

SECTION 3300 SANITARY SEWER SYSTEM REHABILITATION

3301 SCOPE: This section governs the furnishing of all labor, equipment, tools, materials, testing and the performance of all work to rehabilitate the sanitary sewer system.

3302 REFERENCES: Referenced manuals or Specifications for testing shall refer to the latest adopted standards at the time of receiving the Notice to Bidders from:

ASTM	American Society of Testing materials
APWA	American Public Works Association
MCIB	MidWest Concrete Industry Board

3303 MATERIALS: Except as modified herein, all materials used for rehabilitation of the Sanitary Sewer System shall conform to the requirements stipulated in applicable sections of these specifications.

- A. Sewer pipe: The pipe for replacement shall conform to Section 3000 except as follows:
 - 1. Pipe liners: The material for lining the pipe for trenchless replacement shall be high density polyethylene pipe (HDPE) meeting the requirements of ASTM F714 PE SDR-PR based on outside diameter, and shall conform to the following:
 - 1. Pipe shall have a cell classification of 345434B in accordance with ASTM D3350.
 - 2. Polyethylene base resin shall conform to the requirements of ASTM D1248, Type III, Class B, Grade P34, category 5. The resins shall contain antioxidants and be stabilized, for protection against ultra-violet degradation.
 - 3. Wall thickness: The minimum wall thickness of the polyethylene pipe shall meet the following:

Depth of cover (feet)	Minimum SDR of Pipe
0-16	19
>16.1	17
 - 4. Color: Pipe shall be standard carbon black with no internal coatings. Light gray pigment throughout will be acceptable.
 - 5. Pipe shall be homogenous throughout and be free from cracks, holes, foreign matter, blisters, or other irregularities.
 - 6. Joints: Butt fusion joints in accordance with ASTM D2657. No gasketed joints shall be allowed without prior approval of the Engineer. Threaded or solvent welded joints will not be permitted.
 - 2. Service connections: The sewer main shall be connected and sealed to service laterals with one of the following:

1. A field assembled adapter tee consisting of a compression fit gasket and seal clamp and adapter pipe stub selected to match the existing service pipe. Adapter tees shall be "Inserta Tee" or equal.
 2. A heat fusion saddle made of polyethylene pipe compound that meets the requirements of ASTM D1248, Class C for fusion welding to polyethylene pipe. Fusion saddles shall be as manufactured by Driscopipe, Miller, Dupont, or Central Plastics.
 3. Connections shall be watertight and shall not permit infiltration between the pipe and the liner.
3. Cured-in-place pipe materials:
- a. The sewn tube shall meet the requirements of ASTM F1216, Section 3.1 and shall not contain fiberglass continuous strand matt. The tube shall be constructed to withstand inversion pressures, have sufficient strength to bridge missing pipe, stretch to fit irregular pipe sections, and shall invert smoothly around bends.
 - b. The wetout tubes shall have a uniform thickness that when compressed at installation pressures will meet or exceed the design thickness.
 - c. The tube shall be a size that when installed will tightly fit the internal circumference and length of the original pipe. Allowance should be made for circumferential stretching during inversion.
 - d. The outside layer of the tube (before wetout) shall be polyethylene coated, a translucent flexible material that clearly allows inspection of the resin impregnation (wetout) procedure. The plastic coating shall hold the resin inside the tube without leakage, accommodate inversion, stretch to size and shall not delaminate before, during or after curing of the CIPP.
 - e. The tube shall be homogeneous across the entire wall thickness containing no intermediate or encapsulated elastomeric layers. No material shall be included in the tube that may cause delamination in the cured CIPP. No dry or unsaturated layers shall be evident.
 - f. The wall color of the interior pipe surface of the CIPP after installation shall be alight reflective color so that a clear detail examination with closed circuit television inspection equipment may be made.
 - g. Seams in the tube shall be stronger than the unseamed felt. Where the length requires joining, the sewn joint shall not be perpendicular to the long axis but spirally formed and sewn.
 - h. The outside of the tube shall be marked for distance at regular intervals along its entire length, not to exceed five (5) feet. Such Markings shall include the Manufacturers name or identifying symbol.
 - i. The minimum length shall be that deemed necessary by the contractor to effectively span the distance from the inlet to the outlet of the respective manholes unless otherwise specified. The contractor shall verify the lengths in the field before impregnation. Individual inversion runs can be made over one (1) or more manhole sections as determined in the field by the contractor and approved by the owner.

- i. A cementitious grout shall be used for stopping very active infiltration and filling voids and shall be mixed and applied according to manufacturer's recommendations. The grout shall be volume stable, and have a minimum 28 day compressive strength of 250 psi and a one day compressive strength of 50 psi. *Strong-Seal "grout 250" or Engineer approved equal.*
 - ii. A cementitious grout shall be used for same application as Grout 25, but is designed for special soil conditions, and shall be used per manufacturer's recommendations. This grout shall be volume stable and have a minimum twenty-eight (28) day compressive strength of 1,000 psi. *Strong-Seal "Grout 1000" or Engineer approved equal*
 - iii. Chemical Grouts may be used for stopping very active infiltration and shall be mixed and applied per manufacturer's recommendations.
- e. Liner Materials: A cementitious product shall be used to form a structural/structurally enhanced monolithic liner covering all interior substrate surfaces. The liner material shall be applied with machinery specially designed for the application, and shall have the following minimum requirements at 28 days.

Compressive strength	ASTM C495	>3000 psi
Tensile strength	ASTM C496	>300 psi
Flexural Strength	ASTM C293	>600 psi
Shrinkage@90% RH	ASTM C596	0%
Bond	ASTM C321	>130 psi
Density, when applied		105 pcf

- f. Liner material shall be one of the following products:
- i. Strong-Seal MS-2A or Permacast MS-10,000 shall be made with Type I or Type III Portland Cement and shall be used according to manufacturer's recommendations in applications where there is no or very mild sulfide conditions (pH 3.0 or higher).
 - ii. Strong-Seal MS-2C or permacast CR-5,000 with Calcium Aluminate Cement and shall be used according to manufacturer's recommendations in applications where there is evidence of severe sulfide conditions (pH 2.0 or higher)
 - iii. Strong-Seal Sewpercoat PG or Permacast MS-10,000 with ConShield, shall be made with calcium aluminate cement and calcium aluminate aggregate and shall be used per manufacturer's recommendations in any harsh hydrogen sulfide conditions regardless of surface pH as long as environment is in a municipal sanitary system. Refer to Sewpercoat PG specifications for physical properties and application procedures.

2. WATER: Water used to mix product shall be clean and potable. Questionable water shall be tested by laboratory in accordance with ASTM C-94 procedure. Potable water need not be tested.
3. OTHER MATERIALS: No other material shall be used with the mixes described above without prior approval or recommendation of the Engineer.

3304 CONSTRUCTION DETAILS:

A. Trenchless Replacement - Pipe Bursting Tools:

1. Static Pull method (TRS Process): The process involves the use of a static “moling” device suitable sized to break out the old pipe with a flared plug that bursts the existing pipe.
 - a. The maximum outside diameter of the pipe bursting tool shall be greater than the maximum inside diameter of the existing sewer pipe.
 - b. The tool shall be pulled along the inside of the existing sewer pipe.
 - c. The pipe bursting tool shall be of such dimension that the maximum diameter of the tunnel created shall not exceed the maximum outside diameter of the new pipe, plus 1 INCH.
 - d. The existing sewer pipe shall be broken up into small fragments and these fragments driven into the surrounding pipe zone. The tool shall make a tunnel along the space formerly occupied by the existing sewer pipe and shall place the new pipe by pulling it into place in the tunnel. This process continues until the new pipe reaches the machine pit.
2. Pneumatic Method (TT Technologies process): The pipe bursting tool shall be designed and manufactured to force its way through existing pipe materials by fragmenting the pipe and compressing the old pipe sections into the surrounding soil as it progresses. Only pneumatically operated equipment with either front or rear expanders for the proper connection to the polyethylene will be allowed for use.
 - a. The bursting unit shall be pneumatic and shall generate sufficient force to burst and compact the existing pipe line.
 - b. The bursting head shall incorporate a shield/expander to prevent collapse of the hole ahead of the pipe insertion.
 - c. The pipe bursting unit shall be remotely controlled.
 - d. The pipe burster shall have its own forward momentum while being assisted by winching. A hydraulic winch shall give the burster friction by which it can be moved forward. To form a complete operating system, the burster must be matched to a constant tension hydraulic winching system.
 - e. Winch Unit: The pneumatic pipe bursting tool must be used in conjunction with a constant tension hydraulic twin Capstan Winch of either 20, 10, or

5 tons, the size of the winch depends on the diameter of the pipe to be replaced. In no case is the constant tension on the winch to exceed 20 tons.

B. Pipe reaming tools: The operation shall be conducted with a directional drilling machine and a reamer that grinds and pulverizes the pipe, the excess peripheral material flushed and removed with the drilling fluids and the HDPE pipe of the required size pulled into place simultaneously.

C. Manhole Lining:

1. Equipment: Application equipment shall be as recommended by the materials manufacturer.

2. Application:

a. Preparation: Place covers over invert to prevent extraneous material from entering the sewer lines.

i. All foreign material shall be removed from the manhole wall and bench using a high pressure water spray (minimum 2,500 psi). Loose and protruding brick, mortar, and concrete shall be removed using a mason's hammer and chisel and/or scraper. Fill any large voids with patching material as specified herein. The surface to be repaired must be clean and free of any loose materials with walls totally saturated with water.

ii. Active leaks shall be stopped using infiltration control material according to manufacturer's recommendations. Some leaks may require weep holes to localize the infiltration during application. After Application the weep holes shall be plugged with infiltration control material prior to the application of the final coat. When severe infiltration exists, drilling may be required in order to pressure grout using a cementitious grout or chemical grout, as specified herein for grouting material. Manufacturer's recommendations shall be followed when pressure grouting is required.

iii. All manhole steps shall be removed and the wall repaired prior to lining.

b. Invert, pipe seal and bench repair:

i. After all preparations have been completed, remove all loose material and wash the wall again.

ii. Any bench, invert, pipe seal and/or service line repairs shall be made at this time using patching material and shall be used per manufacturer's recommendations.

iii. Invert repair shall be performed on all inverts with visible damage or where infiltration is present or when vacuum testing is specified. After blocking flow through the manhole, and thoroughly cleaning

invert, the patching material shall be applied to the invert in an expeditious manner. The material shall be troweled uniformly onto the damaged invert at a minimum thickness of ½ inch at the invert extending out onto the bench of the manhole sufficiently to tie into the structural/ structurally enhanced monolithic liner to be applied. The finished invert surfaces shall be smooth and free of ridges. The flow may be reestablished in the manhole within thirty (30) minutes after placement of the material.

- iv. Mixing: Mixing shall be done in strict accordance with the material manufacturer's instructions.
- v. Spraying: On all manholes, a single application of the liner mix shall be spray applied to a total thickness of 1 inch in one application.

D. Manhole Cover Insert: Should prevention of groundwater inflow through the manhole cover be required, a PARSON MANHOLE INSERT, or approved equal, shall be installed under the cover. The insert shall be manufactured to exact measurements and made of High Density Polyethylene Copolymer or Stainless Steel material.

The manhole insert shall vent the sewer system by means of two ventilation holes or valve(s) (1 or 2) manufactured of an Ethylene Propylene compound. An adhesive backed, closed cell neoprene or cross linked polyethylene gasket may be applied as required on the underside of the rim of the insert by the manufacturer. A corrosion resistant nylon lifting strap shall also be included and installed by the manufacturer.

HDPE Plastic (ASTM D-1248, Class A, Cat. 5 Type III)
Impact brittleness -105 deg. F ASTM D-746-70
Softening Temperature 254 deg. F ASTM D-1525-70
Tensile Strength 700 psi ASTM D-638-71A
Thickness Uniform 1/8 in.

STAINLESS STEEL
Corrosion Resistance Excellent
Tensile Strength 600 MPa ASTM A-240M
Density 8,000 kg/m³
Endurance Limit 240 MPa

The manhole frame rim shall be cleaned of all dirt and debris prior to measuring. The manhole insert shall be manufactured per exact measurements. Measurements must be done in strict accordance with manufacturer's instructions.