

## **SECTION 330144 – RELINING SEWERS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this section.

#### **1.2 SUMMARY**

- A. This section includes the furnishing and installation of the major items listed below:
  - 1. Lining of sewer pipe.
  - 2. Connection of service leads.
  - 3. Connection to manhole.
  - 4. Manholes.
  - 5. Investigation of service leads.
- B. Related sections include the following:
  - 1. Division 31 Section “Earthwork.”
  - 2. Division 33 Section “Sanitary Sewer System.”
  - 3. Division 33 Section “Rehabilitation of Sewer Utilities.”

#### **1.3 SUBMITTALS**

- A. Manufacturer’s Literature: Product data information for materials to be used on this Project.
- B. Procedure:
  - 1. Submit proposed procedure for review by Engineer.
  - 2. Street Closings: Submit proposed detours to proper agency.

#### **1.4 QUALITY ASSURANCE**

- A. General: Acceptability of materials and performance shall be determined by Engineer.
- B. Materials: Certifications by manufacturers.
- C. Performance:
  - 1. Polyethylene Pipe Lining: Pressure test for leakage.
  - 2. Manholes: Visible inspection for leakage and workmanship.

### **PART 2 - PRODUCTS**

#### **2.1 POLYETHYLENE LINER**

- A. Pipe:

1. Diameter: 4 inches - 24 inches; ASTM D1248, Type III C P 34.
2. Cell Classification: ASTM D3350, 3-3-5-4-3-3-C (Table 1).
3. Joints: Butt fusion method.
4. Testing:
  - a. According to applicable ASTM standard for each cell classification.
  - b. Standards: ASTM D1505, ASTM D1238, ASTM D790, ASTM D638, ASTM D1693, and ASTM D2837.

B. Fittings:

1. General:
  - a. Saddle type with stainless steel band clamps and watertight seal.
  - b. Polyethylene and PVC are both allowable.
  - c. Transitions from one material to another shall be made only with approved adapters.
2. Polyethylene: Same as liner pipe.
3. PVC:
  - a. ASTM D3034 (SDR35).
  - b. Joints: ASTM D3212 Push-on type joints.
  - c. Testing: Standard ASTM D3034.

2.2 INSITUFORM LINER

A. General:

1. Fabrication of liner shall be by a contractor regularly engaged in the fabrication and installation of Insituform liners.
2. Sizing: Fit neatly the internal circumference of the pipe to be lined. Allowance shall be made for stretching of the liner.
3. Length:
  - a. Necessary to carry out insertion and seal liner at inlet and outlet manholes.
  - b. Continuous over entire length of insertion run between two manholes.
  - c. Contractor shall field verify length between manholes prior to liner fabrication.

B. Materials:

1. General:

- a. Polyester fiber felt tubing, lined on one side with polyurethane and fully impregnated with a liquid, thermal setting resin.
  - b. Liner shall be chemically resistant to the environment in a sewer subject to normal domestic sewage.
2. Resin:
- a. Polyester resin, Engineer's approval required for use of fillers or pigments.
  - b. Epoxy resin shall not be used without approval of Engineer.
  - c. Content: 10% to 15% by volume greater than volume of felt in liner.
3. Reinforcing Material:
- a. Felt: Needle interlocked terylene felt formed into sheets not less than 3mm thick. Total thickness to be determined by required liner thickness.
  - b. Mechanical strengthener membrane or strips may be used between felt layers to control longitudinal stretching.
  - c. Polyurethane membrane shall be used as an inner liner during curing, 0.25 mm minimum thickness. This membrane is not to be considered as part of the liner.

C. Mechanical Properties and Testing Standards:

1. Tensile Strength: ASTM D638, 3000 psi at 20`cat yield.
2. Flexural Strength: ASTM D790, 4000 psi.
3. Shear Strength: ASTM D732, 5,500 psi.
4. Modulus of Elasticity: ASTM D638, 200,000 psi.
5. Ultimate Elongation at Yield: 2%
6. Impact Strength: ASTM D1709, 1.5 in. - lbs.

D. Thickness:

1. Indicated on the Drawings.
2. Minimum Thickness:
  - a. 6-Inch to 15-Inch Pipe: 6mm.
  - b. 18-Inch to 30-Inch Pipe: 9mm.

2.3 MISCELLANEOUS

A. Polyethylene Liner Terminal Sealer:

1. Jute: Dry, non-oiled.
2. Chemical Grout:
  - a. Urethane foam.

- b. 3M Grouting Compound CR-202, Polypack by Avanti International; or equal.
- B. Adapters and Flexible Couplings: Fernco; Logan; or equal.
- C. Quick-Setting Hydraulic Cement: Waterplug (Standard Drywall Products); Ipanex R (IPA Systems, Inc.) with Type I portland cement; or equal.

### PART 3 - EXECUTION

#### 3.1 GENERAL

- A. Cleaning:
  - 1. Sewer shall be cleaned prior to lining.
  - 2. Refer to Division 33 Section "Rehabilitation of Sewer Utilities."
- B. Television Inspection:
  - 1. Owner has videotape records of sewer line available for viewing at the office of Engineer.
  - 2. Contractor shall retelevise pipeline prior to lining and at completion of project . Supply Owner with one videotape of completed liner.
  - 3. Verify that service leads are connected to the sewer by dyeing building sewers when performing television inspection prior to pipe lining.
- C. By-Pass Pumping: In accordance with Division 33 Section "Rehabilitation of Sewer Utilities."
- D. Line Obstructions:
  - 1. Removal: Responsibility of Contractor.
  - 2. Method: Determined by Engineer in cooperation with Contractor.
- E. Service Lead Investigation:
  - 1. Where indicated on the Drawings.
  - 2. Refer to Division 31 Section "Earthwork."
- F. Earthwork required shall be done in accordance with Division 31 Section "Earthwork."
- G. Work shall be scheduled to minimize the interruption of service to building occupants within the lined section. Sewer service shall not be interrupted overnight.

#### 3.2 POLYETHYLENE PIPE LINING

- A. General:
  - 1. Establish excavation and pulling points prior to start of construction.
  - 2. Service lead investigation shall take place after lining of mainline sewer.
  - 3. Lining shall be according to ASTM F585 and these Specifications.

4. Detail: As indicated on the Drawings.
- B. Jointing:
1. Butt Fusion Method:
    - a. In accordance with manufacturer's recommendations.
    - b. With equipment designed for butt fusion and with trained personnel.
    - c. ASTM D2657
  2. Flexible Coupling: Shall be used only where insertion pit is not at a manhole.
- C. Excavations:
1. Based on location of sewer lines, pulling distances and traffic conditions.
  2. Minimum Length:
    - a. Bottom: 16 times the outside diameter of the liner.
    - b. Slope: 2 feet horizontal to 1-foot vertical.
  3. Width: Adequate for safety and working conditions.
  4. Depth: Spring-line of existing sewer.
- D. Insertion:
1. Use winch and pulley for insertion.
  2. Attach a pulling head to guide liner.
  3. Maximum Allowable Stretching: 1.5%.
  4. Maximum Pulling Speed: 1 ft./sec.
  5. Pulling operation shall continue without interruption until complete.
  6. Allow liner to recover from stretching prior to proceeding further. Recovery period shall be determined from manufacturer's data.
- E. Termination at Manhole:
1. Grout annular space between liner pipe and original sewer pipe.
    - a. Jute and chemical grout according to manufacturer's instructions.
    - b. Chemical grout shall not protrude in manhole, finish area around pipe with quick-setting hydraulic cement.
    - c. Detail: As indicated on the Drawings.
    - d. Do not grout downstream manhole until service leads are reconnected.

2. Rebench manhole to conform with Division 33 Section "Sanitary Sewer System."

F. Service Lead Connections:

1. General:

- a. Detail: As indicated on the Drawings.
- b. Remote Tap: Not allowable.
- c. Owner shall notify Contractor in writing when a service lead is not to be reconnected.

2. Fittings:

- a. Connect to the liner pipe in accordance with manufacturer's approved recommendations.
- b. Tap of liner pipe shall not be made until fitting has been secured to liner pipe.

3. Connection to Existing Service Lead:

- a. Remove first section of service lead and inspect adjacent section for damage. If damaged report to Engineer and do not proceed until authorized by Engineer.
- b. If service lead is undamaged, place flexible coupling or adapter on replacement lead.
- c. Make joint at new fitting and connect replacement lead to existing lead with flexible coupling or adapter according to manufacturer's instructions.
- d. Replacement lead shall be of the same material as the new fitting.

G. Backfill:

1. Detail: In accordance with Drawings.
2. Refer to Division 31 Section "Earthwork."

### 3.3 INSITUFORM LINING

A. Storage and Transportation of Liner:

1. Impregnate with resin not more than 24 hours prior to installation.
2. Storage:
  - a. Out of direct sunlight.
  - b. Maximum Temperature: 40 degrees F.

3. Transportation:
  - a. Light proof container.
  - b. Maximum Temperature: 40 degrees F.

B. Inversion:

1. Water: Supplied by Owner from nearest fire hydrant.
2. In accordance with manufacturer's approved recommendations.
3. Maximum Inversion Rate: 32 ft./min.
4. Maximum Hoop Tension in Felt Liner: 8000 psi.

C. Curing:

1. Water Temperature:
  - a. Minimum: 160 degrees F.
  - b. Maximum: 194 degrees F.
2. Measuring Temperature:
  - a. Gages on incoming and outgoing water supply lines.
  - b. Thermocouples placed between liner and existing pipe at both ends of operation.
  - c. Readings shall be taken every 15 minutes.
  - d. Record of readings shall be supplied to Engineer.
3. Completion:
  - a. Uniform temperature reached as determined by thermocouples.
  - b. Exposed portions appear hard and sound.

D. Post Curing:

1. Minimum time of 3 hours under inversion head and within curing temperature range.
2. Do not open liner until temperature is less than 110 degrees F.

E. Service Lead Connections:

1. Owner shall notify Contractor in writing when a service lead is not to be reconnected.
2. Leads shall be reconnected by cutting liner from the inside.
3. Cutting shall produce a smooth edge and there shall not be an annular space between liner and service lead.

3.4 CLEANING

A. Methods:

1. Inflatable Rubber Ball: Place snugly fitting ball in upstream manhole of sewer and introduce water behind it. Ball shall pass through pipe with only the force of water propelling it.
2. High pressure water jet.
3. Debris: Including that cemented or wedged shall be removed at first available downstream manhole.

B. Final Acceptance: All sewers shall be thoroughly cleaned before final acceptance.

### 3.5 TESTING AND INSPECTION

A. Observation: By Engineer.

B. Notification:

1. Testing: Contractor arrange with Engineer following cleaning and pretesting.

C. Equipment and Manpower: Contractor provide everything required for testing.

D. Low Pressure Air Test for Leakage:

1. Required for polyethylene liner only.
2. Performed prior to reconnection of service leads.
3. Test each manhole to manhole section separately.
4. Pressure: Initially 4.0 psi greater than groundwater backpressure for 2 minute duration.
5. Pressure Drop: Measure time interval for pressure drop from 3.5 to 2.5 psi. Compare with appropriate table (Article 3.6) for allowable time interval.
6. Contractor shall repair leaks and repeat tests until acceptable results are achieved.

### 3.6 TABLES FOR LOW PRESSURE AIR TEST

A. Refer to Division 33 Section "Sanitary Sewer System."

END OF SECTION 330144