

## APPENDIX A - PIPE BURSTING TECHNICAL SPECIFICATIONS

### A. GENERAL REQUIREMENTS

1. Scope. The work covered by this section of the Specifications shall consist of reconstructing the existing 8-inch diameter vitrified clay and unreinforced concrete sanitary sewer lines as indicated on the Construction Drawings. Replacement shall be accomplished by bursting the existing pipe and simultaneously inserting a high-density polyethylene (HDPE) pipe. The Contractor shall provide all materials, labor, equipment, and services necessary for bypass pumping of sanitary and stormwater flows, excavation of access pits, reconnection of service laterals, restoration of pavement and landscaping, final television inspection, and all other related work.
2. Pipe Bursting. The City makes no warranty regarding the suitability of pipe bursting technology for this project. The Contractor is fully responsible to determine whether conditions are suitable for pipe bursting and to select the people, methods, and equipment required to successfully perform the work.
3. Reference Specifications, Codes, and Standards. The following references are part of this Specification. In case of conflict between the requirements of this Specification and those of the listed documents, the requirements of this Specification shall prevail. The last edition of the following references shall be used:

ASTM D 1238	Measuring Flow Rates of Thermoplastics by Extrusion Plastometer
ASTM D 1248	Polyethylene Plastics Molding and Extrusion Materials
ASTM D 1505	Density of Plastics by the Density-Gradient Technique
ASTM D 1693	Environmental Stress Cracking of Ethylene Plastics
ASTM D 1928	Preparation of Compression Molded Polyethylene Test Samples
ASTM D 2321	Underground Installation of Thermoplastic Flexible Sewer Pipe
ASTM D 2657	Heat Joining of Thermoplastic Pipe and Fittings
ASTM D 2837	Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials
ASTM D 3035	Polyethylene Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter
ASTM D 3261	Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
ASTM D 3350	Polyethylene Plastic Pipe and Fittings Materials
ASTM F 585	Insertion of Flexible Polyethylene Pipe in Existing Sewers
ASTM F 714	Specification of Polyethylene (PE) Plastic Pipe (SDR –PR) Based on Outside Diameter
ASTM D1.1	AWS Standard Qualification Procedure

### B. CONTRACTOR SUBMITTALS

Data to be Submitted by Bidder with the Bid. A copy of the Statement of Experience form and licensed installer documentation shall be submitted with the bid. Failure to submit and meet the requirements outlined below may be grounds for rejection of the bid.

1. Statement of Experience Requirements. This form shall be completed in its entirety. The form can be found in Appendix B.
  - a. Contractor: The Contractor must have minimum field experience for HDPE pipe bursting installation of three (3) successfully completed projects totaling a minimum of 2,000 linear feet of mainline using the proposed pipe bursting technology.
  - b. Superintendent: All pipe bursting technology shall be supervised by a project superintendent with the following minimum experience. The superintendent must have minimum supervisory field experience for HDPE pipe bursting installation of three (3) successfully completed projects totaling a minimum of 2,000 linear feet of mainline using the proposed pipe bursting technology.
  - c. Pipe Fusion Technician: Polyethylene pipe joining shall be performed by personnel certified as fusion technicians by a manufacturer of polyethylene pipe and/or fusing equipment. The fusing equipment shall

be operated only by technicians who within the last two (2) years have had experience fusion welding 8-inch or larger diameter HDPE pipe (totaling 500 linear feet minimum).

**C. DATA TO BE SUBMITTED AFTER AWARD OF CONTRACT**

The Contractor shall submit copies of the following to the Engineer after award of the contract, but prior to the start of work and a minimum of one week prior to the preconstruction meeting. The Contractor shall not start work until all submittals are turned in.

1. Pipe Bursting Literature: Shop drawings, catalog data, manufacturer’s technical data, dimensioned drawings, and installation details/sketches and other pertinent information for the HDPE pipe bursting installation work. All materials provided shall be fully in accordance with the requirements of the reference specifications listed in Section 1.01B.
2. Installation Plan: The Contractor shall submit marked up Plans indicating all of the excavation locations and excavation dimensions required for the pipe bursting and installation of the HDPE pipe. Narrative text must be included describing how utilities and other improvements are to be protected at each excavation.
3. Affidavit of Compliance: The Contractor shall submit a certified affidavit of compliance for all HDPE pipe and fittings furnished confirming that the materials fully conform to the requirements specified herein.
4. Bypass Pumping Plan: The Contractor shall submit a bypass pumping plan for review by the Engineer. The plan shall include proposed methods and equipment for stormwater and sewage control in accordance with Section 1.14 of the Special Specifications. This submittal shall include methods of controlling main pipeline flow, including location where stormwater and sewage is to be diverted, type of pipe to be used for bypass, and the method of service lateral flow control. Also, include methods for employing standby equipment when required during any emergency to include the use of a second pumping unit on standby or two pumps alternating.

**D. MATERIALS**

1. HDPE Pipe and Fittings:
  - a. Materials used for the manufacture of HDPE pipe and fittings shall be extra high molecular weight, high density ethylene/hexene copolymer PE 3408 Polyethylene resin meeting the specified physical property and pipe performance requirements.
  - b. The pipe and fittings shall be extruded from resin meeting specifications of ASTM D3350 with a cell classification of PE 345434C; and ASTM D 1248 pipe grade resin Type III, Class C, Category 5, Grade P34 polyethylene compound. The HDPE pipe shall have an Environmental Stress Crack Resistance (ESCR) of greater than 1000 hours for 50 percent failure as specified in ASTM F1248.
  - c. The Pipe and fittings shall be homogenous throughout and free from visible cracks, holes, foreign inclusions, or other injurious defects. The pipe shall be as uniform as commercially practical in color, opacity, density and other physical properties.
  - d. The pipe shall have a Standard Dimension Ratio (SDR) of 17 with the following dimensions:

Existing Sewer Approximate Inside Diameter, Inches	HDPE Nominal O.D., Inches	HDPE Approx. I.D., Inches	Min. Wall Thickness, Inches
8	8.625	7.611	0.507
10	10.750	9.486	0.632
12	12.750	11.250	0.750
15	16	14.118	0.941
18	18	15.882	1.059
21	22	19.412	1.294
24	24	21.176	1.412
30	30	26.470	1.765

- e. The heat fusion saddles shall have a Standard Dimension Ratio (SDR) of 17 with 4-inch and 6-inch outlets, as required for each service lateral.
- f. The pipe shall be to the dimensions and tolerances specified in ASTM F 714. Additionally, the pipe shall be inspected per industry-accepted manufacturer standards for:
  - Diameter
  - Wall thickness
  - Concentricity
  - Quick burst pressure and ductility
  - Joint strength
  - Straightness
  - Ovality
  - Toe-in
  - Overall workmanship inspection on I.D. and O.D.
  - Print line
- g. Pipe Extrusion
  - The pipe shall be extruded using a melt homogenizing/plasticating extruder and appropriate dye. The extruder screw design should be customized for the HDPE being processed to minimize melt fracture of the molecular structure thus reducing the molecular weight and changing some physical properties from resin to pipe. The resin should be processed at its melt temperature of 375 degrees Fahrenheit to 425 degrees Fahrenheit. The extruded tubular melt will be vacuum or pressure sized in downstream cooling tanks to form round pipe to specification diameter and wall thickness with a “matte finish” surface.
  - The pipe shall contain no recycled compound except that generated in the manufacturer’s own plant from resin of the same specification from the same raw material. The pipe shall be homogenous throughout and free of visible cracks, holes, voids, foreign inclusions or other deleterious defects, and shall be identical in color, density, melt index, and other physical properties throughout.
- h. Pipe Marking

During extrusion production, the HDPE pipe shall be continuously marked with durable printing following this format:

  - Nominal size
  - Standard dimension ratio
  - Pressure rating
  - Type (trade name)
  - Material classification
  - Certification basis
  - Blank position for nsf/fm use
  - Pipe test category
  - Plant
  - Extruder number
  - Date
  - Operator number
  - Shift letter
  - Resin supplier code

## **E. PACKAGING AND SHIPPING**

1. Packaging and shipping shall be done in accordance with the manufacturer’s instructions. Each standard and random length of pipe in compliance with this standard shall be stamped with a clear and permanent mark with the following information: name and trademark of manufacturer, nominal pipe size, dimension ratio, the letter PE followed by the polyethylene grade per ASTM D 1248, followed by the Hydrostatic Design Basis in hundreds of psi.
2. Package the pipe in a manner designed to deliver the pipe to the project neatly, intact, and without physical damage. The transportation carrier shall use an appropriate method and intermittent checks to ensure the pipe is properly supported, stacked, and restrained during transport such that the pipe is not nicked, gouged, or physically damaged.

## F. PIPE HANDLING

1. It shall be the Contractor's responsibility to locate and secure a staging area for this project at which to stockpile and store equipment and materials. Stockpiling of pipe in the City right-of-way is prohibited.
2. The Contractor shall exercise special care during the unloading, handling, and storage of all polyethylene pipe to ensure that the pipe is not cut, gouged, scored or otherwise damaged. Any pipe segment which has cuts in the pipe wall exceeding 10 percent of the wall thickness shall be cut out and removed from the site at the Contractor's expense.
3. Handle fused segments of pipe to avoid damage to the pipe. Lifting fused sections of pipe with chains or cable type chokers must be avoided. Nylon slings are preferred. Spreader bars are recommended when lifting long fused sections. Care must be exercised to avoid cutting or gouging the pipe.
4. All pipe damaged before, during, or after installation shall not be used and shall be removed from the site by the Contractor at his cost to the satisfaction of the Engineer. Inspect the pipe prior to installation to ensure that there is no damaged pipe.

## G. STORAGE

1. Store pipe on clean, level ground to prevent undue scratching or gouging of the pipe. If the pipe must be stacked for storage, such stacking shall be done in accordance with the pipe manufacturer's recommendations.
2. Where necessary due to ground conditions, store the pipe on wooden sleepers, spaced suitably, and of such width as to not allow the deformation of the pipe at the point of contact with the sleeper or between supports.
3. Limit stacking of the pipe to a height that will not cause excessive deformation of the bottom layers of pipes under anticipated temperature conditions.

## H. PIPE JOINING

1. The Contractor is not allowed to stockpile pipe or any other material used for the contract within the City right-of-way. However, the Contractor shall be allowed to layout and fuse within the right-of-way the amount of pipe that will be installed in the next two immediate pipe bursting runs (the segment being installed and the segment to be immediately pipe burst). The Contractor is not allowed to transport additional pipe into the right-of-way until the previous section has been installed.
2. Sections of polyethylene pipe shall be jointed into continuous lengths on the job site above ground. The joining method shall be the butt fusion method to provide a leak proof joint. Socket fusion, threaded or solvent-cement joints and connections are not permitted. All equipment and procedures shall be used in strict compliance with the pipe manufacturer's recommendations. Fusion equipment used in the joining procedure shall be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, fusion temperature, alignment, and fusion pressure. The pipe fusion technician shall meet the experience requirements as outlined above.
3. A fire-retardant bag or suitable enclosure shall be used with the heater plate to facilitate control of heating process and to protect the heater plate surfaces from dirt and other debris when not in use. The heater plate surfaces shall be cleaned regularly as needed to prevent accumulation of fusion welding residues or other substances that may result in faulty pipe joining.
4. Butt fusion shall conform to ASTM D2657 and pipe manufacturer's criteria for the type of joining. The butt-fused joint shall be true alignment and shall have uniform roll-back beads resulting from the use of proper temperature and pressure. The joint shall be allowed adequate cooling time before removal of pressure. 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 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 procedure stated above. In addition, any section of the pipe having other defects such as concentrated ridges, discoloration, excessive spot roughness, pitting, variable wall thickness or any other defect of manufacturing or handling as determined by the Engineer shall be discarded and not used.

5. The inside and outside of pipe ends shall be cleaned with a cotton or non-synthetic cloth to remove dirt, water, grease and other foreign materials. The pipe ends shall be cut square and carefully aligned just prior to heating.
6. After achieving the proper melt pattern, the pipe ends shall be brought together in a firm rapid motion applying sufficient pressure to form a pipe bead (1/8 inch to 3/16 inch in height) around and inside the entire circumference of the pipe.
7. Any make-up pieces needed to connect from the HDPE installed by pipe bursting to a manhole or to another segment of sewer shall also be HDPE SDR 17 of the same diameter. Make-up pieces shall be connected to the previously installed HDPE pipe by use of a heat fusion coupling. Electrofusion couplings may be used for field closures as necessary. No mechanical couplings will be allowed unless specifically called out in the Construction Drawings.

## I. INSERTION AND RECEIVING PITS

1. General. In accordance with requirements outlined above, after award of the contract and prior to beginning work, the Contractor shall submit an installation plan to the Engineer indicating the location and size of all pits required for the work. Pit location and size shall be verified in the field prior to construction of the project and are subject to Engineer approval.
2. Location and Number. Insertion pits shall generally be excavated at or near the upstream end of each line segment to be replaced unless otherwise required. Pits shall be centered over the existing sewer line. The Contractor shall minimize the number of pits; however, sufficient number of pits shall be utilized to properly construct the project. Receiving pits, if needed, shall be at or near the downstream end of each segment to be replaced.
3. Dimensions. Dimensions of the pits shall be of sufficient size and length to accommodate the depth of the sewer system shown on the Construction Drawings and to meet the requirements of manufacturer's allowable bending radius and installation requirements for new pipe to be installed. Minimum insertion pit length shall be equal to 2.5 times the depth plus eight feet.
4. Safety. All pits shall be prepared and backfilled in accordance with sound bedding practices and in accordance with ASTM D2774 and D2321. All pits shall be adequately braced to ensure safe work areas. Payment for shoring shall be as specified in the Special Provisions. The pits shall be covered with steel plates when not in use to prevent unauthorized entry. At the end of each workday, the Contractor shall ensure all steel plates are securely fastened with cold mix to any paved surface surrounding the pit or by other means acceptable to the Engineer if the surrounding surface is unpaved. Any holes in the steel plates shall be sealed.
5. Maintenance and Protection of Existing Utilities. The Contractor shall maintain, restore, and protect all existing utilities, pipes or structures located within or adjacent to the pits.

## J. REPLACEMENT OF AND CONNECTION TO MANHOLES

1. Replacement of Manholes. All existing sanitary sewer manholes shown on the Construction Drawings to be replaced shall be removed and disposed of by the Contractor and replaced with manholes per the Standards.
2. Connection to Manholes. The Contractor is required to reconnect all new and existing pipes to the replaced manholes as well as to any existing manhole that is not called out for replacement.
  - a. HDPE Pipe to Sanitary Manhole Connections. The Contractor shall connect the new polyethylene pipe to new sanitary sewer manholes by installation of a flexible pipe-to-manhole connector that shall provide a watertight joint between both the pipe and connector and the connector and the manhole. A non-shrink grout shall be used to fill the annular space. The connector shall be "Kor-N-Seal" with "Wedge Korband" (Type I or II as required for pipe diameter) as manufactured by NPC, Inc., or approved equal. The connections shall be installed per the manufacturer's recommendations. Connection to existing manholes shall be accomplished per the *Standard Construction Specifications*.

The Contractor shall allow the polyethylene pipe to return to its original length and shape in the unstressed state before making the connection to the service laterals and before trimming excess liner in the manhole or making the connection to the manhole.

## **K. PIPE INSTALLATION**

1. The pipe bursting tool shall be designed and manufactured to force its way through the existing pipe materials by fragmenting the pipe and compressing the old pipe sections into the surrounding soil as it progresses. The bursting unit shall generate sufficient force to burst and compact the existing pipeline.
2. The new sewer main shall be installed on the same line and grade of the existing sewer main.
3. The bursting tool shall be of the dimensions such that the design maximum diameter of the tunnel shall not exceed the maximum outside diameter of the new pipe plus one (1) inch. The Contractor shall take extreme care to protect facilities, such as adjacent utilities and aboveground terrain or improvements from damage by forces generated by the pipe bursting equipment. Should the Contractor's equipment/operation cause such damage, the Contractor shall stop work and modify his equipment and/or methods to the satisfaction of the Engineer to prevent further damage.
4. The Contractor shall thread the pulling cable, chain, or rods and associated lines through the existing sewer section to be replaced and attach to the nose of the bursting device. Tension shall be increased to allow the expander to begin the breaking process and pull the HDPE pipe into the existing pipe.
5. The pulling machine shall provide a constant tension to the burster so that it may operate in an efficient manner. The machine shall ensure directional stability in keeping the unit online.
6. The Contractor shall allow the polyethylene pipe to return to its original length and shape in the unstressed state before making the connection to the laterals and trimming any excess liner in the manhole before making the connection to the manhole. The liner pipe manufacturer's recommendations shall be followed regarding the relief and normalization of stresses and strain due to temporary stretching or elongation after pulling operations are completed. Time allowed for stress and strain relief shall not be less than 24 hours.

## **L. ACTIVE LATERALS**

The Engineer has noted the locations of existing tees/wyes/taps on the Construction Drawings. However, it shall be the Contractor's responsibility to determine whether each of the connections is active. The Contractor shall TV inspect each tee/wye/tap in advance to determine whether it is active using a camera launched from the main up each service lateral a minimum of 10 feet or until a plug is found, whichever is sooner. The Contractor shall videotape this inspection and provide a copy of the videotape and hard copy inspection log to the Engineer prior to any service lateral excavation in a given segment.

The Contractor shall then excavate, expose, and completely disconnect all the active laterals in a given run before pipe bursting operations commence. The existing lateral connections may be encased in mortar, concrete, or reinforced concrete. There will be no additional compensation for the demolition of this concrete. The Contractor shall excavate at each active lateral connection to a depth equal to one (1) times the outside diameter of the main under the invert of the existing main to allow free movement of the bursting head.

If any lateral cannot be disconnected for the time necessary to install the HDPE pipe and reconnect the lateral, the Contractor shall bypass pump the lateral to a sanitary sewer main. The method of bypass pumping shall be submitted by the Contractor to the Engineer for review and the method of bypass pumping shall not be allowed until the method is satisfactory to the Engineer. In the event sewage backs up and enters a building, the Contractor shall be responsible for cleanup, repair, and property damage costs and claims.

Upon installation of the HDPE pipe and successful completion of required testing, the Contractor shall reconnect the active laterals. The Contractor shall install temporary flexible pipe (such as corrugated) between the saddle and the lateral during the relaxation period of the HDPE pipe. After the HDPE pipe has been allowed to relax, the Contractor shall make the permanent connections to the laterals. The Contractor shall first allow the new HDPE pipe to return to its original length and shape in the unstressed state. The pipe manufacturer's recommendations shall be followed regarding the relief and normalization of stress and strain due to temporary stretching or elongation after pulling operations are completed. Time allowed for stress and strain relief shall not be less than 24 hours. The laterals shall be reconnected to the new sanitary sewer pipe by open excavation using polyethylene heat fusion saddles as manufactured by Phillips Driscopipe, Inc. or approved equal. The connections shall be watertight and installed in accordance with the manufacturer's written instructions.

The Contractor shall be responsible for promptly restoring, correcting, and paying any costs resulting from failure to reconnect properly any service lateral connection shown on the Construction Drawings.

## **M. CROSSING/ADJACENT UTILITIES**

The Engineer has contacted private and public utilities and has shown on the Construction Drawings those utilities within the project limits indicated as existing by the various utilities. It shall be the Contractor's sole responsibility to determine from the utility information provided on the Construction Drawings if the sewer pipe can be pipe burst without damaging the adjacent and crossing utilities. If the Contractor determines that he cannot successfully pipe burst in the area of the crossing or adjacent utility, the Contractor shall replace such portions by open cut excavation. All work necessary for the open cut replacement of the sewer, including street restoration, shall be paid for at the unit bid price for pipe bursting at the specified diameter and no additional payment will be made.

If the Contractor elects to burst the sewer in the area of a crossing/adjacent utility, the Contractor shall be responsible for all costs associated with repair of the utility and any resulting damage claims should it be damaged through the bursting operation. If the crossing utility is a water main or gas line, the Contractor shall contact the Engineer and the affected utility at least 48 hours prior to starting the bursting operations. In addition, the Contractor shall excavate and expose any water or gas main crossing prior to the start of the bursting operation. The excavation shall remain open until the bursting head has successfully passed the utility crossing.

## **N. TEMPORARY SEWAGE BYPASS**

The work specified in this section includes all costs for labor, materials, accessories, equipment, and tools for performing all operations required to bypass pump sewage around a manhole or sewer section in which work is to be performed. This work shall be consistent with the temporary sewage bypass pumping guidelines as stated in the Special Provisions.

## **O. TESTING**

The Contractor shall be responsible to perform testing as required in the City of Albany *Standard Construction Specifications*.