

Section 2340

Pipe Bursting

PART 1: General

1.1 *General Description of Work –*

1.1.1 This specification shall cover the rehabilitation of existing sanitary sewer via The Pipe Bursting Method. Pipe bursting is a system by which a bursting unit splits the existing pipe while simultaneously installing a new Polyethylene Pipe of the same size or larger where the old pipe existed. Only equipment with either front or rear expanders for the proper connection to the Polyethylene Pipe will be allowed for use. The bursting tool must be used in conjunction with a constant tension/variable speed winch. The winch shall have twin cable pulling capstans with twin hydraulic drive motors and twin gear boxes for independent operation 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.

1.1.2 This specification shall also cover the repair of manhole openings upsized by pipe bursting to provide a permanent, watertight connection between the pipe and manhole structure. The Contractor shall reform and reconstruct manhole benching and channels for upsized piping.

1.2 *References –* The following documents form a part of this specification to the extent stated herein and shall be the latest editions thereof. Where differences exist between codes and standards, the one affording the greatest protection shall apply, as determined by the ECUA.

ASTM D1248	Polyethylene Plastics Molding and Extrusion Materials
ASTM 02657	Heat Joining of Thermoplastic Pipe and Fittings
ASTM D3035	Polyethylene Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter
ASTM D3261	Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
ASTM 03350	Polyethylene Plastic Pipe and Fitting Materials
ASTM F714	Standard Specification for Polyethylene Plastic Pipe Based on Outside Diameter

1.3 *Submittals –*

1.3.1 The Contractor shall submit catalog cuts, specifications, dimensioned drawings, installation details and sketches, and other pertinent information associated with the work. All materials provided shall fully comply with the requirements of the referenced specifications listed above.

1.3.2 The Contractor shall verify all connection details with the pipe Manufacturer.

1.3.3 The Contractor shall submit detail drawings and a written description fully describing construction procedures and sequences. This information will include locations for bypass insertion and receiving pits, a plan to bypass sewage flow from the host sewer and service

laterals, method for disconnection and reconnection of the sewer service lateral connections, and details for installing new service laterals.

1.3.4 Certification of workmen training as required herein.

1.4 *Quality Assurance –*

1.4.1 The Contractor shall be certified by the particular pipe bursting system Manufacturer that he/she is a fully trained user of the pipe bursting system.

1.4.2 The Pipe Bursting Contractor must have successfully completed five (5) pipe bursting projects of similar size and scope within the United States in the last four (4) years using the pipe bursting equipment and material for the type that meet the requirements stated within these specifications.

1.4.3 The Project Superintendent and pipe bursting machine operator are require to have at least two (2) years of pipe bursting experience using the similar type of equipment required for this project.

1.4.4 Polyethylene pipe jointing shall be performed by personnel trained in the use of butt-fusion equipment and recommended methods for new pipe connections. Personnel directly involved with installing the polyethylene pipe. Training shall be performed by qualified representatives.

1.4.5 The Contractor shall hold the Owner and Engineer whole harmless in any legal action resulting from patent infringements.

1.5 *Pre-Installation Procedures –*

1.5.1 *Cleaning* – Prior to pipe bursting operations, the Contractor shall thoroughly clean the existing sewer pipe. The cleaning shall constitute removal of all debris, solids, roots and other deposits in the existing sewer system.

1.5.2 *Pre-Inspection and Measuring of Service Connections* – The Contractor shall inspect the existing sewer pipe immediately before the pipe bursting operation to assure that the existing pipe conditions are acceptable for the installation. The Contractor shall also create a log as well as video documentation with exact measurements of each service connection in the sewer pipe, in order to re-connect the service connections after the installation. The service connection log shall at least state the exact distance from the manhole wall to the middle of each service connection, the manhole number from where the measurement has been taken and the location of the service connection {i.e. 9 o'clock, 11 o'clock etc.)

PART 2: Products

2.1 *General –*

2.1.1 *Material* – The Contractor shall provide polyethylene pipe as specified. The pipe shall be fabricated to the diameter and tolerance in accordance with ASTM 03035. The minimum ratio of orthogonal diameter prior to installation shall be 0.95. All pipes shall be made from virgin grade materials. The pipe shall be of the diameter and class shown or specified and

shall be furnished complete with all fabricated fitting and other appurtenances required to complete the entire project as designed.

2.1.2 *Markings* – Pipe materials shall be legibly marked by the pipe Manufacturer with the following information:

- 2.1.2.1 Name and trademark of the Manufacturer
- 2.1.2.2 Nominal pipe size
- 2.1.2.3 Dimension ratio
- 2.1.2.4 The letters PE followed by the polyethylene brand per ASTM 01248, followed by the Hydrostatic Design Basis in hundreds of PSI.
- 2.1.2.5 Manufacturing Standard Reference
- 2.1.2.6 A production code from which the date and place of manufacture can be determined

2.2 *HDPE Pipe* –

2.2.1 *Pipe Properties and Features* – Shall be high molecular weight, high-density polyethylene pipe. The materials shall be listed by the Plastic Pipe Institute (PPI) with a designation for PE 3408 and have a minimum cell classification of 345434C, D, or E as described in ASTM 03350. The pipe material shall meet the requirements for Type III, Class B or C, Category 5, Grade P34 material as described in ASTM D1248. 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 pipe. Pipe (excluding black colored pipe) stored outside shall not be recycled. Pipe and fittings shall be made in conformance with ASTM F714 and ASTM D 3261 as modified for the specified material. The pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions or other injurious defects. It shall be uniform in density and other physical properties. Any pipe not meeting these criteria shall be rejected.

2.2.2 *Markings* – HDPE pipe color shall be gray with green striping. Striping shall be three, one half inch wide stripes equally spread around the pipe circumference for the entire length.

2.2.3 *Size* – HDPE pipe shall be DIPS DR 17.

2.2.4 *Service Laterals* – All existing service laterals shall be reconnected to the new HDPE sewer line and replaced to the easement line and tested.

Connection of the new service lateral to the mainline shall be accomplished by means of a compression-fit service connection. The service connection shall be specifically designed for connection to the sewer main being installed, and shall be INSERTA TEE® as manufactured by INSERTA FITTINGS Co., Hillsboro, Oregon, Telephone (503) 357-2110 Fax (503) 359-5417; or approved equal. Install using procedures and equipment as referenced in Manufacturer's written installation instructions.

The Contractor may optionally provide service connection via a fusible HDPE tee/wye connection.

PART 3: EXECUTION

- 3.1 *General* – The Contractor shall protect existing and new facilities including utilities, road pavement, and private property from damage by forces generated by the pipe bursting and supporting equipment. Any damage to the existing facilities that result from the pipe bursting operation shall be the responsibility of the Contractor.

If it is found that the damage is a result of the pipe bursting operation, the cost to repair or replace the damaged facility shall be the responsibility of the Contractor.

3.2 *Preparation* -

- 3.2.1 All sewer service connections shall be located by the pre-construction video and marked prior to commencing any pipe bursting operation and pipe insertion. Upon commencement, pipe insertion shall be continuous and without interruption from one manhole to another, except as approved by the Engineer. Upon completion of the insertion and installation of the new pipe, the Contractor shall expedite the reconnection of lateral service connections to minimize inconvenience to the citizens/customers.
- 3.2.2 Contractor shall determine the location of any obstacles to bursting the existing pipe, such as steel repair collars or steel reinforcement, by electromagnetic induction, magnetic susceptibility, research of repair records, video inspection, and/or other methods.

3.3 *Handling and Storage* –

- 3.3.1 The Contractor shall exercise special care during unloading, handling and storage of all polyethylene pipe to ensure that it is not cut, gouged, scored, or otherwise damaged. Any pipe segment with pipe wall cuts exceeding 10 percent of the wall thickness shall be cut out and removed from the site at the Contractor's expense. The pipe shall be stored in such a manner that it is not deformed axially or circumferentially to the extent that it may hinder pipe installation. After unloading any pipe material ordered to the project site and before installing the pipe, the Contractor shall inspect all pipe to verify its condition.
- 3.3.2 Polyethylene pipe without an ultraviolet inhibitor shall not be stored unprotected against the outside elements.

- 3.4 *Sags in Line* – If the pre-installation video inspection reveals a sag in the existing sewer greater than one half the diameter of the existing pipe, the Contractor will install replacement pipe to provide an acceptable grade without the sag. The Contractor shall take 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 Engineer.

3.5 *Pipe Joining* –

- 3.5.1 The Contractor shall join the polyethylene pipe into continuous lengths on the job site. Pipe joining shall be accomplished through use of the butt fusion method and shall be performed in strict accordance with the pipe Manufacturer's recommendations and specifications. Fusion equipment used in the joining procedure shall meet all conditions recommended by the pipe Manufacturer, including, but not limited to, fusion temperature, alignment, and fusion pressure. Electrofusion means, methods, and materials may be used for field closures where trench environment safely permits such utilization.

- 3.5.2 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.
- 3.5.3 Butt fusion shall conform to ASTM 02657 and pipe Manufacturer's criteria for the type of joining. Joint strength shall be equal to that of the adjacent pipe.
- 3.5.4 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, faced, and carefully aligned immediately prior to heating.
- 3.5.5 Upon 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.
- 3.5.6 Terminal sections of pipe that are joined within the insertion pit shall be connected with Central Plastics Electrofusion Couplings or connectors with tensile strength equivalent to that of the pipe being joined.

3.6 *Pipe Installation –*

- 3.6.1 After the service connections have been located and marked by the Contractor the Contractor will excavate and expose so the Contractor can isolate all sewer service connections prior to replacing the existing sewer. Service Lateral excavation shall be performed in such a manner as to avoid humps in the new sewer due to unevenly distributed resistance on the sides of the exposed existing sewer.
- 3.6.2 Where practical, the Contractor may utilize existing manholes or machine or insertion pits. If the Contractor for his convenience uses a manhole not designated for replacement, the Contractor will replace the manhole at his own expense. Manhole inverts, benches, and channels shall be removed to permit access for installation equipment as appropriate. When installing through an existing manhole, the input and output pipe openings shall be enlarged sufficiently to accommodate the maximum OD size of the pipe bursting device. At no time shall the bursting device and/or the installation process place undue stress on the existing manhole opening surface. Benches and channels shall be reconstructed after the new pipe is in place.
- 3.6.3 *Bursting Head* – The pipe bursting tool shall be designed and manufactured to force its way through existing pipe materials by cutting and fragmenting the pipe and compressing the old pipe sections into the surrounding soil as it proceeds. The bursting unit shall generate sufficient force to cut, burst, and expand the existing pipe line.

The pipe bursting tool shall be pulled through the sewer by a winch located at the upstream manhole. The bursting unit shall pull the polyethylene pipe (PE) 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. The pipe bursting unit shall be remotely controlled.

The bursting action of the tool shall increase the external dimensions sufficiently, causing breakage of the pipe at the same time expanding the surrounding ground. This action shall not only cut and break the pipe but also create the void into which the burster can be

winched and enables forward progress to be made. At the same time the polyethylene pipe, directly attached to the sleeve on the rear of the burster, shall also move forward.

The burster shall have its own forward momentum while being assisted by power winching. The power winch shall give the burster constant tension by which it can move forward. To form a complete operating system, the burster must be matched to a constant tension power winching system.

- 3.6.4 *Winch Unit* – A winch shall be attached to the front of the bursting unit, connecting to or through the guide head. The winch shall provide a constant tension to the bursting in order that it may operate in an efficient manner. The winch shall have twin capstan with twin hydraulic drive motors and twin gear boxes for independent operation. In no case shall the winch cable storage spool be considered part of the twin capstan pulling system.

The winch shall be hydraulically operated providing a constant tension throughout the operation. The winch shall be of the constant tension type but shall be fitted with a direct reading load gauge to measure the winching load.

The winch must automatically maintain a constant tension at a set tonnage reading.

The constant tension winch shall supply sufficient cable in one continuous length so that the pull may be continuous between approved winching points.

The winch, cable and cable drum must be provided with safety cage and supports so that it may be operated safely without injury to persons or property.

The Contractor shall provide a system of guide pulleys and bracing at the exit pit to minimize cable contact with the existing line between launch and exit pits.

The supports to the trench shoring in the insertion pit shall remain completely separate from the winch boom support system and shall be so designed such that neither the pipe nor the winch cable shall be in contact with them.

The Contractor shall secure the pipe to concrete structures or manholes after the pipe has been installed through the length of sewer being replaced. The Contractor shall install an Engineer approved water stop or flange adapter that is fused and seated perpendicular to the pipe axis, around the pipe exterior, and grouted into the structure wall to create a watertight seal at the manhole wall. The new pipe shall be installed to initially extend 12 inches inside the manhole opening. The structure or manhole connections shall be made a minimum of 12 hours after pipe insertion.

- 3.7 *Low Pressure Air Testing* – Provide low pressure air testing of the newly installed HDPE per the requirements of Section 2570-“Gravity Sewer Collection Systems”.

- 3.8 *Construction Method* –

3.8.1 Equipment used to perform the work shall be located away from buildings so as not to create noise impact. Provide a silent engine compartment with the winch to reduce machine noise, as required to meet local codes and regulations.

3.8.2 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 pipe and

lubricant Manufacturers. Lubrication fluids shall be contained in stabilized mud pits or tanks. Lubrication fluids shall be removed and disposed of by the Contractor at no additional cost to the Owner. Under no circumstances will the pipe be stressed beyond 72 percent of polyethylene pipe Manufacturer's specified minimum yield strength. Winch line is to be centered in pipe to be burst with adjustable boom.

- 3.8.3 The installed pipe shall be allowed to cure for 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 reconnection 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 Central Plastics Electrofusion couplings or equivalent. 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 Manufacturers recommended procedures.

- 3.8.4 Following the relaxation period, the annular space shall be sealed. Sealing shall be made with non-shrink, watertight materials approved by the Engineer and shall extend a minimum of eight (8) inches into the manhole wall in such a manner as to form a smooth, uniform, watertight joint. The terminating, pipe ends in manholes shall be connected by Central Plastics Electrofusion couplings, or equivalent, to eliminate ground water infiltration. Installations of electrofusion couplings shall be done in accordance with the Manufacturers recommended procedures.

3.9 *Final Cleaning and Television Inspection –*

- 3.9.1 Prior to final inspection and acceptance of the new pipe, the Contractor shall flush and clean the system by removing all accumulated construction debris, rocks, gravel, sand, silt, and other foreign material from the pipe.
- 3.9.2 After completion of the pipe installation service reconnecting, finish work at the manholes, and final cleaning, the sewer shall be televised.