

CONCRETE PRESSURE PIPE IN TUNNEL INSTALLATIONS



Concrete Pressure Pipe being pushed into tunnel.

Tunneling is a necessary aspect of water pipeline construction – often to traverse obstacles such as mountains, rivers, and railroads, or to avoid open excavation which would be costly and disrupt traffic-filled city streets or residential neighborhoods. Because Concrete Pressure Pipe is rigid enough to maintain its joint configuration, even when transmitting substantial forces, it is an ideal pipe material for tunnel installations.

All four types of Concrete Pressure Pipe are ideal for ensuring leak-proof systems in tunnel applications. These types are Reinforced Concrete, Steel-Cylinder Type (C300); Prestressed Concrete, Steel-Cylinder Type (C301); Reinforced Concrete, Noncylinder Type (C302); and Bar-Wrapped, Steel-Cylinder Type (C303).

CONSTRUCTION METHODS

Construction methods for installing Concrete Pressure Pipe in tunnels varies with the size of the pipe, the length of the tunnel, and the type of primary liner casing system used. The liner casings are usually one of four types: steel liner plate, steel ribs and timber lagging, precast concrete segments, or concrete pipe itself.

There are two construction methods used to install the tunnel liner: tunneling and jacking. Each project requires individual evaluation by experienced engineers to determine the appropriate installation method. For smaller diameter pipe in short tunnels, such as those under a highway or a railroad, it is common practice to slide the Concrete Pressure Pipe through a liner.



Checking joint of Concrete Pressure Pipe before pushing pipe into tunnel.

Transporting or moving large pipe into or through the tunnel varies from a simple push-pull skidding arrangement, to using hydraulic jacks, winches and cables, or special pipe-carrying machines that not only transport the pipe but are capable of positioning and joining a section of pipe to the previously placed section.

JOINT TESTING

No pipe laying job is complete without testing the joint for leaks. Competitive pipe materials require filling the line with water and applying a pressure to test for leaks. Typically, this is accomplished after a considerable amount of pipeline has been placed into the tunnel. Should a leak occur, finding it is a

major problem, and correcting it is an even larger one. With Concrete Pressure Pipe, a double O-ring testable joint alternative gives the pipe laying contractor the assurance of watertight joints immediately after make-up, and the test takes only minutes to perform. In practice, the joint employs dual O-ring gaskets with an air test fitting installed between them, accessible from the interior of the pipe. Immediately after making the joint, the contractor connects an air line from a small air tank or pump to the test fitting and pressurizes the space between the gaskets. Any leakage is detected immediately; however the joint test pressure is usually monitored for a minimum of 30 seconds. On the rare occasion that leakage takes place, the joint is disassembled and the gaskets are replaced.

PIPE PROTECTION

If Concrete Pressure Pipe is to be pushed or pulled into the tunnel liner, care must be taken to protect the pipe from damage. Provision must also be made to protect the steel bell and spigot joint rings. Options include:

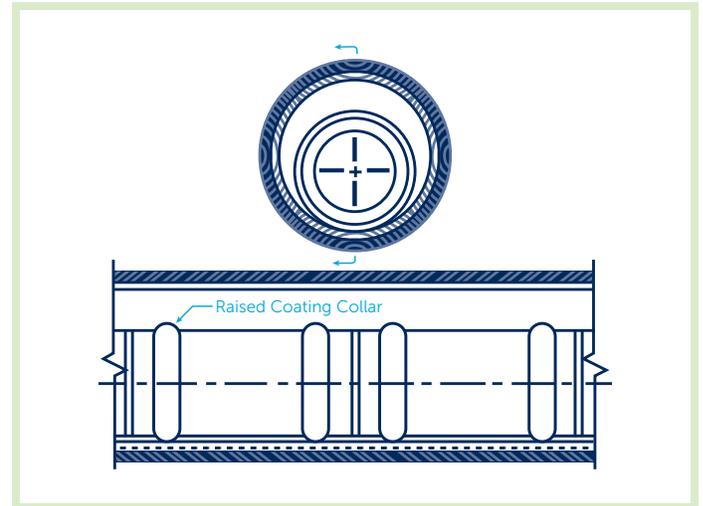
- For mortar-coated Concrete Pressure Pipe, an additional band of mortar can be applied to the exterior of the pipe, during manufacture, to act as a wearing surface.
- Timber sections can be strapped to the exterior of each pipe to act as runners, with the liner surface lubricated, possibly with bentonite.
- Exterior segmented bands, with plastic tipped steel ribs called casing spacers, can be bolted together around the pipe at the job site. The ribs act as runners, reducing friction and protecting the pipe exterior from damage.
- In any push-pull installation, a lubricant, such as bentonite may also be used on the tunnel liner system to reduce the sliding resistance.
- If pipe is to be pushed or pulled into the tunnel liner, the pipe ends must be protected from damage. This can be accomplished with timber cushions placed in the joints.

Consult with the pipe manufacturer for details. Regardless of the pipe installation method, if the annular space between the tunnel liner and the Concrete Pressure Pipe is not filled with portland cement or grout, then joint corrosion protection must be provided. Acceptable options include applying protective coatings on the steel joint rings, utilizing preformed grout bands or employing other approved corrosion protection systems.

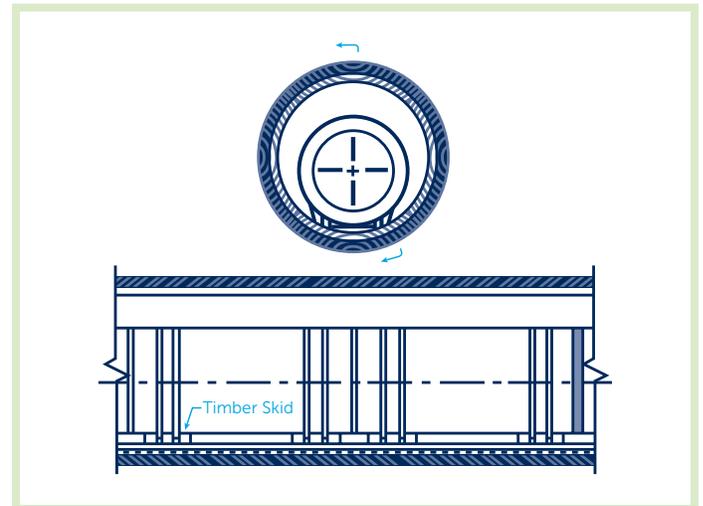
LONG-TERM PIPE SUPPORT

Typically, the annular space between the Concrete Pressure Pipe and the tunnel liner is filled with portland cement grout. A bulkhead is used to retain the mortar or grout. It is placed in the annular space at each end of the section that is to be grouted. Provision must be made to prevent floatation of the pipe and to vent trapped air.

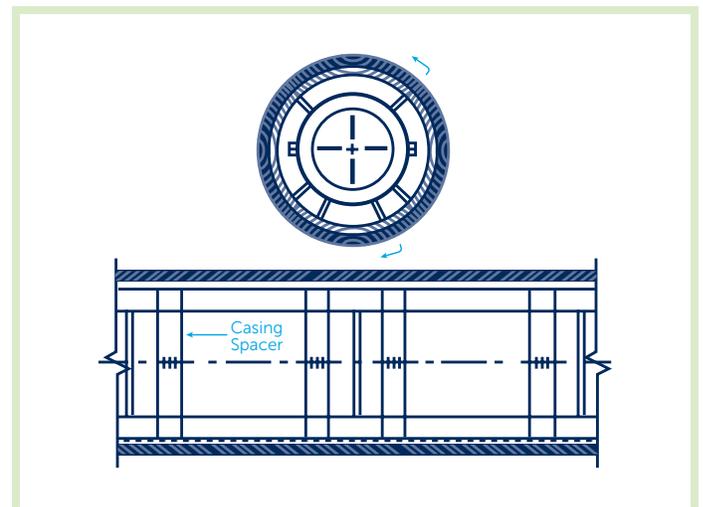
Raised Coating Collar Method



Timber Skid Method



Casing Spacer Method



Methods for installing Concrete Pressure Pipe inside a Casing.



Concrete Pressure Pipe attached to timber skids.

Grout may be delivered to the annular space through ports installed in the pipe walls during manufacturing, or by use of a grout placement line extended back to the remote bulkhead. The grout placement line is withdrawn as the grouting progresses.

Alternatively, the annular space may be filled with sand, or the pipe may be blocked, top and bottom as well as sides, to prevent its shifting in the tunnel.

LEARN MORE

For more information about using Concrete Pressure Pipe in tunnel construction, speak with your Concrete Pressure Pipe supplier, or contact the American Concrete Pressure Pipe Association at **714.801.0298** or **www.accpa.org**.

APPLICATIONS

A variety of projects have utilized Concrete Pressure Pipe in tunnel installations. Concrete Pressure Pipe is manufactured with concrete to bear the compressive loads, and reinforcing steel to bear the tensile loads.

Whether the pipeline must traverse a river, pass under city streets, or be placed under railroad or highway embankments, Concrete Pressure Pipe can be designed and manufactured to take the loads of installation, and still perform for a lifetime.



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