

# Chapter 13

## Specifications



## Material Requirement

These specifications cover the purchase of high density polyethylene (HDPE) pipe liners for lining existing culvert pipes. Pipe liners furnished to this specification shall meet or exceed all requirements.

Bidders are cautioned to read the specifications carefully, as there may be special requirements not commonly offered by the pipe liner manufacturer.

### **Pipe liner shall meet the following requirements and conform to the reference specifications:**

The liner pipe shall be made of high density polyethylene resins in accordance with the requirements of ASTM D3350. The Cell Classification will be a minimum 345464C and shall have the Plastic Pipe Institute designation of PE3608.

Pipe liner shall be a Dimension Ratio (DR) of 32.5. The installed pipe shall have a smooth, non-corrugated interior and exterior surface.

The liner shall be capable of being joined into a continuous length by an interlocking method. The joints shall not create an increase in the outside diameter of the liner pipe to eliminate any coupling difficulties. The joints must be water-tight with gaskets that are capable of handling pressures up to 25 feet of head per ASTM D3212. Each HDPE shall have a male and a female end. The supplier shall furnish a manufacturer's certification stating that the material in the pipe meets the requirements of ASTM D3350 with a minimum cell classification of PE345464 C with the physical properties indicated above.

The supplier shall certify the dimensions meet the requirements of ASTM F714.

Before inserting the liner pipe, the existing pipe must be cleaned if needed. All debris or other materials must be removed from the host pipe.

After the liner is in place, the area between the original pipe and the liner shall be completely filled with low density flowable fill or cellular grout.

# SAMPLE SPECIFICATION

## Sample Specifications for Snap-Tite® Culvert Liners

*This Specification is available at [www.culvert-rehab.com](http://www.culvert-rehab.com) in a downloadable word format form for this format and CSI format. A grout specification is also available at [www.culvert-rehab.com](http://www.culvert-rehab.com) in a downloadable CSI word format.*

**1. Description** — This Item shall govern for furnishing, installing, grouting and providing all labor, material and equipment necessary to rehabilitate existing culvert pipe by sliplining an existing culvert pipe with high density polyethylene (HDPE) pipe. The pipes shall be sizes, types, designs and dimensions shown on the plans and shall include all connections, joints and other appurtenances as required to complete the work.

The sliplining process will require the contractor to completely grout the annular void between the host and insert pipe. The grouting process shall be considered subsidiary to this item.

**2. Materials** — Unless otherwise specified on the plans or herein, culvert pipe renewal shall conform to the following:

Snap-Tite® Culvert Liner as provided by ISCO Industries or approved equal.

**A. Liner Material – High Density Polyethylene (HDPE) Pipe**

1. High density polyethylene pipe and fittings shall meet the requirements in the AASHTO M326-08 Specification.
  - a. 3rd Party Test Data must be submitted at time of bid. Test Data must also be verified by an approved PE for accuracy.
2. Raw Materials. The pipes and the fittings shall be manufactured from PE resin compounds, which have a minimum cell class 345464C as defined and described in ASTM D3350.
3. HDPE Resin Specifications.

Property	Specifications	Unit	Nominal Value
<b>Material Designation</b>	<b>PPI/ASTM</b>		<b>PE3408/PE3608</b>
Cell Classification	ASTM D3350		345464C
1. Density (3)	ASTM D1505	Gm/cm <sup>3</sup>	0.955
2. Melt Index (4)	ASTM D1238	gm/10 min.	0.11
3. Flexural Modulus (5)	ASTM D790	psi	135,000
4. Tensile Strength (4)	ASTM D638	psi	3,200
5. Slow Crack Growth			
a. ESCR	ASTM D1693	hours in 100% igepal	>5,000
b. PENT (6)	ASTM F1473	hours	>100
6. HDB @ 73 deg. F (4)	ASTM D2837	psi	1,600
7. UV Stabilizer (C)	ASTM D1603	%C	2.5%

**B. Designation of Type**

1. The HDPE pipes used for liners in gravity flow culverts shall be solid-wall construction with mechanical end connectors, male and female, consisting of 2 machined-groove landing points, to prevent the pipe from pulling apart during installation.
2. Individual liner section lengths shall be a minimum of 6 ft. but shall not exceed 50 ft. unless pre-approved.

- C. Pipe joints** shall comply with ASTM D3212 Standard Specification for joint tightness.
    - 1. Extrusion welded joints shall not be allowed to join the liner pipe together to keep grout from leaking out during the grouting stage.
    - 2. Neoprene Cement shall not be allowed to create a seal at the joint to prevent grout from leaking out during the grouting stage.
  - D. Hydraulic flow characteristics** for the liner pipe shall provide a Manning's coefficient of  $n = 0.00914$ . Pipe Manufacturer shall submit 3rd party test data verifying the Manning's coefficient has been achieved.
  - E. Liner Pipe** material must be pre-approved by the governing state agency's materials testing department before bid and have a minimum of 1,000' of said liner installed in said state.
  - F. Oval Pipe**
    - 1. The liner shall be furnished in an oval shape to match the existing CMP elliptical pipe, with horizontal and vertical wood struts inserted through the liner by the manufacturer before delivery to the jobsite, as to keep the liner in an oval shape before grouting into place. After the liner has been grouted fully in place, the struts shall be removed. The Contractor is responsible for ascertaining actual measurements prior to ordering the liner.
  - G. Other pipe liners** that do not meet this specification must be submitted for approval prior to bid date.
  - H. Liner Pipe must be manufactured in the United States under the 'Buy American Products' program**
  - I. Grouting Material** – Contractor shall utilize material specifications for solidification of the annular void between host and the inserted liner with low-density flowable fill or cellular grout. The cellular grout with a density between 40 and 80 lbs. per cubic foot may be used. Reduced-density flowable fill grout with a density between 100 and 120 lbs. per cubic foot may be used.
  - J. End Treatment** – The upstream/inlet end of the new liner pipe shall be fitted with a flow enhancement device to reduce inlet control effects. The device shall be HDPE material, same as the liner pipe, and have a connector included for connection to the liner pipe. The opening at the end of the device shall be larger than the ID of the host pipe. 3rd Party Test data shall be provided to show improvement of flow by at least 30% at 2 feet of headwater depth or an entrance loss coefficient (K) of approximately 0.2 for outlet control conditions. The device shall be the Hydro-Bell or approved equal.
- 3. Cleaning** — The existing culvert pipe shall be cleaned by whatever means necessary to remove all obstructions which may be encountered that would prevent insertion of the pipe liner into the host pipe as approved by the engineer. This work will not be paid for directly, but shall be considered subsidiary to this item.
- 4. Construction**
- A. Installation**
    - a. Contractor must be pre-approved by the pipe manufacturer and a letter of this pre-approval must be submitted from the manufacturer to the contractor at the time of bid.
    - b. Contractor personnel shall have a minimum of 5,000' of slipline material installation experience and submit three previous slipline project references similar in size and scope of bid in writing.

- c. Manufacturer's Rep must be on site at critical stages of the liner installation and grouting application.

**B. Liner Pipe** – Liner pipe shall be inserted and installed in accordance with manufacturer's recommendations. Grade of liner pipe shall be maintained parallel to grade of host pipe.

**C. Grouting**

- a. Upon completion or partial completion of the sliplining process, grouting will be required to be placed in the annular void between the insertion pipe and the host pipe. Cellular grout with a density between 40 and 80 lbs. per cubic foot may be used. Reduced-density flowable fill grout with a density between 80 and 120 lbs. per cubic foot may be used. Project engineer shall state density of grout to be used on drawings or in specifications.
- b. A detailed plan on holding the liner pipe on the invert of the host pipe shall be submitted to the engineer for approval.
- c. The annular void shall be completely grout filled without deflecting the insertion pipe greater than 1.5 percent.
- d. The contractor shall provide end seals at the open points of each run of pipe to be grouted.
- e. Penetration of the host pipe shall be permitted for host pipe constructed with Corrugated Metal Pipe (CMP) to facilitate grouting of the annular void. Multiple fill pipes will be required.
- f. The annular void shall be grouted solid by injecting grout from one end of the pipe run and allowing it to flow toward the other end. Venting of the annular void shall be performed to assure uniform filling of the void space during the grouting process.
- g. An open-ended, high-point tap or equivalent vent must be provided and monitored at the bulkhead opposite to the point of grouting.
- h. Pressure on the annular void shall not exceed 2 PSI to avoid damage to the liner pipe. Regardless of the pressure, the contractor shall be solely responsible for any damage or distortion to the insertion pipe due to the grouting process.
- i. The grout shall be made using the preformed foam process using foam-generating equipment calibrated daily by the foam manufacturer to produce a precise and predictable volume of foam. The foam concentrate shall be certified by the customer to have specific liquid/foam expansion ratio at a constant dilution ratio with water.
- j. The specific job mix shall be submitted to the customer by either the foam concentrate supplier or the certified /licensed contractor for approval prior to use on this project. The mix shall have a minimum 28 day compressive strength of 300 psi.
- k. Grout mixed off-site shall be delivered to the jobsite in a truck mixer filled to half its capacity. The foam concentrate shall then be added to the cement mix in the truck and mixed to a uniform consistency and pumped into the annular space.
- l. Contractor must have a written erosion control plan with a method for waste grout recovery submitted to county with attached bid proposal.
- m. Customer will verify that post-construction conditions are acceptable after installation and ensure that proper seeding and general cleanup has been completed.

**D. Pipe Stockpiling and Handling** – Pipe and fittings shall be stockpiled in a safe manner at each contractor staging area or pit location. The stockpiling shall be arranged to cause a minimum of interference to pedestrian and stored outside the safety clear zone of vehicular traffic. When handling sliplining pipe, the contractor shall take all precautions necessary to avoid damaging the pipe. For pipe with cuts greater than 10% of the wall thickness, repair or replacement will be at the entire expense of the contractor.

**5. Clean-up and Restoration** — Upon acceptance of the installation work and testing, the contractor shall clean-up and restore the project area affected by operations as approved by the engineer.

**6. Measurement** — This item shall be measured by the foot. Such measurement shall be made along the flowline of the liner pipe, complete in place.

For multiple culverts to be lined, the measurement length shall be the sum of the lengths of each barrel, measured as prescribed above.

The accepted quantities of pipe liner will be paid for at the contract unit price per linear foot for the size of the existing pipe in which the liner is installed, complete in place.

**7. Payment** — The work performed and the materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for as the unit bid for “Sliplining Culvert Pipe” of the type, design (if required), and size specified. This price shall be full compensation for cleaning existing pipe; for furnishing, hauling, installing liner pipe and placing grout; for all connections; and for all labor, tools equipment, materials, clean-up and incidentals.