

SECTION 023020
JACKING, BORING OR TUNNELING (S-65)

1. DESCRIPTION

This specification shall govern provisions of the required opening for the installation of conduits by the methods of jacking, boring, or tunneling as shown on the plans and in conformity with this specification.

2. MATERIALS

Unless indicated otherwise in the drawings, casing pipe shall be smooth pipe with minimum yield strength of 35,000 psi. Minimum casing wall thickness shall be as follows:

Casing Diameter (Inches)	Minimum Wall Thickness (Inches)
Less than 12	1/4
Over 12 to 18	5/16
Over 18 to 22	3/8
Over 22 to 28	7/16
Over 28 to 34	1/2
Over 34 to 42	9/16
Over 42 to 48	5/8
Over 48	Specified by Engineer

3. CONSTRUCTION REQUIREMENTS

Where encasement or carrier pipe is required to be installed under railroad embankments or under highways, streets, or other facilities by jacking, boring or tunneling methods, construction shall be made in a manner that will not interfere with the operation of the railroad, highway, or other facility, and will not weaken or damage any embankment or structure. During construction operations, barricades and lights to safeguard traffic and pedestrians shall be furnished and maintained, as directed by the engineer, until such time as the backfill has been completed and then shall be removed from the site.

The drilling of pilot holes for the alignment of pipe prior to its installation by jacking, boring or tunneling will not be a requirement but may be necessary to maintain grade. The drilling of pilot holes will be considered as incidental work and the cost thereof shall be included in such contract pay items as are provided in the proposal and contract.

The contractor shall take the proper precautions to avoid excavating earth beyond the limits of excavation needed to install the conduit. All damages by excavating, either to surface or subsurface structures, shall be repaired or replaced by the contractor at his own cost and expense.

The removal of any obstruction that may be found to conflict with the placing of this pipe will not be measured for payment or paid for as a separate contract pay item. The removal of any such obstruction will be included in such contract pay items as are provided in the proposal and contract.

The contractor shall dispose of all surplus materials at his own cost and expense at site approved by the engineer.

4. SAFETY REQUIREMENTS

Suitable bracing, shoring and barricading shall be placed as necessary to provide a safe condition. Proper ventilation for excavations and tunnels shall

be required. Any excavation that remains open after working hours shall be covered with a steel plate of sufficient thickness to support traffic.

5. CONSTRUCTION BY JACKING

If the grade of the pipe at the jacking end is below the ground surface, suitable pipes or trenches shall be excavated for the purpose of conducting the jacking operations and for placing end joints of the pipe. This excavation shall not be carried to greater depth than is required for placing of the guide and jacking timbers and no nearer the roadbed than the minimum distance shown on the plans.

At the other end of the pipe, an approach trench shall be excavated accurately to grade. All open trenches and pits shall be braced and shored in such a manner as will adequately prevent caving or sliding of the walls into the open trench or pit.

Heavy-duty jacks suitable for forcing the pipe through the embankment shall be provided. In operating jacks, even pressure shall be applied to all jacks used. A suitable jacking head not less than 6 inches larger than the outside diameter of the pipe, usually of timber and suitable bracing between jacks and jacking head, shall be provided so that pressure will be applied to the pipe uniformly around the ring of the pipe. The jacking head shall be of such weight and dimensions that it will not bend or deflect when an opening for the removal of excavated material as the jacking proceeds. A suitable jacking frame or backstop shall be provided. The pipe to be jacked shall be set on guides that are straight and securely braced together in such manner to support the section of the pipe and to direct it in the proper line and grade. All timber and other materials used in the construction of the jacking assembly will be of such quality and dimensions that they will withstand all stresses to which they are subjected in such a manner as to insure even pressures on the pipe during jacking operations. The whole jacking assembly shall be placed so as to line up with the direction and grade of the pipe.

As the jacking proceeds, the embankment material shall be excavated slightly in advance of the pipe in such a manner to avoid making the excavation larger than the outside diameter of the pipe, with the excavated material being removed through the pipe. The excavation for the underside of the pipe, for at least one third of the circumference of the pipe, shall conform to the contour and grade of the pipe. The excavation for the top half of the pipe shall conform closely to the outside diameter of the pipe and a clearance greater than 2 inches will not be permitted. All voids between the pipe and the earth shall be filled with non-shrinking grout. Grout holes shall be provided in the pipe.

The grouting shall follow immediately upon completion of the jacking operation.

All carrier pipes installed by jacking shall be supported as required by the plans.

The distance that the excavation shall extend beyond the end of the pipe depends on the character of the materials, but it shall not exceed 2 feet in any case. The pipe, preferably, shall be jacked from the low or downstream end. Lateral or vertical variation in the final position of the pipe from the line grade established by the engineer will be permitted only to the extent of 1 inch per 10 feet, maximum of 6 inches, provided that such variation shall be regular and only in one direction and that the final grade of flow line shall be in the direction indicated on the plans.

When jacking of pipe is once begun, the operation shall be carried on without interruption, insofar as practicable; to prevent the pipe from becoming firmly

set in the embankment.

Any pipe damaged in jacking operations shall be repaired or removed and replaced by the Contractor at his entire expense.

The pits or trenches excavated to facilitate jacking operation shall be filled immediately after the jacking of the pipe has been completed unless an encasement only has been installed; in which case, the trenches and pits shall be left open until the carrier pipe has been laid through and manholes have been built if required. The pits or trenches shall then be backfilled in accordance with 022020, Excavation and Backfill for Utilities & Sewers.

7. CONSTRUCTION BY BORING

The hole shall be bored mechanically with a suitable boring assembly designed to produce a smooth, straight shaft and so operated that the completed shaft will be at the established line and grade. The size of the bored hole shall be of such diameter to provide ample clearance for bells or other joints.

Voids outside the casing shall be grouted with non-shrinking grout and will be considered subsidiary work. In addition to the requirements stated above, the applicable provisions of "Construction By Jacking", in regard to the construction of trench, tolerance in line and grade, method of operation, backfilling, etc., shall govern for construction by boring.

7. CONSTRUCTION BY TUNNELING

The tunnel shall be excavated in such a manner and to such dimensions, which will permit placing of the proper supports necessary to protect the excavation. The contractor shall take the proper precautions to avoid excavating earth beyond the limits of excavation shown on the plans. All damages by excavating, either to surface or subsurface structures, shall be repaired or replaced by the contractor at his own cost and expense.

If required by the plans or if required for safety, suitable steel or timber sheeting, shoring and bracing shall be used to support the sides and roof of the excavation. Supports may be left in place provided that they clear the steel liner plate or carrier pipe. No separate payment will be made for supports left in place. Nothing contained herein shall prevent the contractor from placing such temporary or permanent supports as he deems necessary, nor shall it be construed as relieving the contractor from his full responsibility for the safety of the work, and for all damages to persons and property.

Liner plate shall be place when the foundation is in a condition satisfactory to the engineer. Tunnel dimensions shall be minimum dimensions and subsequent grout fill around the perimeter of the liner plate, shall be at the expense of the contractor. The liner plate shall be laid true to line and grade. Tolerance in line and grade shall be as specified in, "Construction by Jacking".

The void between the tunnel wall and the tunnel lining shall be backfilled with non-shrinking grout having a minimum compressive strength of 1000 pounds per square inch at 28 days. Grout shall not be placed inside the liner plate.

All pipe damaged during construction operations shall be repaired or removed and replaced by the contractor at his entire expense.

8. JOINTS

If corrugated galvanized metal pipe is used, joints may be made by field bolting

or by connecting bands, whichever is feasible. If reinforced concrete pipe 24 and larger in diameter with tongue and groove joints is used for the encasement pipe, the interior joints for the full circumference shall be sealed and packed with mortar and finished smooth and even with the adjacent section of pipe. If steel pipe is used for the encasement pipe, the joints shall be welded sealed for the full circumference.

9. MEASUREMENT & PAYMENT

Unless indicated otherwise in the proposal, Jacking, Boring, and tunneling shall not be measured for pay but shall be subsidiary to the casing pipe or the liner plate.