**Section 2.5**

**TECHNICAL SPECIFICATION FOR**

**REHABILITATION OF EXISTING WATER MAIN BY PIPE BURSTING (PB)**

**NOVEMBER 2000**

**Part 1: General**

* 1. **Scope of Work**

 Furnish all materials, labor, equipment, tools, and required incidentals for the replacement of water mains by Pipe Bursting method. The Pipe Bursting process is defined as the trenchless reconstruction of existing water mains by the simultaneous insertion of liner pipe within the bore of the existing pipe, by breaking and expanding the existing pipe. The scope includes reconnection of existing water service connections television inspection of the newly rehabilitated pipe and complete installation in accordance with the contract documents. Only hydraulically and pneumatically operated equipment will be allowed for this method.

* 1. **Liner Pipe Description**

Unless otherwise specified in the plans and/or specifications, one of the following pipes or approved equal can be considered for horizontal directional drilling contingent upon approval by the Owner:

* Fusible Polyvinylchloride (PVC) Water Pipe as manufactured by Underground Solutions, Inc.
* Restrained Joint Polyvinylchloride (PVC) Water Pipe as manufactured by CertainTeed Corporation.

The pipe to be used must be certified for use as a pressure-rated water delivery system and fire protection piping applications conforming to all standards and procedures, and meeting all testing and material properties as described in applicable pipe specifications and/or plans.

* 1. **Related Works**
* Technical Specification for Fusible Polyvinylchloride (PVC) Water Pipe
* Technical Specification for Restrained Joint Polyvinylchloride (PVC) Water Pipe

**Part 2:Quality Assurance**

* 1. **Reference Standards**

 This section below contains references to the following documents. They are a part of this section as specified and modified.

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| ANSI/AWWA C110/A21.10 |  American National Standard for Ductile-Iron and Gray-Iron Fittings, 3-inch through 48-inch, for Water and Other Liquids |
| ANSI/AWWA C111/A21.11 | American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings |
| ANSI/AWWA C153/A21.53 |  AWWA Standard for Ductile-Iron Compact Fittings for Water Service |
| AWWA C605 |  Standard for Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water |
| AWWA C651 |  Standard for Disinfecting Water Mains |
| AWWA C900 |  Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 in. through 12 in. (100mm Through 300mm), for Water Distribution |
| AWWA C905 | Standard for Polyvinyl Chloride (PVC Pressure Pipe and Fabricated Fittings, 14 in. through 48 in. (350mm Through 1200mm), for Water Distribution and Transmission |
| AWWA M23 |   AWWA Manual of Supply Practices PVC Pipe—Design and Installation, Second Edition |
| ASTM D1784 |  Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds |
| ASTM D2152 |  Test Method for Degree of Fusion of Extruded Poly(Vinyl Chloride) (PVC) Pipe and Molded Fittings by Acetone Immersion |
| ASTM D2241 |  Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR‑PR) |

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| ASTM D2665 |  Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings |
| ASTM F477 |  Elastomeric Seals (Gaskets) for Joining Plastic Pipe |
| ASTM F1057 |  Standard Practice for Estimating the Quality of Extruded Poly (Vinyl Chloride) (PVC) Pipe by the Heat Reversion Technique |
| UNI-PUB-08 |  Tapping Guide for PVC Pressure Pipe |
| NSF-14 |  Plastics Piping System Components and Related Materials |
| NSF-61 |  Drinking Water System Components--Health Effects |
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**2.2 Qualification Requirements (Check with Underground Solution)**

* The Contractor shall be certified by the manufacturer of the pipe bursting system that it is a fully trained, licensed installer of their pipe bursting system. Contractor must provide a letter to the Owner documenting this requirement.
* The Contractor shall have at minimum of at least three (3) years verifiable experience using the pipe bursting method while meeting the following criteria:

- A minimum total of 25,000 LF of completed pipe bursting footage.

- A minimum total of 10,000 LF of upsizing where similar sized diameter increases have been successfully completed in pipe diameters of 8-inch to 12-inch range.

* Personnel performing pipe bursting must be certified by manufacturer of pipe bursting system having successfully completed training in:

Operating bursting equipment to be used

Installing proposed replacement pipe.

Operation and maintenance of all equipment to be used

* + - Personnel performing fusing of liner pipe and fittings must be certified by manufacturer of fusing equipment having successfully completed training in:

Handling replacement pipe materials.

Butt fusion of pipe joints, saddle fusion of fittings for water services

Operation and maintenance of all equipment to be used.

**2.3 Warranty**

* + - A one-year warranty for the pipe shall be included from the Contractor, and shall cover the cost of replacement pipe and freight to project site, should the pipe have any defects in material or workmanship.
		- In addition to the standard pipe warranty, the pipe bursting Contractor shall provide in writing a warranty for a period of one year for all the pipe bursting work including material, installation, and pressure testing at no additional cost to the owner.
		- Unless otherwise specified, the warranty period shall begin after the Certificate of Acceptance is issued for the Contract.

**2.4 Submittals**

 The Contractor shall furnish the following documents made in a timely manner so

 that project schedule can be met:

2.4.1 Material Data

* + - Shop drawings, catalog data and manufacturer's technical data showing complete information on material composition, physical properties, and dimensions of new pipe and fittings.
		- Manufacturer's recommendation for handling, storage, and repair of pipe and fittings damaged.

2.4.2 Process Demonstration

* Detailed installation procedure including pipe bursting method to be used.
* Method of construction and restoration of existing water service connections. This shall include detail drawings and the written description of the entire construction procedure to install pipe.

2.4.3 Testing Documentations

Television inspection reports along with video made after new pipe installation.

2.4.4 Reference

Provide a list of at least three projects completed in the last three years by the contractor/installer where a water main was successfully rehabilitated using the pipe bursting method. Include contact names, addresses and phone numbers of agencies involved.

2.4.5 Pre-Construction Submittals

 The following Product Data is required from the pipe supplier and/or fusion provider:

* Pipe Size
* Dimensionality
* Pressure Class per applicable standard
* Color
* Recommended Minimum Bending Radius
* Recommended Maximum Safe Pull Force
* Fusion technician qualification indicating conformance with this specification

The following work plan and information is required from the Contractor and/or pipe bursting Contractor, if requested. This work plan and information shall also be supplied to the pipe supplier, should it be requested:

* Pipe bursting equipment information and certification indicating the applicability of equipment, operator, and methods commensurate with the size and scope of the project, including any proposed lubricants to be used in the operation.
* Contingency plan, including the following:
* Unforeseen obstructions that stop or delay the operation
* Unforeseen deflections that would over bend the fusible polyvinylchloride pipe
* Excessive surface heaving or subsidence
* Damage to existing utility installations
* Required spot repairs of the existing line
* Shop drawings shall include for each pipe bursting operation all excavation locations, interfering utilities, excavation dimensions, temporary water and traffic control schematics.
* Work schedule identifying construction sequencing, daily work hours and working dates for each installation.

2.4.6 Post-Construction Submittals

 The following as recorded data is required from the contractor and/or fusion provider (if applicable) to the owner or pipe supplier upon request:

* Approved data logger device reports
* Fusion joint documentation containing the following information:
* Pipe Size and Thickness
* Machine Size
* Fusion Technician Identification
* Job Identification
* Fusion Joint Number
* Fusion, Heating, and Drag Pressure Settings
* Heat Plate Temperature
* Time Stamp
* Heating and Cool Down Time of Fusion
* Ambient Temperature

**Part 3: Product**

**3.1 Liner Pipe**

As specified in Section 1.2 of this specification.

* 1. **Pipe Bursting Equipment**
		1. General

The pipe bursting system shall be designed and manufactured to force its way through the existing line by fragmenting the pipe and compressing the broken pieces into the surrounding soil as it progresses. The bursting unit shall generate sufficient force to burst and expand the existing pipeline and allow for the insertion of the liner pipe.

* + 1. Allowable Types of Pipe Bursting System
			1. Static Pipe Bursting Systems
				- Static pipe bursting systems shall be characterized by a tapered or blunt nosed bursting head being pulled through the host pipe and breaking the host pipe by applying radial pressure to the host pipe. The host pipe fails by ‘hoop’ tensile stress applied by the bursting head, and is fragmented and pushed into the surrounding bedding and soil as the bursting head progresses.
				- The bursting head shall be followed by an expansion head which shall further push the fragmented pipe into the surrounding soil and bedding to a diameter that allows the insertion of the liner pipe behind it. Under no circumstances shall the pipe pull head, which is attached directly to the liner pipe, be used to expand or otherwise increase the diameter of the host pipe, or fragmented host pipe.
				- The pull head may be advanced by a hydraulic or winching mechanism, and may be connected by means of a cable, chain, or rod.
			2. Hydraulic Pipe Bursting Systems
				- Hydraulic pipe bursting systems shall be characterized by a pull head that is equipped with hydraulically actuated ‘petals’ that break the host pipe by applying radial pressure to the host pipe. The host pipe fails by ‘hoop’ tensile stress applied by the head, and is fragmented and pushed into the surrounding bedding and soil as the pull head progresses.
				- The pull head shall be followed by an expansion head which shall further push the fragmented pipe into the surrounding soil and bedding to a diameter that allows the insertion of the liner pipe behind it. Under no circumstances shall the pipe pull head, which is attached directly to the liner pipe, be used to expand or otherwise increase the diameter of the host pipe, or fragmented host pipe.
				- The pull head may be advanced by a hydraulic or winching mechanism, and may be connected by means of a cable, chain, or rod.
			3. Pneumatic or Percussion Pipe Bursting System

UNDER NO CIRCUMSTANCES SHALL PNEUMATIC OR PERCUSSIVE BURSTING SYSTEMS BE ALLOWED.

* + 1. Bursting Lubricants
			- Bursting lubricants shall be used at the request of the pipe bursting contractor and at the discretion of the Owner and Engineer.
			- Lubricants shall be compatible for long term use with PVC pipe.

3.2.4 Pipe Pull Heads

* + - Pipe pull heads shall be utilized that employ a positive through-bolt design assuring a smooth wall against the pipe cross-section at all times.
		- Pipe pull heads shall be specifically designed for use with liner pipe, and shall be as recommended by the pipe supplier.

3.2.5 Pipe Rollers

* + - Pipe rollers, if required, shall be of sufficient size to fully support the weight of the pipe during handling and pullback operations.
		- A sufficient quantity of rollers and spacing, per the pipe supplier’s guidelines shall be used to assure adequate support and resist excessive sagging of the product pipe.

**Part 4: Execution**

**4.1 Delivery, Storage and Handling**

Transport, handle and store pipes and fittings as recommended by manufacturer. 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 Owner, at the Contractor's expense, before proceeding further. Deliver, store and handle other materials as required to prevent damage.

* 1. **Cleaning and TV Inspection of Existing Pipeline**
* The host pipe shall be cleaned and inspected by TV prior to the bursting operation in accordance with, and if required by the contract documents.
	+ - * Cleaning and TV inspection of the host pipe shall indicate condition of host pipe and suitability of host pipe for liner pipe insertion by pipe bursting methods.
			* Obstructions considered detrimental to the pipe bursting operation which may include corporation taps, valves and valve bodies, and collapsed piping shall be remedied prior to bursting and liner pipe insertion.
			* Spot repairs shall be made in accordance with the drawings and these specifications.

**4.3 Obstruction Removal**

* Identify any point repairs required, such as dropped joints, intruding service connections, collapsed pipe, sags in main or any other obstructions prior to the pipe bursting process. The Contractor shall remove all obstructions to perform pipe bursting operation, as necessary.
* The contractor shall notify the inspector for approval to make an excavation after

 having exhausted all other options to remove any obstruction or retrieve any pipe

 bursting tool or camera from the water main.

**4.4 Location and Protection of Underground Utilities**

* Correct locations of all underground utilities that may impact the installation is the responsibility of the Contractor.
* Utility location and notification services shall be contacted by the Contractor prior to the start of construction.
* All existing lines and underground utilities shall be positively identified, including exposing those facilities that are located within an envelope of possible impact of the bursting operation as determined for the project specific site conditions. It is the Contractor and pipe burst system operator’s responsibilities

 to determine this envelope of safe burial depth and offset from existing utilities. This will include, but is not limited to soil conditions and layering, utility proximity and material, pipe bursting system and equipment, and foreign subsurface material.

**4.5**  **Excavation and Access Pits**

* The location of access pits shall be submitted to the Engineer prior to construction.
* Access pit length shall be such that the minimum bending radius for the liner pipe, per the pipe supplier is maintained. Sheeting, shoring and bracing requirements shall be in accordance with these specifications and applicable jurisdictional standards.
* Access pit excavations shall be performed at all points where the liner pipe will be inserted into the existing pipeline. When possible, access pit excavations shall coincide with host pipe service connection points or other appurtenance installations.
* The liner pipe may be continuously or partially supported on rollers or other Owner and Engineer approved friction decreasing implement during joining and insertion, as long as the pipe is not over-stressed or critically abraded prior to or during installation.

**4.6 Pipe Bursting Operation**

* + - * Any known pre-existing concrete encasements shall be excavated and broken out prior to the bursting operation to allow the steady and free passage of the pipe bursting head.
			* The new pipe shall be inserted immediately behind the bursting head in accordance with the pipe supplier’s recommended procedures. The bursting equipment shall be specifically designed and manufactured for the type of insertion process being used.
			* Immediately following the completion of a pipe bursting installation, if possible, the pipe should be pushed back into the location of the insertion, at the pulling head, until a small amount of movement is realized at the insertion pit on the other side of the installation from the pulling equipment.

**4.7 Preparation Prior To Making Connections Into Existing Piping Systems**

* Approximate locations for existing piping systems are shown in the construction documents. Prior to making connections into existing piping systems, the contractor shall:
* Visit the field to verify location, size, piping material, and piping system of the existing pipe.
* Obtain all required fittings, which may include saddles, sleeve type couplings, flanges, tees, or others as shown in the construction documents.
* Have installed all temporary pumps and/or pipes in accordance with established connection plans.
* Unless otherwise approved, new piping systems shall be completely assembled and successfully tested prior to making connections into existing pipe systems.

**4.8 Pipe System Connection**

* + - Pipe connections shall be installed per applicable standards and regulations, as well as per the connection manufacturer’s guidelines and as indicated in the construction documents. Pipe connections to structures shall be installed per applicable standards and regulations, as well as per the connection manufacturer’s guidelines.

**4.9 External Service Connections**

* In re-connection or reconstruction of existing water services, selected service connection pipe diameter must match existing service.
* All water service connections shall be identified, located and excavated prior to the pipe any construction.
* Tapping shall be performed using standard tapping saddles designed for use on PVC piping in accordance with AWWA C605. Tapping shall be performed only with the use of tap saddles or sleeves. NO DIRECT TAPPING WILL BE PERMITTED. Tapping shall be performed in accordance with the applicable sections for Saddle Tapping per Uni-Pub-8.
* All connections requiring a larger diameter than that recommended by the pipe supplier, shall be made with a pipe connection as specified and indicated on the drawings.
* Equipment used for tapping shall be made specifically for tapping PVC pipe:
* Tapping bits shall be slotted “shell” style cutters, specifically made for PVC pipe. ‘Hole saws’ made for cutting wood, steel, ductile iron, or other materials are strictly prohibited.
* Manually operated or power operated drilling machines may be used.
* Taps may be performed while the pipeline is filled with water and under pressure (‘wet’ tap,) or when the pipeline is not filled with water and not under pressure (‘dry’ tap).

**4.10 Testing**

Testing shall comply with all applicable jurisdictional building codes, statutes, standards, regulations, and laws.

4.10.1 Hydrostatic Testing and Leakage Testing for Pressure Piping

All hydrostatic and leakage testing shall be in accordance to Sec 506.5 COD (Hydrostatic Test) as specified in City of Dallas Addendum to the North Central Texas Council of Governments (NCTCOG) Public Works Construction Standards, Latest Edition.

* + - * In preparation for pressure testing the following parameters must be followed:
				+ All air must be vented from the pipeline prior to pressurization. This may be accomplished with the use of the air relief valves or corporation stop valves, vent piping in the testing hardware or end caps, or any other method which adequately allows air to escape the pipeline at all high points. Venting may also be accomplished by ‘flushing’ the pipeline in accordance with the parameters and procedures as described in AWWA C605.
				+ The pipeline must be fully restrained prior to pressurization. This includes complete installation of all mechanical restraints per the restraint manufacturer’s guidelines, whether permanent or temporary to the final installation. This also includes the installation and curing of any and all required thrust blocking. All appurtenances included in the pressure test, including valves, blow-offs, and air-relief valves shall be checked for proper installation and restraint prior to beginning the test.
				+ Temporary pipeline alignments that are being tested, such as those that are partially installed in their permanent location shall be configured to minimize the amount of potentially trapped air in the pipeline.

4.10.2 Partial Testing

* Segments of the pipe may be tested separately in accordance with standard testing procedure, as approved by the Owner and Engineer.

**4.11 Disinfection of the Pipeline for Potable Water Piping**

Once all pipe work is completed to the satisfaction of the Construction Manager, Dallas Water Utilities shall perform, as required, chlorine disinfection, sampling and analysis of the newly installed liner in accordance with the specifications and/or as ordered by the Engineer.

**4.12 Final Acceptance**

 Upon completion of installation, testing and inspection, clean and restore project area

 affected by work of this section.

**Part 5: Method of Measurement and Payment**

 Method of Measurement and Payment for the work included in this section will be in

 accordance with the payment schedule in the Bid Proposal.

**\*\*END OF SECTION\*\***