

Technical Specifications for the Reconstruction of Sanitary Sewer by the Pipe Bursting/Replacement Process

1. GENERAL

1.1 DESCRIPTION

This specification covers requirements to rehabilitate existing sanitary sewers by the pipe bursting method. Pipe bursting is a system by which a pneumatic burster unit splits the existing pipe while simultaneously installing a new polyethylene pipe of the same size or larger size pipe where the old pipe existed, then reconnect existing sewer service house connections, television inspection of the polyethylene pipe and complete the installation in accordance with the contract documents.

1.2 QUALITY ASSURANCE

- A. The Contractor shall be certified by the particular pipe bursting system manufacturer that such firm is licensed installer of their system.
- B. Polyethylene pipe jointing shall be performed by personnel trained in the use of thermal butt-fusion equipment and recommended methods for new pipe connections. Personnel directly involved with installing the new pipe shall receive training in the proper methods for handling and installing the polyethylene pipe. Training shall be performed by a qualified representative.
- C. The Contractor shall hold the City of LaGrange harmless in any legal action resulting from patent infringements.
- D. The Contractor shall have a minimum of 5 years experience using the pipe-bursting method and shall have installed no less than 10,000 thousand feet.
- E. The Contractor must have successfully completed at least 3 job(s) in the past 12 months, similar in scope, to the requirements of pipe bursting set forth in these bid documents.

1.3 SUBMITTALS

Submit the following Contractor's Drawings/Documentation:

- A. Shop drawings, catalog data, and manufacturer's technical data showing complete information on material composition, physical properties, and

dimensions of new pipe and fittings. Include manufacturer's recommendation for handling, storage and repair of pipe and fittings damaged.

- B. Detailed construction procedures, and layout plans to include sequence of construction.
- C. Methods of construction, reconnection and restoration of existing service laterals.
- D. The methods of modification, if required, for existing manholes.
- E. Detailed procedures for the installation and bedding of pipe launching and receiving pits.
- F. Sewer bypass plans, including methods and list of equipment to be utilized.
- G. Traffic control plans.
- H. Project schedule.
- I. Contingency plans for the following potential conditions:
 - 1) Unforeseen obstruction(s) causing burst stoppage, such as unanticipated change(s) in host pipe material, repair section(s), concrete encasements(s) or cradle(s), buried or abandoned manholes(s) or changes in direction not depicted on the drawings provided.
 - 2) Substantial surface heave occurring due to depth of the existing pipe vs. the amount of upsizing.
 - 3) Damage to existing service connections and replacement pipeline's structural integrity and methods of repair.
 - 4) Damage to other existing utilities.
 - 5) Loss of and return to line and grade.
 - 6) Soil heaving or settlement.
- J. Certification of workmen training for installing pipe.
- K. Television inspection reports and video tapes made after new pipe installation.
- L. Documentation that the criteria outlined in 1.2 Quality Assurance, items D and E have been met.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Transport, handle and store pipe and fittings as recommended by manufacturer.
- B. If new pipe and fittings become damaged before or during installation, it shall be repaired as recommended by the manufacturer or replaced as required by the City of LaGrange at the Contractor's expense, before proceeding further.
- C. Deliver, store and handle other materials as required to prevent damage.

1.5 METHODS FOR NEW PIPE INSTALLATION

The methods approved for rehabilitation of existing sanitary sewers by pipe bursting and installation of new polyethylene pipe are those utilizing static or impact force, or prior approved equal. 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. The pipe bursting tool shall be pulled through the sewer by a winch located at the either upstream or downstream manhole. The bursting unit shall pull the polyethylene pipe with it as it moves forward. The bursting head shall incorporate a shield/expander to prevent collapse of the hole ahead of the PE pipe insertion

2. MATERIALS

- 2.1.1** Polyethylene plastic pipe shall be high density polyethylene pipe and meet the applicable requirements of ASTM F714 Polyethylene (PE) Plastic Pipe (SDR-PR) based on outside diameter, ASTM D1248 and ASTM D3350.
 - A. Sizes of the insertions to be used shall be such to renew the sewer to its original or greater flow capacity.
 - B. All pipe shall be made of virgin material. No rework except that obtained from the manufacturer's own production of the same formulation shall be used.
 - C. The liner material shall be manufactured from a high density high molecular weight polyethylene compound which conforms to ASTM D1248 and meets the requirements for Type III, Class C, Grade P-34, Category 5, and has a PPI rating of PE 3408.

- D. The body of the pipe produced from this resin shall have a minimum cell classification of 345444C under ASTM D3350 and the inner wall shall be light in color and have a minimum cell classification of 345444E under ASTM D3350. A higher cell classification limit which gives a desirable higher primary property, per ASTM D3350 may also be accepted by the City of LaGrange at no extra cost to the owner. The value for the Hydrostatic Design basis shall not be less than 1600 PSI (11.03 MPA) per ASTM D2837.
- E. The polyethylene pipe shall have light colored interior fully bonded and co-extruded pipe structure. The bond between the layers shall be strong and uniform. It shall not be possible to separate the two layers with a probe or point of a knife blade so that the layers separate cleanly at any point, nor shall separation of bond occur, between layers, during testing performed under the requirements of this specification.
- F. The pipe shall be homogeneous throughout and shall be free of visible cracks, holes, foreign material, blisters or other deleterious faults.
- G. Dimension Ratios: The minimum wall thickness of the polyethylene pipe shall meet the following:

Depth of Cover (Feet)	Minimum SDR of Pipe
0 -16.0	21
> 16.1	17

- H. Material color shall be black on the outside for ultraviolet protection and have 10 mils of a light-colored inner layer for enhanced television inspection.

2.1.2 TESTS

Tests for compliance with this specification shall be made as specified herein and in accordance with the applicable ASTM specification. A certificate with this specification shall be furnished, upon request, by the manufacturer for all material furnished under this specification. Polyethylene plastic pipe and fittings may be rejected if they fail to meet any requirements of this specification.

3. SEWER SERVICE CONNECTIONS

- 3.1** All sewer service connections shall be identified, located and excavated prior to the pipe insertion to expedite reconnection. Upon commencement, pipe insertion shall be continuous and without interruption from one manhole to another, except as approved by the City of LaGrange. Upon completion of insertion of the new

pipe, the Contractor shall expedite the reconnection of services so as to minimize any inconvenience to the customers. Excavation for laterals should be to a depth of 1 foot below the lateral. This will help to prevent uneven expansion of the soil by the bursting tool.

- 3.2** Sewer service connections shall be connected to the new pipe by mechanical methods or electrofusion methods. Once the saddle is secured in place, a hole shall be drilled the full inside diameter of saddle outlet in pipe liner.
- A. Mechanical saddles shall be made of polyethylene pipe compound that meets the requirements of ASTM D1248, Class C, have stainless steel straps and fasteners, neoprene gasket and backup plate. Mechanical saddles shall be Strap-On-Saddle type as manufactured by Driscopipe or Tapping Saddle manufactured by Fernco Joint Sealer Co., DFW Plastics, Inc. or approved equal.
 - B. Electrofusion saddles as manufactured by Central Plastics or approved equal or conventional fusion saddles as manufactured by Central Plastics, Phillips Driscopipe or Plexco shall be installed in accordance with the manufacturers recommended procedures.

4. PREPARATION

4.1 BYPASSING SEWAGE

- A. By-Pass Pumping: The Contractor, when and where required, shall provide diversion for the pipe bursting/replacement process. The pumps and by-pass lines shall be of adequate capacity and size to handle all flows. All costs for by-pass pumping, required during installation of the pipe shall be subsidiary to the pipe reconstruction item.
- B. The Contractor shall be responsible for continuity of sanitary service to each facility connected to the section of sewer during the execution of the work.
- C. If sewage backup occurs and enters buildings, the Contractor shall be responsible for clean-up, repair, property damage cost and claims.

4.2 TELEVISION INSPECTION

Television inspection of pipelines shall be performed by experienced personnel trained in locating breaks, obstacles and service connections by closed circuit color television.

Television inspection shall include the following:

- A. Video tapes (post) to be submitted to the City before final invoice.
- B. Video tapes to remain property of the City; Contractor to retain second copy for his use.
- C. All flows tributary to reach of sewer being inspected are to be completely by-passed around the reach during inspection if necessary and required by City.
- D. Post construction video tape upon completion of reconstruction of each reach of sewer with the voice description, as appropriate with stationing of services indicated. Data and stationing to be on video.
- E. Should any portion of the inspection tapes be of inadequate quality or coverage, as determined by the City, the Contractor will have the portion reinspected and video taped at no additional expense to the City.

4.3 LOCATING UTILITIES

Prior to commencing work the Contractor shall verify the location of all adjacent utilities. The minimum clearance from other utilities shall be approximate two (2) feet. The Contractor shall expose all interfering and crossing utilities by spot excavating at the planar intersection of the pipe and removing the soil from around the utility.

4.4 SUBSURFACE CONDITIONS

Subsurface investigations deemed necessary by the Contractor to complete the work shall be included in the Bid Proposal at no additional cost to the City of LaGrange. Copies of all reports and information obtained by the Contractor shall be provided to the City of LaGrange.

The minimum depth of cover over the installed pipe shall be ten (10) times the amount of displacement from the diameter of the existing pipe or three (3) feet from the top of the existing pipe, whichever is greater. The Contractor may, with the prior approval of the City of LaGrange reduce the minimum depth of cover.

Unless otherwise noted in the Contract Documents, settlement or heaving of the ground surface during or after construction will not be allowed. The Contractor is solely responsible for the costs for repairing any surface heaving unless specified otherwise in the contract documents. However, at the discretion of the City of

LaGrange, if soil conditions are not favorable and pipe up-sizing is required a minimal amount of ground heaving may be allowed.

5. CONSTRUCTION METHODS

5.1 Insertion or launching pits shall only be allowed at locations of existing or proposed manholes, unless otherwise approved by the City of LaGrange, to minimize impact on existing trees or developed areas. Launch pits need to be long enough to properly align the bursting tool with the existing pipe and to allow the HDPE pipe to make a graceful "S" bend out of the pit and transition to the surface above. A good rule of thumb to use is to multiply the depth of the existing pipe by a factor of four (4). The product is an approximate minimum launch pit length.

5.2 Equipment used to perform the work shall be located away from buildings so as to lessen the noise impact. Provide silencers or other devices to reduce machine noise as required.

5.3 The Contractor shall install all pulleys, rollers, bumpers, alignment control devices and other equipment required to protect existing manholes, and to protect the pipe from damage during installation. Lubrication may be used as recommended by the manufacturer. Under no circumstances will the pipe be stressed beyond its elastic limit.

5.4 The installed pipe shall be allowed the manufacturer's recommended amount of time, but not less than four (4) hours, for cooling and relaxation due to tensile stressing prior to any recollection of service lines, sealing of the annulus or backfilling of the insertion pit. Sufficient excess length of new pipe, but not less than four (4) inches, shall be allowed to protrude into the manhole to provide for occurrence. Restraint of pipe ends shall be achieved by means of electrofusion couplings. The electrofusion couplings shall be slipped over pipe ends against manhole wall and fused in place. Installation of electrofusion couplings shall be done in accordance with the manufacturer's recommended procedures.

5.4 The annular space shall be sealed at the manhole. Sealing shall be made with material approved by the City of LaGrange and shall extend a minimum of eight (8) inches into the manhole wall in such manner as to form smooth, uniform, watertight joint.

5.5 FIELD TESTING

A. After the existing sewer is completely replaced, internal inspection with television camera and video tape shall be carried out as required. The finished

tape shall be continuous over the entire length of the sewer between two manholes and be free from visual defects.

B. Low Pressure Air Test

- 1) For safety reasons, air testing of sections of pipe shall be limited to lines with an average inside diameter less than 36 inches. The low pressure air test shall conform to ASTM C828 and C924.
- 2) The length of line to be tested at one time shall be limited to the length between adjacent manholes.
- 3) Sections of pipe which have an average inside diameter of 36 inches or larger shall be air tested at each joint.
- 4) The test section shall be pressurized to 4.0 pounds per square inch ("psi") and held above 3.5 psi for 5 minutes.
- 5) Air is to be added as required to hold pressure during this 5 minute period.
- 6) At the end of the 5 minute saturation period, the pressure shall be recorded and the time period shall begin with a pressure of 3.5 psi.
- 7) For sections of pipe up to 36 inch average inside diameter, the minimum time allowable for the pressure to drop from 3.5 psi to 2.5 psi shall be computed using the following equation:

$$T = 0.085 (D) (K) / (Q)$$

Where:

T = time for pressure to drop 1.0 pound per square inch gauge in seconds K = 0.000419 (D) (L), but not less than 1.0

D = the average inside diameter of the pipe in inches L = length of pipe in feet of same size being tested

Q = rate of loss in cubic feet per minute per square foot of internal surface area (a value of 0.0015 shall be used)

The testing times and minimum testing times for each pipe diameter are shown below:

Pipe Diameter (Inches)	Time (seconds)	But Not Less Than (minutes)	Pipe Diameter (inches)	Time (seconds)	But Not Less Than (minutes)
6	.885L	5:40	21	10.471L	19:50
8	1.52L	7:34	24	13.676L	22:40
10	2.374L	9:27	27	17.309L	25:30
12	3.419L	11:20	30	21.369L	28:20
15	5.342L	14:10	33	25.856L	31:10
18	7.693L	17:00			

- 8) The minimum time allowable for the pressure to drop from 3.5 psi to 2.5 psi during a joint test, regardless of size, shall be 20 seconds.
- 9) When the prevailing ground water is above the sewer being tested, air pressure shall be increased 0.43 psi for each foot the water table is above the flow line of the sewer.
- 10) A pressure gauge shall be supplied by the Contractor and shall have minimum divisions of 0.10 psi and shall have an accuracy of 0.04 psi.
- 11) Calibration of the gauge shall be certified by a reliable testing firm at 6-month intervals or as required by the Engineer.
- 12) Any section failing to meet the requirements shall be examined and the leak found and repaired at no additional expense to the Owner.
- 13) After repair, the section shall be retested.

C. Defects which may affect the integrity or strength of the pipe in the opinion of the Engineer shall be repaired or the pipe replaced at the Contractor's expense.

6. PIPE JOINING

- 6.1** The polyethylene pipe shall be assembled and joined at the site using the thermal butt-fusion method to provide a leak proof joint. Threaded or solvent-cement joints and connections are not permitted.

All equipment and procedures used shall be in strict compliance with the manufacturer's recommendations. Fusing shall be accomplished by personnel certified as fusion technicians by a manufacturer of polyethylene pipe and/or fusing equipment.

- 6.2** The butt-fused joint shall be properly aligned and shall have uniform roll-back beads resulting from the use of proper temperature and pressure. The joint surfaces shall be smooth. The fused joint shall be watertight and shall have

tensile strength equal to that of the pipe. All joints shall be subject to acceptance by the Engineer and/or his representative prior to insertion. All defective joints shall be cut out and replaced at no cost to the City. Any section of the pipe with a gash, blister, abrasion, nick, scar, or other deleterious fault greater in depth than ten percent (10%) of the wall thickness, shall not be used and must be removed from the site. However, a defective area of the pipe may be cut out and the joint fused in accordance with the procedures stated above. In addition, any section of pipe having other defects such as concentrated ridges, discoloration, excessive spot roughness, pitting, variable wall thickness or any other defects of manufacturing or handling as determined by the Engineer and/or his representative shall be discarded and not used.

- 6.3** Terminal sections of pipe that are joined within the insertion pit shall be connected with a full circle pipe repair clamp, electrofusion couplings or connectors with tensile strength equivalent to that of the pipe being joined. The butt gap between pipe ends shall not exceed one-half (1/2) inch.

7. MEASUREMENT AND PAYMENT

- 7.1** The inserted pipe shall be paid for per linear foot of the size pipe specified and shall include all pipe bedding, backfill material, annulus sealing material and launching pits. Locating and reconstruction of services and all reconnections of services shall be paid for per each connection made, including fittings and pipe.
- 7.2** The work performed as prescribed by this item will be paid at the unit price per linear foot of sanitary sewer by pipe bursting/replacement for the specified pipe diameter and location, per each for "Locate, reconstruct and reconnect" for the specified pipe diameter, which price shall be full compensation for the installation of the new pipe, furnishing and placing of all materials, labor, tools, equipment, cleaning, and preparation of the existing pipe to receive the new liner, and any other necessary items required to complete the project.
- 7.3** Video inspection of final installed pipe shall be paid based on the cost per linear foot to televise the entire length of new pipe.
- 7.4** The cost of any necessary by-pass pumping shall be considered subsidiary to the cost of pipe installation and shall not be a separate pay item.
- 7.5** Replacement and modification of manhole inverts and bottoms shall be considered part of the trenchless pipe replacement operation, and no additional compensation will be allowed unless otherwise addressed in the contract documents.

8. WARRANTY

All work performed under this Contract shall be warranted to be free from defects in material and workmanship for a period of one year from the date of acceptance. If the Engineer determines that the process has failed during the warranty period, the Contractor will perform any and all repairs at no additional cost to the City of LaGrange.