
PIPE REHABILITATION**PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Sliplining Pipe
- B. Cured-in-place Pipe Lining
- C. Deformed/Reformed Pipe Lining
- D. Folded/Formed Pipe Lining
- E. Spot Repairs by Pipe Replacement

1.02 DESCRIPTION OF WORK

- A. Pipe Lining:
 - 1. Resin impregnated, cured-in-place.
 - 2. Deformed/reformed polyethylene.
 - 3. Folded/formed polyvinyl chloride.
 - 4. Sliplining.
- B. Pipe spot repairs.

1.03 SUBMITTALS

Follow the General Provisions (Requirements) and Covenants.

1.04 SUBSTITUTIONS

Follow the General Provisions (Requirements) and Covenants as well as the following:

Provide, as a minimum, the following information for evaluation.

A. Product Information:

- 1. Product name.
- 2. Year product first available in the United States.
- 3. Total footage or number of line segments installed in the United States.
- 4. Results of all available product testing, including but not limited to leakage, physical properties, pipe stiffness, chemical resistance, strain-corrosion, external loading, flow characteristics, infiltration/inflow reductions, structural capacity, and external hydrostatic loading capacity.
- 5. Samples of before and after product.
- 6. Design method.
- 7. Typical lining thickness for pipe sizes included in the project.

1.04 SUBSTITUTIONS (Continued)**B. Manufacturer Information:**

1. Manufacturer name.
2. Years of experience manufacturing the product.
3. Country of manufacture of all product components.
4. Quality control procedures for product manufacture, including inspection requirements, testing procedures, and allowable tolerance levels.
5. Related ASTM standards, or other nationally recognized standards for product manufacturing.

C. Installer Information:

1. Installer name.
2. Completed project list for last five years including for each project and year completed, client name/address/contact person/phone number, footages installed by pipe diameter, and number of lateral reinstatements.
3. Detailed installation procedures, including estimated times for each task, lateral reinstatement methods, number of required excavations, and other items unique to each product.
4. Video of installation process, if available.
5. Evidence of properly trained personnel.
6. Related ASTM standards or any nationally recognized standards for product installation.
7. Available equipment list.
8. Detailed procedures for repairing the product in the event of future damage or failure and for tapping future service connections, including and required specialized equipment or training.
9. Videos of two rehabilitated sewer sections showing before and after conditions.
10. Additional information may be required. The submittal of prequalification information in no way implies that the product, manufacturer, or installer will be deemed to be qualified. The Contracting Authority, in its sole discretion, will determine whether a product, manufacturer, or installer does or does not qualify as an approved equal.

1.05 DELIVERY, STORAGE, AND HANDLING

Follow the General Provisions (Requirements) and Covenants.

1.06 SCHEDULING AND CONFLICTS

Follow the General Provisions (Requirements) and Covenants.

1.07 SPECIAL REQUIREMENTS

- A. Prior to start of work, notify all affected parties 24 hours in advance as to the length of time their service will be blocked.
- B. Notify the Jurisdiction's water works to use meter and pay for water, if required.
- C. Unless otherwise specified, the Owner will provide water for installation of cured-in-place pipe from a nearby hydrant through a separate valve mounted on the hydrant.
- D. Public Relations Program: Establish a Public Information and Notification Program for contacting each home or business connected to the affected sanitary sewer, informing them of the work to be done and when the sewer will be off-line. The following specific steps are part of the Public Information and Notification Program.
 - 1. Provide written notice to be delivered to each affected home or business describing work, schedule, how the work affects them, and a local telephone number of the Contractor they can call to discuss the project or their problems.
 - 2. Personally contact each home or business on the day lateral verifications using closed circuit video inspection are to be performed. The homeowner or business will be asked to run water down their drain to verify each lateral. If the homeowner is unavailable, attempt other arrangements (cleanouts) to drain water through the lateral to verify each connection.
 - 3. Provide written notice and personally contact the home or business the day prior to beginning inversion of the section of sewer to which they are connected.
 - 4. Personally contact all homes or businesses that cannot be reconnected within the time stated in the written notice.
 - 5. Furnish and service portable toilets for use by the home or business occupants if so required by any affected served business or homeowner.

1.08 MEASUREMENT AND PAYMENT**A. Pipe Lining:**

- 1. **Measurement:** Each type and size of pipe lining will be measured in linear feet along the centerline of the pipe lining from center of manhole to center of manhole.
- 2. **Payment:** Payment will be made at the unit price per linear foot for each type and size of pipe lining.
- 3. **Includes:** Unit price includes removal of internal obstructions, pipe cleaning, inspection, and all costs associated with the public information and notification program.

B. Building Sanitary Sewer Service Reconnection:

- 1. **Measurement:** Each active existing building sanitary sewer service reconnected to the pipe lining, including the services reconnected by excavating and reconnecting services or by trenchless reconnection methods, will be counted.
- 2. **Payment:** Payment will be made at the unit price for each reconnection.
- 3. **Includes:** Unit price includes, but is not limited to, removal of internal obstructions, pipe cleaning, and all costs associated with the public information and notification program.

1.08 MEASUREMENT AND PAYMENT (Continued)

C. Spot Repairs by Pipe Replacement: Both of the following methods will be used for measurement and payment of spot repairs by pipe replacement.

1. Spot repairs by Count:

- a. Measurement:** Each spot repair location will be counted.
- b. Payment:** Payment will be made at the unit price for each spot repair.
- c. Includes:** Unit price includes, but is not limited to, uncovering and removing existing pipe, placing backfill material for replacement pipe, and restoring the surface.

and;

2. Spot Repairs by Linear Foot:

- a. Measurement:** Each spot repair will be measured in linear feet along the centerline of the replacement pipe.
- b. Payment:** Payment will be made at the unit price per linear foot of spot repair.
- c. Includes:** Unit price includes, but is not limited to, furnishing and installing replacement pipe and connections.

PART 2 - PRODUCTS**2.01 POLYETHYLENE AND POLYOLEFIN MANUFACTURED PIPE FOR SLIPLINING****A. Pipe:**

1. Comply with ASTM D 3035, minimum pipe stiffness of 46 psi.
2. Polyethylene complying with ASTM D 1248, Type III, Class C, Category 5, Grade P 34 or ASTM D 3350 Cell Classification PE 335434C.
3. Maximum outside diameter as specified in the contract documents.

B. Joints:

1. Joined into continuous length on job site.
2. Fuse butt joints according to the pipe manufacturer's recommendations with approved equipment and complying with ASTM D 2657.

2.02 POLYVINYL CHLORIDE PIPE (PVC) MANUFACTURED PIPE 12 INCH TO 36 INCH FOR SLIPLINING**A. Pipe:**

1. Comply with ASTM F 949, minimum pipe stiffness, 46 psi.
2. PVC plastic complying with ASTM D 1784, Cell Classification 12454.

B. Joints: Gasketed joints complying with ASTM F 477 and ASTM D 3212.

2.03 POLYVINYL CHLORIDE PIPE (PVC) MANUFACTURED PIPE 21 INCH TO 48 INCH FOR SLIPLINING**A. Pipe:**

1. Comply with ASTM F 1803, minimum pipe stiffness, 46 psi.
2. PVC plastic complying with ASTM D 1784, Cell Classification 12364.

B. Joints: Gasketed joints complying with ASTM F 477 and ASTM D 3212.

2.04 CENTRIFUGALLY CAST FIBERGLASS REINFORCED POLYMER MORTAR PIPE (CCFRPM) 18 INCH TO 48 INCH FOR SLIPLINING.

A. Pipe: Comply with ASTM D 3262.

B. Joints: Gasketed joints complying with ASTM D 4161.

2.05 RESIN-IMPREGNATED TUBE FOR CURED-IN-PLACE PIPE (CIPP) Lining**A. Pipe Lining:**

1. Comply with ASTM F 1216.
2. Use one or more layers of flexible needled felt or equivalent non-woven material.
3. Stretch material to fit irregular pipe and negotiate bends.

2.05 RESIN-IMPREGNATED TUBE FOR CURED-IN-PLACE PIPE (CIPP) Lining (Continued)

4. Outside layer plastic coated with a translucent flexible material. No delamination of plastic coating.
5. Fabricated to a size that when installed tightly fits length without joints.
6. Designed as per Equation X-1, ASTM F 1216.

B. Resin and Catalyst:

1. Unsaturated, styrene-based, thermoset resin and catalyst system or an epoxy resin and hardener that is compatible with the inversion process.
2. Cures in the presence of water with temperature greater than 150°F and less than 180°F.
3. Initial structural properties complying with ASTM F 1216. Also comply with the following table.

Table 4050.01: CIPP Lining Properties

CIPP Properties	ASTM Test Method	Minimum Value
Flexural Strength	D 790	4,500 psi
Flexural Modulus of Elasticity	D 790	250,000 psi

C. CIPP Lining Dimensions:

1. Use nominal internal diameter and length such that CIPP forms to internal circumference and length of original pipe.
2. Field verify diameter and length.
3. Use one continuous length without joints.

2.06 DEFORMED/REFORMED HIGH DENSITY POLYETHYLENE PIPE LINING (DRP-HDPE)**A. Pipe Lining:**

1. Manufactured in deformed shape from HDPE pipe compound complying with ASTM D 1248, Class C, Category 5 and Grade P 34.
2. Comply with long term hydrostatic strength rating of 1600 psi or more according to ASTM D 2837.
3. Environmental stress crack resistance (ESCR) less than 2,000 hours in 100% solution, Igepal CO-630 at 100°C before failure according to ASTM D 1693, Condition C.
4. Comply with the following table for minimum DRP lining structural standards.

Table 4050.02: DRP-HDPE Lining Properties

FIPP Properties	ASTM Test Method	Minimum Value
Flexural Strength	D 790	3,300 psi
Flexural Modulus of Elasticity	D 790	136,000 psi
Tensile Strength	D 638	3,200 psi

**2.06 DEFORMED/REFORMED HIGH DENSITY POLYETHYLENE PIPE LINING (DRP-HDPE)
(Continued)****B. DRP Lining Dimensions:**

1. Nominal internal diameter and length of existing pipe as specified in the contract documents.
2. Field verify diameter and length.
3. Outside diameter fabricated to fit tightly.
4. Use one continuous length without joints between manholes.
5. Minimum SDR wall thickness as specified in the contract documents.

2.07 FOLDED/FORMED POLYVINYL CHLORIDE PIPE LINING (FFP-PVC)**A. Pipe Lining:**

1. Manufacture in deformed shape complying with ASTM D 1784, Cell Classification 12454
B. Compounds with different cell classifications because one or more properties are superior to those specified are acceptable.
2. Performance requirements complying with ASTM D 3034.
3. Comply with the following table for FFP lining structural properties.

Table 4050.03: FFP-PVC Lining Properties

FIPP Properties	ASTM Test Method	Minimum Value
Tensile Modulus of Elasticity	D 638	350,000 psi
Tensile Strength	D 638	6,000 psi

B. FFP Lining Dimensions:

1. Nominal internal diameter and length of existing pipe as specified in the contract documents.
2. Field verify diameter and length prior to manufacturing.
3. Use one continuous length without joints between manholes.
4. Outside diameter fabricated to fit tightly.
5. Minimum SDR wall thickness as specified in the contract documents and complying with ASTM F 1216.

2.08 PIPE REPAIR COUPLINGS FOR SPOT REPAIRS BY PIPE REPLACEMENT

- A. Style:** Full circle, fully lined, bolted.
- B. Length:** 12 inches, minimum.

2.08 PIPE REPAIR COUPLINGS FOR SPOT REPAIRS BY PIPE REPLACEMENT (Continued)**C. Materials and Manufacturer:**

1. Shells, armors, side bars, lugs, Turner lifting bars, bolts and nuts; complying with ASTM A 240, Type 304 stainless steel.
2. MIG welds, fully passivated.
3. Rubber gasket complying with ASTM D 2000, AA415 with full coverage and a grid pattern.
4. Stainless steel armor bonded to gasket to bridge lug area.

D. Nuts and Bolts: 1/2 inch or 5/8 inch, Teflon coated threads.

2.09 SEWER MAIN PIPE (FOR SPOT REPAIRS)

- A. Comply with [Section 4010](#).
- B. Use materials for pipe replacement as specified in the contract documents or approved by the Engineer.

PART 3 - EXECUTION**3.01 EXAMINATION****A. Cleaning:**

1. Clean and remove soil, grit, debris, and obstructions according to [Section 4060](#) prior to video inspection and/or insertion of pipe lining.
2. Do not flush debris to downstream sections.
3. Deposit removed material at an approved site.

B. Video Inspection:

1. Furnish the Jurisdiction with a recording of sewers: 1) before the lining process and while the flow is being bypassed; and 2) after the lining process and service reconnections have been completed.
2. Provide an on-screen numerical display of the camera location, indexed from the starting manhole, in feet.

C. Service and Obstruction Location:

1. Coordinate and cooperate with the Engineer for service and obstruction location.
2. Locate the active sewer services by one of following:
 - a. Use video inspection to observe service locations, breaks, obstructions, and structural failures.
 - b. Insert a sounding device through the service, noting its location on the ground surface.
 - c. Dye testing.

3.02 BYPASSING SEWAGE

- A. Submit a bypassing plan to the Engineer for review.
- B. Plug the line at a point upstream of pipe to be rehabilitated if bypassing is required.
- C. Pump flow to a downstream point or adjacent system as directed by the Engineer.
 1. Provide pump and bypass lines of adequate capacity to handle all flows.
 2. Provide adequate reserve pumps on-site for emergency use and for storm flows.

3.03 OBSTRUCTIONS

- A. Remove all obstructions.
- B. If an obstruction is encountered that cannot be removed by equipment operating within the pipe, excavate and remove the obstruction upon approval of the Engineer.
- C. Place backfill, compact, and restore the surface according to the contract documents.

3.04 TEMPORARY SEWER SERVICE

If full normal sewer service is not re-established within the times stated, provide temporary facilities or hotel accommodations for affected residents and businesses.

3.05 SLIPLINING**A. Excavation:**

1. For sliplining insertions, excavate at or near one structure and work from the existing manhole at the other end of the section to be pulled.
2. Insertion Pit:
 - a. For sliplining with segmented pipe (one pipe section at a time), construct the insertion pit as required to accommodate the length of individual pipe sections.
 - b. For sliplining with pipe that is to be welded together above ground and pulled into the sewer, dig a pit length 12 times the inside pipe diameter and slope the pit end back to the ground surface at a rate of 2.5 (horizontal) to 1.0 (vertical).

B. Test Head:

1. Pull the pulling head with one short section of sliplining pipe through the sewer before inserting the pipe to test for taps or obstructions protruding too far into the sewer.
2. Attach cables to both ends of the test head to allow for removal if an obstruction is encountered.

C. Installation: Push segmented pipe into the host pipe according to the manufacturer's recommendations, or pull in a continuously welded pipe according to ASTM F 585.**D. Service Reconnection:**

1. Allow the sliplining pipe to recover according to the manufacturer's recommendations.
2. Do not leave the sanitary service unconnected for more than 24 hours.
3. Complete reconnections involving excavation of service lines according to the local plumbing codes.
4. Reconnect excavated service connections according to the local plumbing code, except that the annular space between the host pipe and the sliplining pipe is to be filled with grout.

E. Grouting:

1. Before trimming the ends of the pipe and sealing, allow for the pipe to recover its original length according to the manufacturer's recommendations. Recovery time is at least equal to the time required to pull the pipe into place.
2. Fill the space between the sliplining pipe and the host pipe with CLSM complying with [Section 3010, 2.05](#) or other material approved by the Engineer. Pump filler in from the lower end of the sliplining pipe.

3.06 RESIN IMPREGNATED CIPP LINING

- A. Install according to the manufacturer's recommendations for this lining process and ASTM F 1216 unless noted otherwise.
- B. Use a resin impregnated tube, hydraulically inverted in place with an approved lubricant, and cured-in-place according to ASTM F 1216, Section 7.
- C. Make the tube continuous between manholes. The tube may span several manhole reaches as allowed by the equipment, properties of the CIPP, and the size and condition of the sewer.

3.06 RESIN IMPREGNATED CIPP LINING (Continued)

- D. Ensure the tube is free of uncured spots, lifts (spots cured away from the sewer), and delaminations. Remove and replace deficient sections.
- E. Service Reconnections:
 - 1. Do not leave sanitary service unconnected for more than 24 hours.
 - 2. Complete reconnections involving excavation of service lines according to the local plumbing code.

3.07 DRP-HDPE OR FFP-PVC LINING INSTALLATION

Install according to the manufacturer's recommendations for particular lining material and process, unless otherwise specified.

A. Lining Installation:

- 1. Designate location where insertion is to begin, subject to the Engineer's approval.
- 2. Transport lining to the site in one continuous length on spools compatible with the manufacturer's designated process.
- 3. Heat lining material at the job site as necessary for insertion. Pull lining into the sewer with appropriate pulling heads, cables, and heat distribution equipment.
- 4. Ensure lining is continuous between manholes as allowed by the tensile properties of lining and the size and condition of the sewer.
- 5. Connect fully inserted lining to the heat source distribution equipment.
- 6. Round and expand by uniformly distributed heat, steam, and pressure and by mechanical devices.
- 7. After lining has been expanded to a tight fit, cool gradually under pressure until the process is complete.
- 8. Provide a continuous pipe lining, without joints, over the entire length of pipe.
- 9. Ensure the lining is free of all material defects, pits, pinholes, cracks, crazing, folds, or unrounded sections.
- 10. Repair all defects at no additional cost to the Jurisdiction.

B. Service Reconnections:

- 1. Do not leave sanitary service unconnected for more than 24 hours.
- 2. Complete reconnections involving excavation of service lines according to the local plumbing code.

3.08 SPOT REPAIRS BY PIPE REPLACEMENT

- A. Excavate trench according to [Section 3010](#).
- B. Remove existing pipe to the extent required and disconnect affected sewer services.
- C. Install replacement pipe of the same nominal size as the existing pipe.
 - 1. Use the materials as specified in the contract documents that comply with [Section 4010](#).
 - 2. Place bedding material according to [Section 3010](#).
- D. Install pipe repair coupling.
 - 1. Cut pipes to length required allowing no more than a 1/2 inch gap between butted pipe ends at coupling location. Cut pipes perpendicular to centerline.
 - 2. Clean the outside surface of the existing and replacement pipes as required to provide a positive seal with the pipe repair coupling.
 - 3. Wrap coupling around pipes, centered on butt joint, and tighten bolts according to manufacturer's recommendations.
- E. Reconnect sewer services.
- F. Place backfill in trench according to [Section 3010](#).

3.09 CLEANUP AND CLOSEOUT

- A. Verify that the services are reconnected and fully operable, with at least 90% of original capacity.
- B. Submit initial and final video tapes, CDs, or DVDs to the Engineer.
- C. Remove all equipment and debris.

END OF SECTION