

# **SPECIFICATION FOR REHABILITATION OF SANITARY SEWERS AND PIPELINES USING DEFORMED/REFORMED POLYETHYLENE LINERS**

## **Part 1 GENERAL**

### 1.01 Scope

- A. The work covered by this section of the specifications includes the furnishing of all labor, tools, equipment and materials, and performing all lining of existing sewers with a continuously extruded joint-less and seam-less polyethylene deformed pipe liner. The polyethylene deformed pipe liner will be as specified herein. The work shall also include complete maintenance of all wastewater flows, reopening of service wyes or tees, removal of protruding service connections, etc. When completed, the formed liner should extend from end-to-end of the section being lined in a continuous, joint-less and seam-less, tight fitting, pipe-within-a-pipe as specified herein.

### 1.02 Product Handling

- A. All materials (polyethylene deformed liner, etc.) shall be accompanied by test reports certifying that the material conforms to the specifications listed herein. Materials shall be shipped, stored, and handled in a manner consistent with the written recommendations of the manufacturer.

### 1.03 Submittals

- A. The following submittals shall be made in accordance with the General conditions as supplemented.
  - 1. Contractor's description of his proposed deformed pipe rehabilitation method.
- B. Brochures shall be submitted for all items to be furnished if required in the General Conditions as supplemented. Submittals shall include information on the deformed high-density polyethylene liner intended for installation.
- C. Calculations specifying the design and required thickness of the liner as defined in ASTM F-1606 shall be submitted, when requested by the engineer.

#### 1.04 Safety

- A. The Contractor shall conform to all work safety requirements of pertinent regulatory agencies, and shall secure the site for the working conditions in compliance with the same.
- B. The Contractor shall also perform all of the Work in accordance with applicable OSHA standards. Emphasis shall be placed upon the requirements for entering confined spaces and working with steam.

#### 1.05 Measurement and Payment

- A. Measurement and payment for work described in this section will be made in accordance with the provisions of the section identified as MEASUREMENTS AND PAYMENT.

### **Part 2 MATERIALS**

#### 2.01 Liner

- A. Deformed/Reformed Polyethylene Pipe shall be made from polyethylene resins complying with the cell classification of ASTM D-3350, 345464C, D, or E for High Density Polyethylene (HDPE). The installed liner pipe shall also meet these material cell classifications.
- B. In addition, the liner material shall meet the ASTM F-1533, Standard Specification for Deformed Polyethylene (PE) Liner.
- C. The minimum length of the liner pipe shall be sufficient to effectively span the distance from the starting manhole to the terminating manhole or access point, unless otherwise specified.
- D. Material and Equipment Acceptance
  - 1. At the time of manufacture, each lot of liner shall be inspected for defects and tested in accordance with F-1533. At the time of installation, the liner shall be homogenous throughout, uniform in color, free of cracks, holes, foreign materials, blisters, or deleterious faults.

E. Marking

1. Liner shall be marked at 5-foot intervals or less with a coded number, which identifies the manufacturer, SDR, size, material, date, and shift on which the liner was extruded.

F. Certification

1. The Contractor shall provide certified test results, to the Engineer, from the manufacturer, demonstrating that the material conforms to the applicable requirements.

**Part 3 Execution**

3.01 Liner Installation

A. General

1. The Contractor shall insure the cleanliness of the existing sewer prior to insertion of the liner. All debris that can be removed internally with normal hydro-jet pressure cleaning methods shall be removed. The Engineer, as extra work, will approve obstructions requiring optional robotic or external point repairs for removal.
2. The liner shall be constructed of a material which, when installed, shall provide a structurally sound liner able to withstand all imposed static, dynamic and hydrostatic loads on a long-term basis.

B. Design Requirements

1. The following design requirements must be met by the Contractor for the chosen method of construction:
  - a. The rehabilitation of the sewer main shall be performed without the need for excavation, demolition of existing structures, and be able to reestablish user lateral services without excavation and minimize the disruptions to neighboring homes and traffic. Excavation for point repairs or emergencies shall be permitted, but only as required and directed by the Engineer, and will be considered extra work.
  - b. The liner shall provide the least possible thickness or decrease in pipe diameter to meet the strength and other design requirements of this section.

### C. Preparation of Existing Sewer for Liner

1. Prior to any lining of a pipe so designated, it shall be the responsibility of the Contractor to clean each section of pipe of all foreign material.
2. Inspection of pipelines shall be performed by personnel trained and experienced in locating breaks, obstacles, and service connections by closed circuit television. The interior of the pipeline shall be carefully inspected to determine the location and extent of structural failures. The location of any conditions, which may prevent proper installation of lining materials into the pipelines, shall be noted so that these conditions can be corrected, or addressed as extra work. The Contractor shall locate and designate each service connection to be reinstated after lining. The Contractor shall keep videotape, and suitable inspection logs, for later reference.
3. The Contractor, when required, shall provide for the transfer of flow around the section or sections of pipe that are to be lined. The by-pass shall be made by diversion of the flow from an existing upstream access point and pumping the flow into a downstream access point or adjacent system. The pump and by-pass lines shall be of adequate capacity and size to handle the flow. A backup pump shall be available to replace a malfunctioning bypass pump.
4. The bypass pumping system, If needed, shall be approved by the Engineer in advance, unless needed for an emergency situation.
5. It shall be the responsibility of the Contractor to clear the line of obstructions such as solids or broken pipe that will prevent the insertion of the liner. If possible, a high speed rotating hydraulic cutter shall be used to cut protruding service laterals, roots, slag concrete or similar obstructions in the pipe, and will be considered extra work. The cut shall be made as flush as possible with the wall of the pipe to be restored, and the debris shall be moved down the pipe to the downstream manhole. If inspection reveals an obstruction that cannot be removed by conventional cleaning equipment, the Contractor shall notify the Engineer and the cleaning effort shall be suspended. The Contractor shall propose an alternate method to remove the obstruction to the Engineer for approval. The Contractor and Owner shall mutually agree to the extra work and the cost of the selected method. The Contractor shall confirm that the sewer is clean enough to insure an effective lining.

#### D. Installation of Liner

1. A cable shall be strung through the existing pipe to be rehabilitated and attached to the pipe liner through an existing manhole(s) or access point(s). The pipe liner shall be pulled through the existing manhole(s) and through the existing pipe by this cable. Care shall be taken not to damage the deformed pipe liner during the installation. Appropriate sleeves and/or rollers shall be used to protect the pipe liner.
2. When the deformed pipe liner is in place, it shall be cut and processing manifolds (pipe liner end closing assemblies used for heat and pressure control within the liner) shall be attached and secured at one or both pipe liner ends. The temperature and pressure measuring instruments shall also be attached to the deformed pipe liner at one or both ends.
3. Liner Forming
  - a. Through the use of steam pressure, the deformed pipe liner shall be reformed to conform to the existing pipe wall. Water condensate from the pipe liner shall be exhausted from the pipe; valves shall be gradually closed to build up pressure.
  - b. Heating shall be gradually increased by raising the steam generator output incrementally until the maximum processing temperature is reached. This maximum shall be determined according to the manufacturers' recommendations and the contractor's onsite observations.
4. Cool-Down
  - a. The Contractor shall cool the reformed pipe liner in accordance with the approved manufacturer's recommendations.
  - b. Gradual transition shall be made from the heating to cooling process. Cooling shall be done without pressure interruption and with either water and/or air. When the exterior "skin" temperature on both ends reaches below 100° F. or less, the processing shall be finished. The equipment may then be disconnected.
  - c. Temperatures and pressure shall be monitored and recorded throughout the installation process to ensure that each phase of the process is achieved at the approved manufacturer's recommended temperature and pressure levels.

## 5. Finish

- a. The finished pipe liner shall be continuous over the entire length of an insertion run and be as free as commercially practicable from visual defects such as foreign inclusions, pinholes, and de-lamination. The pipe liner shall be impervious and free of any leakage from the pipe to the surrounding ground or from the ground through the sidewall of the lined pipe.
- b. The beginning and end of the new polyethylene pipe liner shall have manufacturer approved end restraints installed and be sealed, if needed, to the rehabilitated host pipe using a product equal to "3M 5600 Polyurethane Grout".
- c. After the pipe liner has been formed, the Contractor shall reconnect the existing service connections. This shall be done without excavation. In the case of non-man entry pipes, reconnection shall be performed from the interior of the pipeline by means of the television camera and a cutting device that re-establishes them to not less than 95 percent diameter, or more than 110 percent. Where holes are cut through the pipe liner, they shall be wire brushed and smoothed to prevent collection of solids at service connections.
- d. Any deformation in the host pipe, abnormalities, off set joints, or reductions in the host pipe cross sections, whether visible or not, may cause the pipe liner to develop ridges where it is restricted from fully opening. In a gravity flow pipeline application, these ridges are largely cosmetic in nature and do not materially affect the structural integrity of the pipe liner.

### 3.02 Final Acceptance

- A. After installation of the pipe liner and reinstatement of service connections, the Contractor shall perform a TV inspection in the presence of the Owner's Representative. A radial view TV camera shall be used. The finished pipe liner shall be continuous over the entire length of each installation. The pipe liner shall be free of significant visual defects, damage, deflection, holes and the like, other than in areas of reduced host pipe cross section, wherein a minor longitudinal fold may have formed. Reinstated service connections shall be neat and smooth.

### 3.03 Clean-Up

- A. After the pipe liner installation has been completed and inspected, the Contractor shall clean up the project area. The Contractor in accordance with State and Federal laws and regulations shall dispose of all excess material and debris not incorporated in the permanent installation. The project area affected by the Contractor's operations shall be reinstated.

### 3.04 Warranty

- A. The manufacturer shall warrant the pipe liner to be free from defects in raw materials for one year from the date of delivery. The Contractor shall warrant the pipe liner installation for a period of one year. During the Contractor warranty period, any defect, which materially affects the integrity or strength of the pipe liner, shall be repaired at the Contractor's expense in a manner mutually agreed to by the Owner and the Contractor.