jack the casing through the soil simultaneously.
- E. Bored installations shall have a bored-hole diameter essentially the same as the outside diameter of the casing pipe to be installed.
- F. Execute boring ahead of the casing pipe with extreme care, commensurate with the rate of casing pipe penetration. Boring may proceed slightly in advance of the penetrating pipe and shall be made in such a manner to prevent any voids in the earth around the outside perimeter of the pipe. Make all investigations and determine if the soil conditions are such as to require the use of a shield.
- G. As the casing is installed, check the horizontal and vertical alignment frequently. Make corrections prior to continuing operation. For casing pipe installations over 100 feet in length, the auger shall be removed and the alignment and grade checked at minimum intervals of 60 feet.
- H. Any casing pipe damaged in jacking operations shall be repaired, if approved by the Engineer, or removed and replaced at Contractor's own expense.
- I. Lengths of casing pipe as long as practical shall be used, except as restricted otherwise. Joints between casing pipe sections shall be watertight butt joints with complete joint penetration, single groove welds, for the entire joint circumference, in accordance with AWS recommend procedures. Prior to welding the joints, the Contractor shall ensure that both ends of the casing sections being welded are square.
- J. The Contractor shall prepare a contingency plan which will allow the use of a casing lubricant, such as bentonite, in the event excessive frictional forces jeopardize the successful completion of a casing installation.
- K. Once the jacking procedure has begun, it should be continued without stopping until completed, subject to weather and conditions beyond the control of the Contractor.

- L. Care shall be taken to ensure that casing pipe installed by jacking and boring method will be at the proper alignment and grade. Casings for gravity sanitary sewer shall not vary more than 3/32" per foot of length from the indicated grade. Any improperly installed or otherwise defective casing shall be removed and replaced at no additional cost to the Owner.
- M. The Contractor shall maintain and operate pumps and other necessary drainage system equipment to keep work dewatered at all times.
- N. Adequate sheeting, shoring and bracing for embankments, operating pits and other appurtenances shall be placed and maintained to ensure that work proceeds safely and expeditiously. Upon completion of the required work, the sheeting, shoring and bracing shall be left in place, cut off or removed, as designated by the Engineer.
- O. Trench excavation, all classes and types of excavation, the removal of rock, muck, debris, the excavation of all working pits and backfill requirements are included under this Section.
- P. All surplus material shall be removed from the right-of-way and the excavation finished flush with the surrounding ground.
- Q. Grout backfill shall be used for unused holes or abandoned pipes.

3.5 ROCK EXCAVATION

- A. In the event that rock is encountered during the installation of the casing pipe which, in the opinion of the Engineer, cannot be removed through the casing, the Engineer may authorize the Contractor to complete the crossing by tunneling.
- B. At the Contractor's option, the Contractor may continue to install the casing and remove the rock through the casing at no additional cost to the Owner.

3.6 SHEETING REMOVAL

- A. Remove sheeting used for shoring from the shaft and off the job site. The removal of sheeting, shoring and bracing shall be done in such a manner as not to endanger or damage either new or existing structures, private or public properties and to avoid cave-ins or sliding in the banks.

3.7 INSTALLATION

- A. Install casings by dry-boring through the casing while simultaneously jacking the casing.
- B. Any proposed alternate method shall be approved in writing by the Engineer.
- C. Weld joints to provide a watertight joint.
- D. After construction of the casing is complete, and accepted, install the utility line as indicated on Contract Drawings.
- E. Gravity Sewers:

1. Provide spacers sized to achieve pipe slope and elevations indicated on the Contract Drawings.
 2. Check the alignment and grade of the casing and prepare a plan to set the pipe at proper alignment, grade and elevation, without any sags or high spots.
- F. Install the utility in the casing pipe ensuring each joint is properly restrained before the joint is installed into the casing.

3.8 INSTALLING PIPE IN CASING

- A. General:
1. Inspect carefully, ensuring that all foreign material is removed from the casing and the casing meets alignment criteria for the type of carrier pipe being used.
 2. For pressure systems, the casing deflection shall not exceed the maximum deflection recommended by the carrier pipe.
 3. Install casing spacers on the carrier pipe per the manufacturer's instructions.
 4. For sanitary and storm sewer provide spacer sizing and length necessary to obtain the pipe slope and elevations as shown on the plans.
 5. Provide centered or restrained configuration.
 6. Install the carrier pipe in the casing ensuring each joint is pushed "home" before the joint is installed into the casing.
 7. Provide restrained joint carrier pipe for all joints inside of casing.

3.9 END SEALS

- A. Install rubber end seals in accordance with manufacturer's instructions.

3.10 RESTORATION

- A. Restore all areas disturbed and repair any damages that occurred during the completion of the work to original or better conditions. All damaged areas shall be repaired at no additional cost to the Owner.

END OF SECTION 33 05 23.16