SECTION 6000 TUNNELING, BORING AND JACKING (PIPELINES)

6001 SCOPE. This section governs construction of steel casings, complete with bulkheads and sand fill, by boring and/or jacking at the locations and to the lines and grades indicated on the drawings directed by the Engineer, or where constructed at the contractor's option, when approved, to bypass obstructions without open cutting.

6002 MATERIALS.

A. Steel Liner Plate. Steel tunnel liner plates shall be Armco "Standard", Commercial Shearing and Stamping Company "Commercial", Republic "Truscon Paneled Out", or equal and shall be galvanized in accordance with ASTM A 123. The design and shape of the liner plates shall be such that assembly can take place entirely from within the tunnel liner. Sufficient sections shall be provided with one and one-half (1 1/2) inch or larger grouting holes, located near the centers, so that when the plates are installed there will be one line of holes on either side of the tunnel and one at the crown. The holes in each line shall not be more than nine (9) feet apart and, unless otherwise approved, shall be staggered. Bolts and nuts shall conform to ASTM A 153, A 307, A 325 and A 449 as applicable.

B. Steel Casing.

1. Steel casing for bored or jacked construction shall conform to ASTM A-139.

2. Steel shall be grade B under railroads and grade A for all other uses.

3. Minimum wall thickness for steel casing shall be in accordance with the following table:

Diameter of Casing	Under Railroads	All Other Uses
24"	0.406"	0.281"
26"	0.438"	0.281"
28"	0.469"	0.312"
30"	0.469"	0.312"
32"	0.500"	0.312"
34"	0.500"	0.312"
36"	0.500"	0.312"

4. Casing joints shall be welded by a certified welder in accordance with AWWA C-206.

C. End Seals. Ends of each casing pipe or tunnel liner shall be closed with a minimum 1/8-inch neoprene rubber end seal (CCI Pipeline Products, Advance Products & Systems, or approved equal) with stainless steel bands or as shown on the plans. The closure for each casing pipe or tunnel line shall not be constructed until all testing of the line has been completed and accepted.

D. Casing Spacers. Projection-type casing spacers shall be constructed of stainless

steel with glass filled polymer runners of type CCI Pipeline Products model CSS, or approved equal. Casing spacers shall be fastened tightly onto the carrier pipe so that when the carrier pipe is being installed the spacers will not move along the pipeline. Casing spacers shall be no more than 10 feet apart and doubled on each end of the encasement.

E. Sand Fill. Sand fill shall comply with ASTM C-33 or MCIB Section 4, Fine Aggregate. Moisture content of the sand shall not exceed. 0.5%.

6003 CONSTRUCTION DETAILS.

A. General.

1. Prior to starting work, complete details of the method of operation and liner materials to be used shall be submitted to the Engineer. The pipe line, in the area to be tunneled, bored or jacked, shall be completed before the construction of adjacent portions of the same pipe line. The purpose of this requirement is to allow for slight discrepancies in alignment and grade which may occur in the tunneled, bored or jacked installation, so minor adjustments in the adjacent pipe can be made.

2. The maximum allowable deviation from plan alignment and grade shall be as follows:

   a. Alignment 1.0%
   b. Grade 1.0%

B. Casing Installation.

1. The steel casing shall be advanced in a continuous operation without interruption. Sections of the casing pipe shall be welded together to form a continuous conduit capable of resisting all stresses, including jacking stresses. The casing in its final position shall be within alignment and grade tolerances specified in Section 6003 (A2). There shall be no space between the earth and the outside of the casing. Any voids which do occur shall be filled by pressure grouting.

2. Boring operations shall be performed by experienced crews using a rotary type boring machine designed especially for this purpose. Boring shall be performed in a manner to prevent disturbing the overlying and adjacent materials.

3. Jacking.

   a. Jacking frame, guides, blocking, head and reaction devices shall be arranged to apply uniform pressure about the casing circumference without damage to the casing material, and to maintain alignment within specified tolerances.

b. Jacking reaction device shall provide adequate resistance to withstand 200 percent of the maximum jacking pressure.

c. Provide jacks of adequate number and size for the required jacking pressure; but not less than two jacks.

d. Maintain jacking pit and pipe installation in such condition that drainage does not accumulate. Control and disposition of surface and subsurface water at the site of jacking operations shall be the Contractor's responsibility subject to the approval of the Engineer.

e. Excavation of the heading shall not be extended more than 1 inch outside the top and sides (upper 300-degree sector) of the casing and shall be true to grade at the invert (lower 60-degree sector).

f. Once jacking begins, it shall proceed without interruption until installation of the entire length of the jacked line is complete.

4. Excavation in Jacked Casings. Perform excavation within jacked casings by hand or machine methods as necessary to remove the materials encountered without disturbing the overlying material. The jacked casing shall be advanced a sufficient distance ahead of the excavation face and/or shield used as necessary to protect the workman and the work, and to prevent the uncontrolled entry of unstable materials into the casing.

5. Unstable Materials. If materials are encountered during casing installation that cannot be excavated safely or without creating voids around the exterior of the casing, the Contractor shall discontinue casing installation and stabilize such materials by dewatering, chemical soil stabilization, grouting, or other methods, and/or modify equipment and procedures as necessary to complete the casing installation.

C. Lining Installation.

1. Excavation. Excavate by approved methods applicable to materials encountered. Boring operations shall be performed by experienced crews using a rotary type boring machine designed especially for this purpose. Include dewatering and chemical soil stabilization or grouting when necessary due to existing field conditions. Conduct excavation in a manner to prevent disturbing the overlaying and adjacent material.

2. Lining. Assemble liner plates immediately following the excavation. Advance casing continuously with excavation. When liner plates are being installed, care shall be taken to maintain alignment, grade and circular shape of the tunnel. All voids between liner and surrounding earth shall be filled with grout forced in under pressure. The grout shall consist of two parts of sand to one part of portland cement, mixed with sufficient water to maintain a freely pouring consistency. As the pumping

through any hole is stopped, it shall be plugged to prevent the backflow of grout. After lining installation is complete it shall be cleaned of all debris and all leaks which allow flowing or seeping water into tunnel, shall be stopped.

D. Pipe Installation.

1. Pipe shall be placed inside the casing to the plan line and grade by the use of projection type spacers. Projection type spacers shall be RACI or approved equal per Section 6002(D). The casing spacers shall be installed according to the manufacturer's guidelines and recommendations. Wooden skids are not acceptable.

2. End seals shall be constructed per Section 6002(C) after the pipe is installed and approved.

3. No interruption of traffic will be permitted at any location where a tunnel or casing is required.

4. All boring or jacking under Railroads shall conform to the specifications of that specific Railway.