

SECTION 21

REHABILITATION OF SANITARY SEWER MAINS BY THE PIPE BURSTING AND TRENCHLESS PIPE REPLACEMENT METHOD

21.01 SCOPE:

It is the intent of the Specification to define the approved methods and materials for trenchless rehabilitation of existing sanitary sewer mains by the Pipe Bursting and Trenchless Pipe Replacement Method.

These Specifications form a part of the Contract Documents and shall govern for rehabilitating sanitary sewer mains and laterals by the pipe bursting process. The work covered in the section includes the furnishing of all labor, materials, tools, equipment, and required incidentals and performing all operations in connection with the complete rehabilitation of the existing deteriorated sanitary sewer system piping.

The Pipe Bursting and Trenchless Pipe Replacement process is defined as the reconstruction of sanitary sewer pipe by the bursting of the host pipe and inserting new High Density Polyethylene (HDPE) Pipe of specified size and SDR. The HDPE pipe shall extend the full length of the existing pipe and shall provide a structurally sound, impermeable, jointless pipe.

The Contractor shall complete all work in strict accordance with all applicable current OSHA standards. Particular attention is drawn to those safety requirements involving work on an elevated platform and entry into a confined space. It shall be the Contractor's responsibility to comply with OSHA Standards and Regulations pertaining to all aspects of the work.

When required for acceptable completion of the pipe rehabilitation or replacement, the Contractor shall provide bypass pumping for continuous sewage flow around the section(s) of pipe for the installation of replacement pipe. The pump bypass lines shall be of adequate capacity and size to handle the flow in accordance with Section 12.22 in the Standard Specifications.

21.02 MATERIALS:

A. General:

High density polyethylene pipe in accordance with Paragraphs 12.03E of the Owner's Standard Specifications in addition to these specifications shall be used in pipe bursting or trenchless pipe replacement installations. All piping system components shall be the products of one manufacturer and shall conform to the latest edition of ASTM D1248, ASTM D3350, and ASTM F714.

B. Piping and Bends:

Piping and Bends shall be extruded from a polyethylene compound and shall conform to the following requirements:

1. The polyethylene resin shall meet or exceed the requirements of ASTM D3350 for PE 3408 material with a cell classification of 335434C, or better.
2. The polyethylene compound shall be suitably protected against degradation by ultraviolet light by means of carbon black, well dispersed by precompounding in a concentration of not less than 2 percent.
3. The maximum allowable hoop stress shall be 800 psi at 73.4 degrees F.
4. The pipe manufacturer shall be listed with the Plastic Pipe Institute as meeting the recipe and mixing requirements of the resin manufacturer for the resin used to manufacture the pipe in this project.
5. The pipe and bends shall have a minimum standard dimension ratio (SDR) wall thickness as specified by the Engineer.
6. Joining shall be performed by thermal butt-fusion in accordance with the manufacturer's recommendations.
7. Sanitary sewer pipe shall be green in color or contain green striping. Sanitary sewer pipe interior shall be light in color for internal video inspection.

C. Procedures:

1. General:

All polyethylene pipe shall be cut, fabricated, and installed in strict conformance with the pipe manufacturer's recommendations. Joining, laying, and pulling of polyethylene pipe shall be accomplished by personnel experienced in working with polyethylene pipe. The pipe supplier shall certify in writing that the Contractor is qualified to join, lay, and pull the pipe or representative of the pipe manufacturer shall be on site to oversee the pipe joining. Expenses for the representative shall be paid for by the Contractor.

2. Transportation:

Care shall be taken during transportation of the pipe to ensure that it is not cut, kinked, or otherwise damaged.

3. **Storage:**

Pipes shall be stored on level ground, preferably turf or sand, free of sharp objects which could damage the pipe. Stacking of the polyethylene pipe shall be limited to a height that will not cause excessive deformation of the bottom layers of pipes under anticipated temperature condition. Where necessary due to ground conditions, the pipe shall be stored on wooden sleepers, spaced suitably and of such widths as not to allow deformation of the pipe at the point of contact with the sleeper or between supports.

4. **Handling Pipe:**

The handling of the joined pipeline shall be in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. Ropes, fabric, or rubber-protected slings and straps shall be used when handling pipes. Chains, cables, or hooks inserted into the pipe ends shall not be used. Two slings spread apart shall be used for listing each length of pipe. Pipe or fittings shall not be dropped onto rocky or unprepared ground. Slings for handling the pipeline shall not be positioned at butt-fused joints. Sections of the pipes with cuts and gouges exceeding 10 percent of the pipe wall thickness or kinked sections shall be removed and the ends rejoined.

The open ends of all sections of joined and/or installed pipe (not in service) shall be plugged at night to prevent animals or foreign material from entering the pipe line or pipe section.

Waterproof nightcaps of approved design may be used but they shall be so constructed that they will prevent the entrance of any type of natural precipitation into the pipe and will be fastened to the pipe in such a manner that the wind cannot blow them loose.

The practice of stuffing cloth or paper in the open ends of the pipe will be considered unacceptable.

Where possible, the pipe shall be raised and supported at a suitable distance back from the open end such that the open end will be below the level of the pipe at the point of support.

21.03 **CONSTRUCTION PROCEDURES:**

A. **General:**

The following construction procedures shall be performed as a minimum. Additional procedures shall be performed to accommodate actual conditions. The general procedure shall include the following:

1. Hydraulically clean existing piping.
2. Video inspect existing piping and locate existing laterals.
3. Perform point repairs, where applicable.
4. Perform Pipe Bursting process.

5. Reconnect existing active laterals.
6. Perform smoke test.
7. Video inspect rehabilitated pipe.

B. Preinstallation

The following pre4installation procedures shall be completed, as a minimum:

1. Cleaning Existing Piping:

Existing piping scheduled to be rehabilitated shall be hydraulically cleaned prior to videoing.

2. Video Inspection:

A video (television) internal inspection of the cleaned existing piping shall be performed to assure that the piping is clean and conditions acceptable for pipe bursting. One (1) video tape of the internal piping shall be provided to the Engineer for the Owner's records. Bypass pumping and piping shall be performed by the Contractor when required to adequately view the existing piping conditions. All Internal Video Inspections shall be performed in accordance with the Board's Standard Specifications.

3. Line Obstruction/Point Repairs:

Point repairs or obstruction removals shall be performed by the Contractor where video (television) inspections reveal heavy solids, dropped joints, sags in lines, or collapsed pipe, that cannot be removed by conventional sewer cleaning equipment and prevent completion of the pipe bursting process. Point repairs shall be performed in accordance with applicable sections of the Specifications.

C. Pipe Bursting and Trenchless Pipe Replacement Installation:

The Contractor shall submit a detailed description of the proposed techniques and procedures for rehabilitating the existing piping. The Contractor shall submit details to the Engineer for approval prior to beginning work. The format shall generally conform to the following:

1. Excavate Service Connections:

All active service connections shall be excavated to allow for reconnection once the replacement pipe is installed.

2. Guidance System:

The Pipe Bursting and Trenchless Pipe Replacement guidance system shall be inserted into the existing hose pipe through the entire section of the pipe to be rehabilitated/replaced.

3. Insertion:

Once the guidance system is installed, the new HDPE pipe and the pipe bursting and trenchless pipe replacement equipment shall be attached to the guidance system and then pulled back through the existing host pipe.

4. Finished Pipe:

The finished replacement pipe shall be continuous over the entire length from manhole to manhole and be free from visual defects such as foreign inclusion, dry spots, keel, boat hull, pinholes, wrinkles and other deformities. The replacement pipe passing through or terminating in a manhole shall be carefully cut out in a shape and manner approved by the Engineer. The invert and benches shall be streamlined and improved for smooth flow. The replacement pipe shall also meet the leakage requirements of pressure test as specified. Any defect which will affect the integrity or strength of the pipe discovered during the warranty period shall be repaired at the Contractor's expense.

21.04 CONSTRUCTION METHODS:

A. Sealing and Benches in Manhole:

The replacement pipe shall be installed with a tight fitting seal with the existing manholes. The top half of the pipe within the manhole shall be neatly cut off and not broken or sheared off, at least four inches away from the manhole walls. The channel in the manhole shall be a smooth continuation of the pipe(s) and shall be merged with other lines or channels, if any. Channel cross-section shall be U-shaped with a minimum height of half pipe diameter to three-fourths of the pipe diameter for fifteen inches and larger. The side of the channels shall be built-up with mortar/concrete as specified, to provide benches at a maximum of 1 to 12 pitch towards the channel. The replacement pipe in the manhole shall be sealed as specified above before proceeding on to the next manhole section and all manholes shall be individually inspected for replacement pipe cut-offs, benches and sealing works.

B. Service Reconnections:

The exact location and number of service connections shall be determined from TV tapes and/or in the field. It shall be the Contractor's responsibility to accurately field locate all existing service connections whether in service or not. The Contractor shall reconnect all service connections to the replacement pipe including those from unoccupied, abandoned, or vacant lots, unless directed otherwise by the Engineer. Each vacant lot shall also be provided with one service connection location, at an approved location. The Contractor shall be responsible for restoring/correcting, without any delay, all missed or faulty reconnections, as well as for any damage caused to property owners for not reconnecting the services soon enough or for not giving notice to the owners. All services which are reconnected to replacement pipe shall be shown on the "As Built Drawings" with the exact distance from the nearest downstream

manhole. All existing service connections shall be reconnected either by Excavation method as shown in Appendix L and as described below:

1. All existing service connections shall be excavated at the exact location as exposed.
2. A pre-fabricated polyethylene saddle or approved equal fitting shall be installed over the cut out. The saddle shall be a one-piece saddle equipped with a neoprene gasket so that a complete seal is accomplished when the strap-on saddle is tightened with two (2) stainless steel bands, one on each side. The stub-out attached to the saddle must protrude into the HDPE pipe a distance equal to the wall thickness of the liner. The new 6" lateral shall be connected to the existing service line by a rubber coupling with stainless steel bands, as manufactured by "Mission" or an Engineer's approved equal.
3. The flexible coupling shall be secured to the existing service lateral and new stub and/or stack with stainless steel bands. The entire exposed service connection shall be encased in cement stabilized sand a minimum of 6" below and 12" above and on the sides of the pipe at a cost incidental to service connection. The service connections shall be tested by the Contractor and approved by the Engineer before backfilling.
4. Gasketed PVC sewer pipe (ASTM D3034, SDR 26) may be used for all stubs. PVC saddles with neoprene gaskets may be used in lieu of polyethylene saddles.
5. A service reconnection by excavation shall consist of the removal and replacement of any cracked, offset, or leaking existing service line up to a distance of eight feet (8 ft.) from the center of the new liner measured horizontally. Eight (8) inch diameter services shall be connected to the lined sanitary sewer main by the construction of a new manhole.
6. One or more homes discharging into a common connection shall be considered as one service connection.

21.05 TESTING:

All costs for testing the replacement pipe by a pressure method will be incidental to the installation. Two types of testing shall be required after the replacement pipe has been installed in the existing sanitary sewer main. The first is a low pressure air test of the replacement pipe before it has been sealed in place at the manhole, and before any service reconnections have been made. The purpose of this test is to check the integrity of the joints that have been made and to verify that the replacement pipe has not been damaged by inserting it into the sanitary sewer. The second test shall be done after all service laterals have been made for a particular pipe segment between adjacent manholes. The test shall verify the integrity of the connection at the point where it joins the replacement pipe and existing service line.

A. Low Pressure Air Test Procedure:

1. After a manhole-to-manhole section of sanitary sewer main has been rehabilitated or replaced and prior to any service lines being connected to the replacement pipe, the pipe shall be plugged at each manhole with pneumatic plugs. The design of the plugs shall be such that they will hold against the test pressure without requiring external blocking or bracing. One of the plugs shall have three air hose connections: one for inflation of the plug, one for reading the air pressure in the sealed line, and one for introducing air into the sealed line.
2. Low pressure air shall then be introduced into the sealed line until the internal air pressure reaches 4.0 psig greater than the average back pressure resulting from any ground water that may be over the pipe. At least two minutes shall elapse to allow the pressure to stabilize.
3. The time required for the internal pressure to decrease from 3.5 to 2.5 psig greater than the average back pressure resulting from any ground water that may be over the pipe, shall not be less than the time shown for a given pipe diameter in the following table:

Carrier Pipe Diameter (Inches)	Minimum Elapsed Time (Minutes)
84	
105	
12	6
157	

B. Smoke Testing:

Smoke testing shall be performed to check lateral connections and possible leaks in new line.

1. A smoke test shall be performed on all service line connections made by open excavation. No excavated taps shall be backfilled until completion of this test. The Contractor shall isolate the manhole section to be tested from the adjacent manhole sections to prevent smoke from migrating into lines not being tested, as well as, to provide a concentration of smoke in the section being tested.

2. Prior to smoke testing, the Contractor shall distribute written notice(s) to the area residents not less than two (2) days, nor more than seven (7) days, prior to the proposed testing. Notice shall also be given to the City Police Department and local Fire Station twenty-four (24) hours prior to actual smoke testing. This test shall be conducted by forcing smoke from “smoke generators”, as offered by Superior Signal Company, Smoke No. 3C, or an approved equal, through the newly rehabilitated sanitary sewer main. The “smoke generators” shall have a minimum duration for five (5) minutes with a capacity of 1,500 – 2,000 cfm.
3. Smoke shall be introduced in accordance with the Manufacturer’s recommendations and in a manner that will assist with properly verifying leak locations. The Engineer, accompanied by the Contractor, shall check each service line connection being tested. Sources of all leaks shall be found and noted for correction.
4. All service line connections noted as leaking shall be repaired or replaced and then retested. The Contractor may be allowed to leave the service line connection exposed in one (1) manhole section at a time to minimize inconvenience and hazard to the residents. If service line connection repair or replacement, testing or retesting, and backfilling of the excavation is not completed within the work day, the Contractor shall properly cover each excavation with steel plates, or some other approved material to keep the area secure from accidents or hazard.
5. In houses where smoke does not issue from the plumbing vent stacks to confirm the reconnection of the sewer service to the newly installed liner, a dye test may be required to confirm the reconnection. Dye shall be introduced into all service lines and then each line shall be flooded with water. The Contractor and the Engineer shall look to the downstream manhole to detect the dye coming out of the sewer main. This shall confirm a reconnection. If any more than one service connection is dye tested at a time, these dye tests shall be done with enough time allotted between each test to allow the dye to be purged from the line. Otherwise, different colored dyes shall be used.

21.06 POST TESTING OF COMPLETED SECTIONS:

The Contractor shall provide to the Owner a color video tape taken by a 360 degree radial view camera for close-up view showing the completed work, including the condition of the restored taps. Television inspections, tapes, and reports shall be performed in accordance with 12.32 of the Standard Specifications.

END OF SECTION