Item 301
Pipe Bursting

301.1 Description

This item shall govern the labor, materials, equipment and incidentals necessary to rehabilitate existing sanitary sewers by the pipe bursting method which splits the existing pipe and immediately installs a new polyethylene or PVC pipe. Rehabilitation includes flow diversion, reconnecting existing sewer service connections, television inspection, and complete installation in accordance with the Contract Documents.

301.2 Quality Assurance

The requirements set forth in this document specify a wide range of procedural precautions necessary to provide the very basic, essential aspects of a proper pipe bursting installation and are adequately controlled. Strict adherence shall be required under specifically covered conditions outlined in this Section. Adherence to the specifications contained herein, or the Owner's Representative approval of any aspect of the pipe bursting operation covered by this Section, shall in no way relieve the Contractor of their ultimate responsibility for the satisfactory completion of the Work authorized under the Contract.

Certification: The Contractor or Subcontractor shall be certified by the particular pipe bursting system manufacturer that such firm is a licensed installer of their system. If patented processes are involved based on the pipe selection, the installer shall be licensed, trained, and in good standing with the pipe manufacturer.

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 pipe. Training shall be performed by qualified representative.

The Contractor and Manufacturer shall have at least five (5) years of experience with pipe bursting.

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

Protection of Existing Improvements:

Note to Specifier: In the subparagraph below, identify critical crossings of other utilities (gas, water, etc.) or nearby facilities that the Contractor should pay special attention to and may impact whether the pipe bursting installation method should be static instead of pneumatic.

A. Provide protection to prevent damage to existing improvements and structures to remain in place on the Owner's property and adjoining properties.

   1. Special attention should be paid to the following areas during pipe bursting operations:

      a. [Specify/list as necessary for each project.]

B. Restore damaged improvements to their original condition, as acceptable to parties having jurisdiction.

C. Land areas outside the limits of permanent Work performed under this Contract shall be preserved in their present condition. Confine construction activities to areas defined for Work or specifically assigned by the Owner's Representative for his use.

D. Protection of Existing Utilities:

1. Verify horizontal and vertical location of all existing utility locations.

2. Immediately notify the Owner's Representative and applicable utility company of any damages to existing utilities.

3. Make repairs to damaged utilities in accordance with the requirements of the Owner's Representative and applicable utility company at no additional cost to the Owner.

4. Coordinate with property owners. Service disruptions are to be minimized.

5. Coordinate with the Owner and the applicable utility company for shut-off of, or connection to, active utilities. Do not interrupt existing utility services except as authorized in writing by the Owner's Representative.

E. Protection of Work Site: Provide barricades or other types of protectors necessary to warn and prevent access by unauthorized personnel.

301.3 Standards

Comply with local governing regulations if more stringent than specified herein. Piping shall meet the following standards (latest edition) and shall be a part of this Section as if written here in their entirety:

A. American Society for Testing and Materials (ASTM) Standards:

ASTM D1693	Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics
ASTM D2122	Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings
ASTM D2241	Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure Rated Pipe (SDR Series)
ASTM D3034	Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D2657	Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings
ASTM D2837	Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials
ASTM D3035	Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
ASTM D3350	Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
ASTM F585	Standard Guide for Insertion of Flexible Polyethylene Pipe into Existing Sewers

ASTM F714	Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter

B. American Water Works Association (AWWA) Standards:

AWWA C900	Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In.
AWWA C906	Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 65 In.

301.4 Submittals

Submittals shall include:

A. Work Plan: Prior to beginning Work, the Contractor shall submit to the Owner's Representative a work plan as Record Data detailing the procedure (static or pneumatic) and schedule to be used to execute the Project. The work plan should include a description of all equipment to be used, down-hole tools, a list of personnel and their qualifications and experience (including back-up personnel in the event that an individual is unavailable), list of Subcontractors, a schedule of work activity, a safety plan (including MSDS of any potentially hazardous substances to be used), traffic control plan (if applicable), all excavation locations, interfering utilities, and flow bypass plan, an erosion and sedimentation control plan and contingency plans for possible problems. Work plan should be comprehensive, realistic and based on actual working conditions for the Project.

B. Equipment: Contractor will submit specifications on equipment as Record Data. Equipment shall include, but not be limited to: pipe bursting apparatus and equipment, butt fusion welding apparatus, mud system, mud motors (if applicable), down-hole tools, guidance system, rig safety systems. Calibration records for guidance equipment shall be included. Specifications for any drilling fluid additives that Contractor intends to use or might use will be submitted.

C. Material: Provide Shop Drawings of the pipe with material specifications, including size, type, diameter and manufacturer's data and certifications on piping and jointing methods. The shop drawing shall include a Certificate of Adequacy of Design stating the pipe and fittings are satisfactory for the loads which will be imposed during all loading conditions (pipe bursting operations).

D. Contractor shall maintain a daily project log of operations along with a fusion report for all butt fused welding of joints with a copy given to Owner's Representative at completion of the Project.

301.5 Job Conditions, Permits and Easement Requirements

Where the Work is in the public right-of-way or railroad company right-of-way, the Owner will secure the appropriate permits or easements. The Contractor shall observe regulations and instructions of the right-of-way owner as to the methods of performing the work and take precautions for the safety of the property and the public. Negotiations and coordination with the right-of-way owner shall be carried out by the Contractor, not less than 5 days prior to the time of his intentions to begin Work within the right-of-way.

Comply with the requirements of the permit and/or easement. Work within the Texas Department of Transportation (TxDOT) right of way shall comply with TxDOT requirements. If required by the right-of-way owner, obtain Protective Liability Insurance in the amount required by the particular company or other insurance as is specified in the permit at no cost to the Owner. Acquire a permit, agreement, or work order from the right-of-way Owner as may be required.

Construction along roads, railroads and public areas shall be performed in such manner that does not interfere with the operations of the roads, driveways, sidewalks, pedestrian traffic and railroads.

Barricades, warning signs, and flagmen, when necessary and specified, shall be provided by the Contractor.

No blasting shall be allowed.

Existing pipelines and underground conduits are to be protected. The Contractor shall verify location and elevation of any pipelines, telephone cable and fiber optics before proceeding with the construction and shall plan his construction so as to avoid damage to the existing pipelines or telephone cables. Verification of location (vertical and horizontal) of existing utilities shall be the complete responsibility of the Contractor.

301.6 Materials

A. Polyethylene:

1. Gravity Flow Polyethylene Plastic Pipe shall be high density polyethylene with a minimum dimension ratio of **[21 (0- to 10-foot depth)] [17 (depths greater than 10 feet)] [These are minimum DR requirements. Depending on soil, existing pipe material/size, a more stringent DR may be required]** and meet the applicable requirements specified in Section 1.04 (Standards). 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. The pipe shall be homogenous throughout and shall be free of visible cracks, holes, foreign material, blisters or other deleterious faults.

2. For pressure applications to meet TCEQ separation requirements piping shall be AWWA C906 with ductile iron sizing system (DIPS), PE3408 Materials, DR11 Pressure Class 160.

B. PVC:

1. PVC gravity sewer line piping shall be Certainteed Yelomine ASTM D2241 SDR21 PVC with Certalok Couplings or Certainteed AWWA C900 DR18 with Certalok Couplings, or Fusible PVC ASTM D3034 SDR 26 by Underground Solutions.

Note to Specifier: The paragraph below complies with TCEQ requirements for pressure rated pipe in proximity to water lines. Adjust DR or SDR based on application and pressure requirements and edit it for your application.

Note to Specifier: Certainteed PVC pipe is available 2 through 16 inches, fusible PVC is available 4 through 27 inches in ASTM D3034 and 4 through 24 inches in ASTM D2241

SDR 26 pressure rated.

2. For pressure applications to meet TCEQ separation requirements PVC sewer line piping shall be Certainteed Yelomine ASTM D2241 SDR21 (CLASS 200) PVC with Certalok Couplings or Certainteed AWWA C900 DR18 (CLASS 235) with Certalok Couplings, or Fusible PVC ASTM D2241 SDR 26 (Class 160) or Fusible AWWA C900 DR25 (165 Pressure Rating), by Underground Solutions.

3. Pipe Markings: Pipe shall be legibly marked in permanent ink with the manufacturer and trade name, nominal size and DR rating/pressure class, hydrostatic proof test pressure, NSF 61 if applicable, manufacturer date code. Pipe and couplings shall also bear the mark of the certifying agency which have tested and approved the product for use in fire protection applications.

4. Trace Wire: Trace wire shall be installed along all piping with 10 gauge or thicker wire in accordance with Item No. 512 “Conductive Trace Wire.”

5. PVC Couplings: Certainteed PVC Pipe shall be jointed using non-metallic couplings which have been designed as an integral system. High strength thermoplastic splines shall be inserted into mating precision machined grooves in the pipe and coupling to provide full 360-degree restraint with evenly distributed loading. No external pipe to pipe restraining devices which clamp onto or otherwise damage the pipe surface will be allowed. Pipe couplings shall have a leading beveled edge to reduce resistance during pulling operations. Couplings shall be designed at the rated pressure of the pipe which they are used and shall incorporate twin elastomeric sealing gaskets meeting the requirements of ASTM F477. Joints shall be designed to meet the leakage requirements of ASTM D3139.

C. Service Connections:

1. Mechanical saddles made of polyethylene or PVC materials shall match the type and rating of the piping used.

2. Mechanical saddles shall have stainless steel straps and fasteners, neoprene gasket and backup plate.

301.7 Manufactured Products

The existing pipeline shall be cleaned and televised to locate service taps, sags and deflected joints in accordance with Item No. 315 “CCTV Inspection.”

Point repair sags and deflected joints identified by the television inspection.

Notification: The Engineer and Owner’s Representative must be notified 48 hours in advance of starting Work. The pipe bursting installation shall not begin until the Owner’s Representative is present at the Site and agrees that proper preparations for the operation have been made and affected property owners notified.

Note to Specifier: If there are other portions of the Project that require by-pass pumping (tie-ins/connections, vertical conflicts, replace-in-place, etc.), be sure to clarify in Measurement and Payment, that by-pass pumping for pipe bursting is subsidiary to pipe bursting pay item.

By-Pass Pumping: The Contractor shall provide for diversion of flows as necessary for the bursting/insertion 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 installation costs. The Contractor shall be responsible for continuity of sanitary sewer service to each facility connected to the section of sewer during execution of the Work. If sewage backup occurs and enters buildings, the Contractor shall be responsible for cleanup, repair, property damage costs and claims.

Transport and place excavated material in fill areas within the limits of the Work. Excavate unsuitable material encountered within the limits of the Work below the grade indicated and replace with suitable material as directed by the Owner's Representative.

301.8 Installation

Launch pits shall only be allowed at locations of existing or proposed manholes, unless otherwise approved by Owner's Representative or as indicated in the Contract Documents.

Equipment used to perform the Work shall be located away from buildings so as to minimize noise impact. Contractor shall provide silencers or other noise abatement devices to reduce machine noise as necessary.

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.

The selection considerations and installation procedures for all piping materials shall be in accordance with ASTM F85.

Fusing:

A. HDPE fusing shall be accomplished by personnel certified as fusion technicians by the manufacturer of HDPE pipe and/or fusing equipment.

B. 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.

C. All joints shall be subject to acceptance by the Owner's Representative prior to insertion.

D. All defective joints shall be cut out and replaced at no cost to the Owner. Any section of the pipe with a gash, blister, abrasion, nick, scar, or other deleterious fault greater in depth than 10 percent of the wall thickness, shall not be used and shall be removed from the Site. A defective area of the pipe may be cut out and the joint fused in accordance with the above procedures. Any section of 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 Owner's Representative shall be discarded and not used.

E. Pull Loads:

Note to Specifier: Edit the following table. Delete items that do not meet piping callouts in Paragraphs [2.01A] or [2.01B] and the pipe sizes that are not applicable.

HDPE Maximum Pull Loads (lb.) - ASTM F1804				
Minimum Radii = 40 Times Pipe Diameter				
Nominal	**OD**	**SDR11**	**SDR17**	**SDR21**
4	4.8	6529	4374	3583
6	6.9	13,492	9038	7404
8	9.05	23,209	15,548	12,736
10	11.1	34,915	23,389	19,160
12	13.2	49,376	33,077	27,095
16	17.4	85,796	57,474	47,081
18	19.5	107,755	72,184	59,131
20	21.6	132,213	88,569	72,552
24	25.8	188,628	126,361	103,510
30	32	290,180	194,390	159,237

Note to Specifier: Edit the following table. Delete items that do not meet piping callouts in Paragraphs [301.6.A] or [301.6.B] and the inapplicable pipe sizes.

PVC Maximum Pull Loads – CertainTeed				
Size (in.)	**AWWA C900, 905 Pressure Class 165 DR**	**Minimum Radius (ft.)**	**Maximum Pull In Force Tightest Radius (lb.)**	**Maximum Pull In Force Straight Pull (lb.)**
4	18	100	6700	8200
6	18	150	9000	12,800
8	18	200	18,000	25,200
10	18	250	25,600	35,200
12	18	300	26,440	41,100
16	18	450	44,000	68,500

Size (in.)	**Yelomine (ASTM D2241) Pressure Rated- SDR**	**Minimum Radius (ft.)**	**Maximum Pull In Force Tightest Radius (lb.)**	**Maximum Pull In Force Straight Pull (lb.)**
4	21 (200 PSI)	100	6800	8700
6	21 (200 PSI)	150	7100	10,900
8	21 (200 PSI)	200	10,700	17,200
10	21 (200 PSI)	250	20,400	27,200
12	21 (200 PSI)	300	21,000	31,500

PVC Maximum Pull Loads – CertainTeed				
Size (in.)	**AWWA C900, 905 Pressure Class 165 DR**	**Minimum Radius (ft.)**	**Maximum Pull In Force Tightest Radius (lb.)**	**Maximum Pull In Force Straight Pull (lb.)**
16	21 (200 PSI)	400	45,000	62,000

Note to Specifier: Edit the following table. Delete items that do not meet piping callouts in Paragraphs [2.01A] or [2.01B] and inapplicable pipe sizes.

PVC Fusible PVC - Underground Solutions Maximum Pull Loads			
Size (in.)	**AWWA C900 Pressure Class 165 DR**	**Minimum Radius (ft.)**	**Maximum Pull In Force (lb.)**
4	25	100	7700
6	25	144	16,000
8	25	189	27,600
10	25	231	41,600
12	25	275	58,800
14	25	100	8700
16	25	150	10,900
18	25	200	17,200
20	25	250	27,200
24	25	300	31,500
30	25	400	62,000

Size (in.)	**ASTM D2241 Pressure Rated PVC SDR**	**Minimum Radius (ft.)**	**Maximum Pull In Force (lb.)**
3	SCH. 80 (370 PSI)	73	8400
4	SDR 26 (160 PSI)	94	6400
6	SDR 26 (160 PSI)	138	14,500
8	SDR 26 (160 PSI)	180	24,000
10	SDR 26 (160 PSI)	224	37,200
12	SDR 26 (160 PSI)	266	52,800
14	SDR 26 (160 PSI)	292	63,900
16	SDR 26 (160 PSI)	333	83,800
18	SDR 26 (160 PSI)	375	105,000

PVC Fusible PVC - Underground Solutions Maximum Pull Loads			
Size (in.)	**AWWA C900 Pressure Class 165 DR**	**Minimum Radius (ft.)**	**Maximum Pull In Force (lb.)**
20	SDR 26 (160 PSI)	417	130,200
24	SDR 26 (160 PSI)	500	186,700

Size (in.)	ASTM D3034 Gravity PVC	Minimum Radius (ft.)	Maximum Pull In Force (lb.)
4	SDR 26	88	5700
6	SDR 26	131	12,700
8	SDR 26	175	22,900
10	SDR 26	219	35,800
12	SDR 26	260	50,800
15	SDR 26	319	76,000
18	SDR 26	390	113,700
21	SDR 26	459	167,200
24	SDR 26	517	200,100
27	SDR 26	583	254,100

F. Pipe insertions shall be continuous and without interruption from one manhole to another. The pipe shall be assembled and joined on the Site using the thermal butt-fusion method or using Certainteed pipe with Certalok fittings to provide a leak proof joint. Threaded or solvent-cement joints shall not be permitted. All equipment and procedures used shall be in strict compliance with manufacturer's recommendations.

G. The installed pipe shall be allowed the manufacturer's recommended amount of time but not less than 4 hours, for cooling and relaxation due to tensile stressing prior to any reconnection of sewer lines, sealing of the annulus, or backfilling of the insertion pit. Sufficient excess length of new pipe, but not less than 4 inches shall be allowed to protrude into the manhole.

301.9 Finishing

Following the relaxation period, the annular space shall be sealed. Sealing shall be made with material approved by the Owner's Representative and shall extend into the manhole wall in such a manner as to form a smooth, uniform, and water tight joint.

Terminal section pipe that are joined within the insertion pit shall be connected with a full circle pipe repair clamp. The butt gap between pipe ends shall not exceed 1/2 inch.

For pressure piping: Perform Hydrostatic Leak Test in accordance with Item 515 Pipe Testing, Section 515.5.B.3.

Infiltration/Exfiltration Test:

A. The total exfiltration, as determined by a hydrostatic head test, must not exceed 10 gallons per inch of diameter per mile of pipe per 24 hours at a minimum test head of 2.0 feet above

the crown of a pipe at an upstream manhole, or at least two feet above the existing groundwater level, whichever is greater.

B. An owner shall use and infiltration test in lieu of an exfiltration test when pipes are installed below the groundwater level.

C. If the quantity of infiltration or exfiltration exceeds the maximum quantity specified, an owner shall take remedial action in order to reduce the infiltration or exfiltration to an amount within the limits specified by Equation C.3. in Figure: 30 TAC 217.57(a)(1)(B)(ii) before putting the system into service. An owner shall retest a pipe following a remedial action according to the requirements of this chapter.

Low Pressure Air Test- Gravity Flow Sewer Lines:

A. Use air test in lieu of the hydrostatic test if desired, or if pipeline grades do not allow filling the entire pipeline segment or manhole to the indicated depth.

B. Perform low-pressure air tests, using equipment specifically designed and manufactured for the purpose of testing sewer pipelines using low-pressure air. Test is to conform to procedure described in ASTM F1417 except for testing times. The following test times are required:

Pipe Diameter (in.)	Minimum Time (seconds)	Length for Minimum Time (ft.)	Time for Long Length (seconds)
6	340	398	0.855 (L)
8	454	298	1.520 (L)
10	567	239	2.374 (L)
12	680	199	3.419 (L)
15	850	159	5.342 (L)
18	1020	133	7.693 (L)
21	1190	114	10.471 (L)
24	1360	100	13.676 (L)
27	1530	88	17.309 (L)
30	1700	80	21.369 (L)
33	1870	72	25.856 (L)

1. Provide the equipment with an air regulator valve or air safety valve set to an internal air pressure in the pipeline that cannot exceed 6 psig.
2. Pass air through a single control panel.
3. Provide pneumatic plugs that have a sealing length equal to or greater than the circumference of the pipe to be tested.
4. Provide pneumatic plugs that resist internal test pressures without requiring external bracing or blocking.
5. Provide an air compressor of adequate capacity for charging the system.

C. Perform air test only on lines less than 36 inches in diameter. Air tests for pipes larger than 36 inches may be air tested at each joint.

D. Check connections for leakage with a soap solution. If leaks are found, release the air pressure, repair the leak, and retest with soap solution until results are satisfactory, before resuming air test.

E. Determine the shortest allowable time for the pressure to drop from 3.5 pounds per square inch to 2.5 pounds per square inch.

T = 0.0850 DK/Q

T is the time for the pressure to drop 1.0 pound per square inch gauge in seconds; K is 0.000419DL, but not less than 1.0; D is the average inside diameter in inches; L is the length of line of the same pipe size in feet; Q rate of loss, shall be 0.0015 cubic feet per minute per square foot of internal surface.

Air Test for Individual Joints:

A. Lines 36 inches and larger may be tested at individual joints.

B. The shortest allowable time for the pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch gauge is 10 seconds for all pipe sizes.

Deflection Testing for Pipe:

A. Perform deflection tests on flexible and semi-rigid pipe in accordance with ASTM 3034.

Note to Specifier: Update allowable deflection in the subparagraph below.

1. The maximum allowable deflection of pipe measured as the reduction in vertical inside diameter is 5.0 percent unless specified otherwise.
2. Conduct test after the final backfill has been in place a minimum of 30 days.
3. Thoroughly clear the lines before testing.

B. Perform test by pulling a properly sized mandrel through the line for lines up to and 48” in diameter. For larger pipe, measure the vertical deflection from inside the pipe.

C. Excavate and repair pipe with deflections in excess of the maximum allowable deflection.

301.10 Measurement

All pipe burst will be measured per linear foot as measured on the ground from center of manhole to center of manhole.

301.11 Payment

Payment shall include full compensation, in accordance with the pay item established in the bid, for excavation, furnishing, hauling and placing valves and barrel extensions including anchorage and all incidental and subsidiary materials and work; preparing, shaping, dewatering, shoring of trenches, bedding, placing and compacting backfill materials and for all other incidentals necessary to complete the installation, as indicated in the Drawings, complete in place.

Payment, when included as a contract pay item, will be made under the following:

Pay Item:	Pipe Bursting, _____ Diameter, _____ Material	Per LF.

End