

SECTION 02768

PIPE BURSTING/CRUSHING SANITARY SEWERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe Bursting/Crushing existing sanitary sewers.

1.02 UNIT PRICES

- A. The unit price bid for rehabilitating the sewer main shall be full compensation for all materials, labor, equipment and incidentals required to install the replacement pipe within the sewer main. Payment for the replacement pipe shall also include the cost of sealing the replacement pipe in the manholes, reworking the manhole inverts and benches, etc. Payment shall be for actual linear footage for replacement pipe installed in the field and shall be measured between the centerlines of the manholes. Cleaning and television inspection (pre and post rehabilitation) and relevant submittals shall be incidental to the project.
- B. All costs for testing the replacement pipe and the service reconnections shall be considered incidental to the cost of rehabilitating the sewer. The Contractor shall be responsible for making adequate and suitable arrangements for any bypass pumping that may become necessary to prevent any backflow into houses or buildings, or onto the streets between the time the replacement pipe is installed and the service reconnections have been made, tested, and approved by the City. Bypass pumping shall be performed in accordance with Section 02790 - Bypass Pumping and shall be incidental.
- C. Payment for service connections restored by excavation and reconnecting with approved fittings shall be made in accordance with Section 02762 - Service Reconnections. Excavation for service connection which is found plugged and no longer required shall be left as is, and paid as per appropriate bid item for Abandonment of Service Connection. The payment for pipe bursting shall be based on the depth of the deeper flow line of the rehabilitated segment. Two or more service laterals from several houses coming at one point to the sewer (replacement pipe) through stacks, wyes and/or tests, shall be considered as one service connection. However, the Owner's Representative may move/relocate such service connections so as not to exceed more than two houses per each new connection pipe.
- D. The Contractor will submit all post color DVD's in electronic format to the City for acceptance prior to payment.

- E. All other payment shall be made as per bid items. No payment shall be made for work considered incidental or complimentary to a pay item already in bid item. The Contractor shall clarify, for his own benefit, all work required for any item, incidental or otherwise, prior to bidding.

1.03 DEFINITIONS

- A. Pipe Bursting/crushing: The pipe bursting/crushing process is defined as the reconstruction of existing sanitary sewers by the simultaneous insertion of a liner pipe within the bore of the existing pipe, by breaking and expanding the old pipe.

1.04 SYSTEM DESCRIPTION

- A. The pipe bursting/crushing process involves rehabilitation of deteriorated gravity sewer pipe by installing new pipe material within the enlarged bore created by using a static, hydraulic, or pneumatic hammer molding device, suitably sized to break the old pipe or by using a modified boring knife with a flared plug that crushes the existing sewer pipe. Forward progress of the mole or the knife may be aided by hydraulic equipment or other apparatus. Replacement pipe is either pulled or pushed into the bore.

1.05 QUALITY ASSURANCE

- A. Liner Acceptance: Provide liner material which is homogeneous without defects and manufactured to the standards and dimensions specified. Cause for rejection includes physical defects of the liner, such as concentrated ridges, discoloration, excessive spot roughness, pitting, visible cracks, foreign inclusions, and varying wall thickness.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Prevent injury or abrasion to pipe during loading, transportation, and unloading. Do not drop pipe from cars or trucks, nor allow pipe to roll down skids without proper restraining ropes. Use suitable pads, strips, skids, or blocks for each pipe during transportation and while awaiting installation in the field.
- B. Pipe with cuts, gashes, nicks, abrasions, or any such physical damage which may have occurred during shipping, storage, or handling, which are deeper than 10 percent of the wall thickness shall not be used and shall be removed from the construction site.
- C. Use wide belly band slings for lifting and moving pipe. Do not use bare chains in contact with pipe.

1.07 SUBMITTALS

- A. Submittals shall conform to requirements of all sections and provisions of these specifications.
- B. Submit manufacturer's product data with complete information on pipeline materials, physical properties, and dimensions pertinent to this job. Furnish a certificate of compliance with specifications for materials to be supplied.
- C. Submit test reports prepared by an independent testing laboratory certifying that polyethylene pipe conforms to the requirements of ASTM D1248 and ASTM D3350 or that fiberglass reinforced pipe (FRP) pipe conforms to requirements of ASTM D2992 and ASTM D3681, as applicable.
- D. Submit manufacturer's product data on clamps.
- E. Submit videotapes as specified in Section 02733.

1.08 TESTING

- A. The City may run tests on field samples following applicable ASTM specifications at an independent laboratory to verify the required properties and characteristics of supplied materials. Provide product samples as requested by the Owner's Representative.
- B. The City will pay for tests on liner material which meets specifications requirements. Contractor shall pay for failed tests and retesting of failed materials.

PART 2 PRODUCTS

2.01 PIPE BURSTING/CRUSHING SYSTEMS

- A. The manufactures/companies must be pre-approved by the Owner. Provide documentation detailing qualification, references, and experience for Owner approval.

2.02 MANUFACTURERS

- A. Liner pipe systems shall be polyethylene or fiberglass reinforced plastic (FRP) products approved by the City.
- B. Approved manufacturer for polyethylene liner is Chevron Phillips.
- C. Approved manufacturer for FRP liner is Hobas USA, Inc.

2.03 POLYETHYLENE LINER PIPE AND FITTINGS

- A. Provide polyethylene liner pipe, manufactured of solid wall, high density, high molecular weight, polyethylene compound conforming to ASTM D1248, Type III, Class B, Grade P-34, Category 5, with a PPI rating of PE 3408. Use Polyethylene material with a minimum cell classification of 345434D or E (inner wall of Light color) under ASTM D3350. A higher numbered cell classification limit which gives a desirable higher primary property, according to ASTM D3350, is also acceptable. Dimensions and workmanship shall be in accordance with ASTM F714 and ASTM D2122.
- B. The maximum Standard Dimension Ratio (SDR), the ratio of outside diameter of pipe to wall thickness, is specified below. Select the SDR for the deeper of two manholes in a particular pipeline segment.

Existing Nominal Diameter (Inches)	Minimum Outside Diameter (Inches)	Minimum Wall Thickness (Inches)		
		15' Deep	> 15 20' Deep	>20' Deep
		SDR 19	SDR 17	SDR 11
6-8	8.625	0.454	0.507	0.784
10	12.75	0.671	0.750	1.159
12	14.0	0.737	0.824	1.273
15	18.0	0.947	1.059	1.636
18	20.0	1.053	1.176	1.818

- C. Before beginning work, the Contractor shall submit to the Owner’s Representative for approval, the vendor’s specific technical data with complete physical properties of pipe and pipe dimensions pertinent to this job.

2.04 FRP LINER PIPE AND FITTINGS

- A. Provide liner pipe manufactured in conformance to the requirements of ASTM D3262, Type 1, Liner 2, Grade 3. Liner pipe shall be reinforced plastic mortar pipe manufactured by the centrifugal casting process resulting in a dense, nonporous, corrosion resistant, consistent, composite structure. FRP pipe shall have a minimum stiffness of 72 psi measured in accordance with ASTM D2412. Pipes with a stiffness greater than 72 psi may be used with approval of Owner’s Representative.

- B. Resin systems shall be thermosetting polyester epoxy resin, with or without filler, producing a pipe conforming to requirements of ASTM D3262.
- C. Reinforcing glass fibers shall be commercial grade, E-type glass filaments with binder and sizing compatible with impregnating resins.
- D. Filler shall be sand with a minimum 98 percent silica content and a maximum moisture content of 0.2 percent.
- E. Joints shall be low-profile FRP jacking bell-and-spigot joints with elastomeric sealing gaskets to produce watertight joint. Joints shall conform to the requirements of ASTM D4161.
- F. Dimensions and Tolerances:
 - 1. Pipe outside diameters and tolerances shall be in accordance with ASTM D3262, Cast Iron Pipe Equivalent Outside Diameters and the table below. Supply pipe in nominal lengths of 20 feet, when possible. Where radius curves in existing pipe or limitations in entry pit dimensions restrict pipe length, shorter lengths may be used.
 - 2. The FRP pipe minimum outside diameter and minimum wall thickness shall be as specified in the following table:

Existing Sewer Nominal Diameter (Inches)	Minimum Liner O.D. (Inches)	Minimum Wall Thickness 46 psi Stiffness (Inches)	Minimum Wall Thickness 72 psi Stiffness (Inches)
12	13.45	0.34	0.48
15-18	19.50	0.34	0.48

- 3. Fabricated pipe ends square to pipe axis or minus 0.25, inches, or plus or minus 0.5 percent of nominal diameter, whichever is greater.
- G. Flanges and Fittings: Flanges, elbows, reducers, tees, wyes, and other fittings shall be capable of withstanding operating conditions. Fittings shall be contact-molded or manufactured from mitered sections of pipe jointed by glass fiber reinforced overlays.

2.05 LINER PIPE SEAL AT MANHOLE

- A. The annular space between liner pipe and host sewer at manhole shall be sealed with oakum strips soaked in Scotchseal 5600 as manufactured by 3M Corporation, or equal.
- B. Grout mix shall be non-shrink grout.

2.06 CLAMPS AND GASKETS

- A. Clamps shall be stainless steel, including bolts and lugs as manufactured by JCM Industries, Type 108, or equal. Furnish full circle, universal clamp couplings with a minimum 3/16-inch thick neoprene, grid-type gasket. Select clamps to fit outside diameter of liner pipe. Use minimum clamp (length) as specified in the following table:

Liner Pipe O.D. (Inches)	Minimum (<i>Length</i>) of Clamp (Inches)
8.625	18
10.750 or greater	30

2.07 BEDDING MATERIAL

- A. Provide bedding conforming to requirements of Section 02227 and Section 02252.

PART 3 EXECUTION

3.01 PRE-INSTALLATION PREPARATIONS

- A. Contractor shall submit a work plan to the Owner’s Representative for review and acceptance. The work plan shall address the following minimum preparation/steps, unless approved otherwise by the Owner’s Representative.
 1. Safety - The Contractor shall carry out operations under this Section in strict accordance with all applicable 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.
 2. Pre-Installation Television Inspection - It shall be the responsibility of the Contractor to video (TV) inspect the sewer pipe immediately before the pipe bursting/crushing to assure that the existing pipe conditions are acceptable for pipe bursting/crushing. This inspection, as well as the video (TV) inspection after the installation, shall be incidental to the installation of the replacement pipe.
 3. Bypassing Sewage - When required for acceptable completion of the pipe bursting/crushing process, the Contractor shall provide for continuous sewage flow around the section(s) of pipe designated for the installation of replacement pipe. The pump bypass lines shall be of adequate capacity and size to handle the flow in accordance with the applicable section.

4. Line Obstructions - If Pre-Installation video (TV) inspection reveals an obstruction in the existing sewer (heavy solids, dropped joints, protruding service taps or collapsed pipe) which will prevent completion of the pipe bursting/crushing process, and that cannot be removed by conventional sewer cleaning equipment, then an Obstruction Removal shall be made by the Contractor, with the approval of the Owner's Representative.
5. Sags in Line - If Pre-Installation video (TV) inspection reveals a sag in the existing sewer that is greater than one-half the diameter of the existing pipe, it shall be the Contractor's responsibility to install the replacement pipe to result in an acceptable grade without the sag. The Contractor shall take the necessary measures to eliminate these sags by digging a sag elimination pit and bringing the bottom of the pipe trench to a uniform grade in line with the existing pipe invert or by other measures that shall be acceptable to the Owner's Representative. Elimination of sags in the line shall not be paid separately but shall be included in the unit price bid for pipe bursting/crushing.

3.02 BYPASS PUMPING

- A. Refer to Section 02790 - Divergence Pumping.

3.03 INSERTION OR ACCESS PITS

- A. Locate pits so that the total number is minimized and footage of liner pipe installed in a single pull is maximized. Use excavations at point repair locations for insertion pits, where possible.
- B. Before excavating, check with various utility companies (e.g., CenterPoint Energy, AT&T, City, Texas Gas), and determine the location of utilities in the vicinity of the work area. For damage done to utilities, the resulting repair, temporary service, and other such costs shall be borne by Contractor.
- C. Perform excavation and backfill in accordance with requirements of Section 02227.
- D. Perform work in accordance with OSHA standards. Follow requirements specified in Section 01526 - Trench Safety System.
- E. Install and operate necessary dewatering and surface water control measures in accordance with specifications.

3.04 PIPE INSTALLATION

- A. The Contractor shall submit information, in detail, of the procedure and the steps to be followed for the installation of the pipe bursting/crushing system selected, even in the process is named in the specification. All such instructions and procedures

submitted shall be carefully followed during installation. Any proposed changes in installation procedures shall require submittal of revised procedures and acceptance by the Owner's Representative.

1. Finished Pipe - The installed replacement pipe shall be continuous over the entire length of each pipe segment from manhole to manhole and shall be free from visual defects such as foreign inclusions, concentrated ridges, discoloration, pitting, varying wall thickness, pipe separation other deformities. Replacement pipe with gashes, nicks, abrasions, or any such physical damage which may have occurred during storage and/or handling, shall not be used and shall be removed from the construction site. The replacement pipe passing through or terminating in a manhole shall be carefully cut out in a shape and manner approved by the Owner's Representative. The invert and benches shall be streamlined and improved for smooth flow. The installed pipe shall meet the leakage requirements of the pressure test specified later.
2. Process Limitations - Though the installation process may be licensed or proprietary in nature, the Contractor SHALL NOT change any material, thickness, design values or procedural matters stated or approved in the submittals, without the Owner's Representative's prior knowledge and preapproval. The Contractor shall submit, in writing, full details about component materials, their properties and installation procedures and abide by them fully during the entire course of the project.

All sewer rehabilitation by pipe bursting/crushing systems are being considered structurally equal processes as far as "end product" required by the City. The minimum required performance criteria, and/or standards, physical/structural properties, chemicals resistance tests, and the replacement pipe thickness as given in this Specification shall be strictly complied. It shall be the responsibility of the Contractor to comply with the specifications in full without any request for any change after the award of the contract. The City reserves the right to accept, reject, or modify any later requests for change at no additional cost to the City or even to the extent of asking credit for the City.

B. Pipe Jointing

1. Polyethylene Pipe - Sections of polyethylene replacement pipe shall be assembled and jointed on the job site above the ground. Jointing shall be accomplished by the heating and butt-fusion system in strict conformance with the manufacturer's printed instructions.

The butt-fusion system for pipe jointing shall be carried out in the field by operators with prior experience in fusing polyethylene pipe with similar equipment using proper jigs and tools per standard procedures outlined by the pipe manufacturer. These joints shall have a smooth, uniform, double rolled back head made while applying the proper melt, pressure and alignment. It shall be the sole responsibility of the Contractor to provide an acceptable butt-fusion joint. All joints shall be made available for inspection by the Owner's Representative before insertion. The replacement pipe shall be joined on the site in appropriate working lengths near the insertion pit. The maximum length of continuous replacement pipe which shall be assembled above ground and pulled on the job site at any one time shall be 600 linear feet.

2. Centrifugally Cast Fiberglass Pipe - Sections of centrifugally cast fiberglass pipe shall be manufactured with an integral straight bell, gravity jacking bell-spigot joint. This joint shall be affixed to one end of the pipe by the manufacturer.

An elastomeric gasket, supplied by the manufacturer, shall be placed on the groove of the spigot, just prior to installation. The gasket shall be properly seated, then lubricated per manufacturer's instruction. All joints shall be made available for inspection by the Owner's Representative before insertion. The replacement pipe shall be jointed in or near the insertion pit.

- C. Preparation: After completing insertion pit excavation, remove top of existing sanitary sewer line down to the spring line. Connect a Pipe Bursting/Crushing system to the end of liner by use of a suitable pulling head equal to or greater than the outside diameter of liner. Secure pulling head to liner and attach to Pipe Bursting/Crushing system so that liner can be satisfactorily fed and pulled through sanitary sewer main. Prevent ragged edges of existing pipe from scaring liner pipe. Refer to insertion procedures given in ASTM F585. Do not allow sand or other debris to enter the liner.

D. Pulling Liner:

1. The maximum length of continuous liner which may be assembled above ground and pulled at any one time is the length recommended by the manufacturer's printed instructions.
2. Limit the pulling force exerted on liner so that the forces indicated below for the device connected to the winch or pulling mechanism.

Polyethylene Liner O.D. (Inches)	Maximum Pulling Force (Tons)
8.625	6.0
10.75	10.0
14.0	17.0
16.0	23.0
18.0	28.0

3.05 FRP LINER PIPE INSTALLATION

- A. FRP liner pipes may be pulled into the existing sewer. Insert the pipes, spigot end first, with the bell end trailing. Apply pushing force to pipe wall end inside of bell in accordance with manufacturer’s instruction. Do not ally a jacking load to end of bell. Maximum allowable joint angular deflection shall be 1.0 degree. Keep within safe jacking loads given in the following table:

Outside Diameter (Inches)	Maximum Jacking Load (Tons) For 72 psi Stiffness
13.45	22
17.40	30

3.06 CLAMP INSTALLATION

- A. Where excavation for liner pipe insertion are made between two manholes, cut ends of the liner pipe smooth, square to its axis. Join liner pipes with approximately sized stainless steel universal clamp couplings. Gap between ends of liner pipe shall be butted together with space between ends not exceeding 2 inch.
- B. Bedding shall be stabilized cement sand conforming to requirements of Section 02252 - Cement Stabilized Sand. Bedding shall extend 12" above the clamp/liner pipe.

3.07 FRP COLLAR/CLOSURE

- A. FRP collar closure pieces shall be installed in accordance with manufacturer’s recommendations.

3.08 FIELD QUALITY CONTROL

- A. 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 manholes, 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 is a service lateral connection test in accordance with the Section 02762 - Sanitary Sewer Service Reconnections. The test shall be done after all service laterals have been made for a particular pipe segment between adjacent manholes. This test shall verify the integrity of the connection at the point where it joins the replacement pipe and existing service line.
- B. Low Pressure Air Test Procedure - Refer to Section 02732 - Acceptance Testing for Sanitary Sewers.

3.09 SEALING LINER MANHOLE

- A. Allow liner pipe to normalize to ambient temperatures as well as recover from imposed stretch before cutting to fit between manholes, sealing at manholes, and manhole invert shaping. Normalization usually takes at least 12 hours for polyethylene.
- B. Cut liner so that it extends 4 inches into manhole. Make a smooth, vertical cut and slope area over top of exposed liner using non-shrink grout.
- C. Seal the annular space between liner and sanitary sewer main at each manhole with a chemical seal and nonshrink grout. Place strips of oakum soaked in sealer in a band to form an effective watertight gasket in the annular space between liner and existing opening in manhole. Make width of the sealing band a minimum of 8 inches or the thickness of the manhole wall, whichever is greater.
- D. Finish seal with a non-shrink grout placed around annular space from inside manhole. Apply grout in a band not less than 6 inches wide.
- E. Reshape and smooth the manhole invert as specified in Section 02764 - Manhole Rehabilitation. Use approved manhole rehabilitation material to form a smooth transition with a reshaped invert and a raised manhole bench to eliminate sharp edges of liner pipe, concrete bench, and channels invert. Build up and smooth invert of manhole to match flow line of new liner.
- F. The replacement pipe in the manhole shall be sealed as specified above before processing on to the next manhole section and all manholes shall be individually inspected for replacement pipe cut-offs, benches, and sealing work.

- G. Payment by work described above shall be incidental to the unit price bid for pipe bursting/crushing.

3.10 POST INSTALLATION TELEVISIONING OF COMPLETED WORK

- A. The Contractor shall provide the City a color video tape taken by a pan and tilt pipe inspection camera that pans 275 and rotates 360 for close up view showing the completed work, including the condition of the restored service connections.
- B. Television inspections, tapes and reports, etc., shall be in accordance with Section 02733 - Cleaning and Television Inspection. Upon completion of the installation work and testing, the Contractor shall restore/clear the project area affected by his operations. No trash, rubbish, etc., shall be stored at any site, whether the work is in progress or not.

3.11 FINAL CLEANUP

- A. Upon completion of installation work and testing, clean and restore project area affected by the Work. Restoration shall be in accordance with the specifications.

END OF SECTION