

STANDARD SPECIFICATIONS

SECTION 02315

JACKED CASING

PART 1 - GENERAL

A. Description

Tunneling method by jacked casing, directional drilling, or a tunnel boring machine, for highway, railroad, creek, and culvert crossings and other shallow depth tunnels, and carrier pipe installation.

B. Related Work Specified Elsewhere

All related work specified elsewhere, or in other codes or standards, will be as last revised, unless a specific date of issuance is called out in opposition to later revision date(s).

Other sections of the technical specifications, not referenced below, shall also apply to the extent required for proper performance of this work.

- 1. Trenching, Backfilling, and Compacting: 02223
- 2. Concrete: 03300
- 3. Hydrostatic Testing of Pressure Pipeline: 15042

C. Permits

All work shall conform to the specifications and requirements of the State of California Department of Transportation, the Orange County PFRD, the city having jurisdiction, or and other agencies involved. The contractor shall keep a copy of all the required permits in the job site and comply with all the terms and conditions of said permits.

D. Alternative Methods

The contractor may present an alternative detailed proposal in lieu of the methods and materials specified herein to jack or bore casing pipe at the locations shown on the plans. Any such proposal shall be presented to the District representative a minimum of 28 calendar days in advance of the work to allow adequate time for checking, and must be in accordance with all the conditions set forth in the permits.

E. Safety

The contractor shall obtain from the Division of Industrial Safety a classification for each bore exceeding 30-inches in diameter. It shall be the contractor’s responsibility to see that the work is done in conformance with the state requirements. It shall also be the contractor’s responsibility to call the required safety meeting with representatives from the State Division of Industrial Safety prior to beginning the construction of each bore.

F. Scheduling

If the pipeline is not installed within the casing as a continuous operation following completion of jacking, then bulkhead the portals and backfill the approach trenches and later reopen them for pipe installation.

G. Line and Grade

1. The contractor’s attention is called to the fact that the casing pipe must be installed to the tolerances listed on the plans so as to permit the construction of the carrier pipe to the lines and grades shown on the plans.
2. It is the contractor’s responsibility to choose a size of casing at or above the minimum specified, to insure that the jacking is done with a high degree of accuracy to permit installation of the carrier pipe to the grades shown on the plans.

H. Design

It is the contractor’s responsibility to retain an engineer to design a casing that meets or exceeds the minimum specified, and to insure that the casing is compatible with the jacking machine, and the boring head used.

PART 2 – MATERIALS

A. Steel Casing

1. New steel casing pipe, unless otherwise approved by the District representative, shall be butt-welded sheets conforming to ASTM A 245, commercial grade or of plate conforming to ASTM A 283, Grade C, or ASTM A-36.
2. The minimum size and thickness of casing pipes for insertion of various sizes of carrier pipes shall be as described below, unless a larger or heavier wall casing pipe is required by the agency having jurisdiction over the road or railroad crossing:

Pipe Size (Inches)	Min. I.D./O.D.. Casing Size (Inches)	Min. Wall Thickness (Inches)
4	12” I.D.	1/4
6	16” I.D.	1/4
8	18” I.D.	1/4
12	24” O.D.	5/16
16	30” O.D.	3/8

3. It is the contractor's responsibility to retain a design engineer to choose a size of casing at or above the minimum specified, in order that the jacking may be done with a sufficient degree of accuracy to permit installation of the carrier pipe to the grades shown on the plans. The contractor may select a greater thickness and diameter as convenient for method of work and loadings involved, as suitable for the site and as limited by possible interferences, but at no additional cost to District. If specified on the plans, provide 2-inch grout connections spaced at the top and bottom for casing 30-inches and larger in diameter per detail MNWD standard drawing W-13 or S-11.

Casing sections shall be joined by full-circumference butt welding in the field. Prepare ends of casings for welding by providing ¼-inch X 45 degree chamfer on outside edges.

B. Grout

1. Grout shall consist of Portland cement and water or of Portland cement, sand, and water; and all grout mixtures shall contain 2% of bentonite by weight of the cement.
2. Portland cement, water and sand shall conform to the applicable requirements of the concrete section (Section 03300), except that sand to be used shall be of such fineness that 100% will pass a standard 8-mesh sieve and at least 45%, by weight, will pass a standard 40-mesh sieve.
3. Bentonite shall be a commercially processed powdered bentonite, Wyoming type, such as Imacco-gel, Black Hills or approved equal.

C. Stainless Steel Spacers

Casing spaces shall be bolt on style with a two piece shell made of 304 stainless steel of a minimum 14 gauge thickness. Each shell section shall have bolt flanges formed with fins for added strength. Each connection flange shall have a minimum of three 5/16 inch 304 stainless bolts. The shell shall be lined with a ribbed PVC extrusion with a retaining section that overlaps the edge of the shell and prevents slippage. Bearing surfaces (runners) made from UHMW polymer with a static coefficient of friction of 0.11 - 0.13 shall be attached to support structures (risers). The runners shall be attached mechanically by 304 stainless fasteners that are inserted through the punched riser section and welded for strength. Risers shall be made of 304 stainless of a minimum 14 gauge. All risers over 2 inches in height shall be reinforced. Risers shall be welded to the shell. All metal surfaces shall be fully passivated. Casing spacers shall be as specified on the plans.

D. End Seal

End seals shall be virgin Buna-s or Buna-gis (styrene-butadiene) rubber with 316 stainless steel bands. End seal kits shall include a bottle of bonding cement. End seals shall be "Link Seal" or "PSI Model C" end seals.

E. Sacrificial Anodes for Cathodic Protection

1. Anodes for cathodic protection of steel casing shall be 2-inch by 2-inch by 60-inch high purity zinc anodes, bagged in calcium sulfate and bentonite backfill.
2. The anodes shall be cadwelded to the casing with No. 6 high molecular weight polyethylene (HMWPE) -covered, stranded copper lead wire.

PART 3 - EXECUTION

A. Sectional Shield or Jacking Head

1. Fit a sectional shield or steel jacking head to the leading section of the casing. The shield or head shall extend around the outer surface of the upper two-thirds of the casing and project at least 18 inches beyond the driving end of the casing. It shall not protrude more than ½ inch beyond the outer casing surface.

2. Anchor the head to prevent any wobble or alignment variation during the jacking operation.
3. To avoid loss of ground outside the casing, carry out excavation entirely within the jacking head and not in advance of the head. In general, excavated material shall be removed from the casing as jacking progresses and no accumulation of excavated material within the casing will be permitted.
4. A jacking band to reinforce the end of the pipe receiving the jacking thrust will be required.

B. Jacking Pit

1. The approach trench for jacking or boring operations shall be adequately shored to safeguard existing substructures and surface improvements and to ensure against ground movement in the vicinity of the casing portal.
2. Place in the approach trench of jacking pit and firmly bed on the required line and grade heavy guide timbers, structural steel, or concrete cradle of sufficient length to provide accurate control of jacking alignment. Provide adequate space to insert the casing lengths to be jacked. Anchor the timbers and structural steel sections to ensure action of the jacks in line with the axis of the casing. Place a timber or structural steel bearing block between the jacks and the end of the casing to provide uniform bearing upon the casing end evenly distribute the jacking pressure.
3. Provide bracing, shoring and ladders necessary to meet trench safety requirements. Confined space testing may be required as conditions dictate.

C. Control of Alignment and Grade

Control the application of jacking pressure and excavation of material ahead of the advancing casing to prevent it from becoming friction bound or deviating from required line and grade, as detailed in the plans. Do not encroach upon the minimum annular space detailed. Restrict the excavation of material to the least clearance necessary to prevent binding in order to avoid settlement or possible damage to overlying structures or utilities.

D. Grouting

Immediately after completion of the jacking or boring operation, lean grout shall be injected through the grout connections of casings 30-inches and larger in a manner that will completely fill all voids outside the casing pipe resulting from the jacking or boring operation. The lean grout shall consist of one part Portland cement, four parts sand, and sufficient water to produce a workable mixture. Grout pressure is to be controlled so as to avoid deformation of the casing and/or avoid movement of the surrounding ground. Sand for grout to be placed outside the casing shall be of such fineness that 100% will pass a No. 8 sieve and not less than 35% will pass a No. 50 sieve. After completion of grouting, the grout connections shall be closed with cast-iron threaded plugs.

E. Installation of Carrier Pipe

1. The carrier pipe shall be pushed into the casing pipe using stainless steel casing spacers, which shall be sized to restrain the pipe from moving within the casing. If the casing has deviated from the design line and grade; specifically fabricated casing spacers may be used to correct the problem.

2. The casing pipe spacers shall be placed so as to support all of the carrier pipes within two feet or less of the end of the casing pipe. Unless noted otherwise in the plans, casing pipe spacers shall be placed at a minimum of one at the bell end and one at the center of each length of pipe.
3. Before sealing the carrier pipe ends, the carrier pipe shall pass an initial pressure test per Section 15042 or leakage test per Section 15043.

F. Sand Backfill for Annular Space in Jacked Casing

1. Use air-blown sand to fill the annular space between the casing and the carrier pipe unless otherwise required by the agency having jurisdiction over the road or railroad crossing.
2. Furnish the necessary sand, air compressor, hoses, pressure gauges, valves, and fittings for the filling operation.
3. Air blown sand shall conform with the requirements for imported sand in Section 02223. Sand shall be free of lumps when put into the hopper. Sand shall be of a consistency to flow unimpeded and completely fill all voids.
4. Place a bulkhead for retaining the sand in the annular space between the casing and the carrier pipe at each end of the jacked casing. At the start of the sand fill operation, extend the sand discharge pipe from the placing equipment, through the inside of the casing, and to the bulkhead at the remote end of the casing. The method used to place the sand shall be such to ensure complete filling of the annular space. During placement, position the sand discharge pipe so that its discharge end shall be kept well buried in the sand at all times after the sand has been built up over the crown of the pipe at the remote end of the section being filled. Install a riser pipe suitable for a vent in the casing adjacent to the bulkhead at the near end of the casing. Plug the vent pipe with grout upon completion of sand filling.

G. Sealing Ends of the Casing

The ends of the casing pipe shall be sealed with a rubber shroud, held in place with stainless steel straps, as shown on MNWD standard drawing W-13 or S-11. The diameters and lengths of the end seals shall be sized to fit each casing pipe and carrier pipe to assure a positive barrier to backfill debris and seepage.

H. Installing Sacrificial Anodes for Cathodic Protection

1. One sacrificial anode shall be buried at each end of the casing.
2. Lead wire shall be cadwelded to the casing in accordance with Erico Engineering specification No. A160-A05.
3. Cover each weld with Royston "Handy Cap."
4. Each anode shall be saturated with 20 gallons of water, prior to backfill of the trench.

I. Closing the Jacking Pit

After jacking equipment and muck from the tunnel have been removed from the approach trench of jacking pit, prepare the bottom of the jacking pit as a pipe foundation. Remove all loose and disturbed material below pipe grade to undisturbed earth and recompact the material in accordance with Section 02223.

END OF SECTION