WATER MAIN REPLACEMENT

GUIDELINE SPECIFICATION: PIPE BURSTING POTABLE WATER MAINS USING PRE-CHLORINATED PIPE

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The objective of this specification is to educate the reader in a rehabilitation method for potable water lines. The method of pipe bursting known as Pipe Bursting of Potable Water Mains Using Pre-Chlorinated Pipe provides a simple, expeditious manner for replacement and re-connection of buried waterlines with only surgical excavations while minimizing service outages and eliminating the need for temporary service hookups in most cases.

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Disclaimer

The following specifications are a draft copy. Similar specifications have been approved for jobs in Wisconsin and Florida. They are general in nature. Each job has its unique circumstances. These specifications are not complete for any job and cannot be used as such. Earth Tool Company LLC makes no claim as to the specifications' accuracy or completeness and does not represent or warrant them as such. The project engineer, city, or the contractor must provide the final specifications.

1.0 Outline of the Method of Pre-Chlorination of HDPE Pipe

Assuming all qualifications for skill and materials are met, the Pipe Bursting of Potable Water Mains using Pre-Chlorinated Pipe will repeat the method outlined below for each section of pipe being rehabilitated. These processes may be performed in series or in parallel with other sections of pipe within the job; however each section will require these steps.

a. Post notices of service outage.

b. Chlorinate a length of product pipe that yields passing test results for potable water.

c. Hydrostatic test of the product pipe section.

d. Isolate the section to be rehabilitated from the rest of the system so as to maintain pressure integrity of the system as well as pre venting any backflow of chlorinated solution or non - potable water into the system.

e. Excavate a Burst Pit at one end of the section down to pipe grade for placement of the pipe bursting equipment.

f. Excavate an Insertion Pit at the opposite end of the section down to pipe grade for entry of the product pipe.

g. Excavate and remove hydrant tees and valve tees from the host pipe.

h. Rod string to be assembled as it is thrust through the host pipe from Burst Pit to Insertion Pit.

i. Burst tooling and product pipe attached to rod end at Entry Pit.

j. Rod string pulled back and disassembled simultaneously while tooling and product pipe travels from Insertion Pit to Burst Pit.

k. Excavate Service Connection Pits.

l. Service Connections shall be made to the newly installed main.

m. Flush the newly installed main with potable water.

n. Inspect for leaks at new connections and perform final pressure test.

o. Final connection of the replaced section of pipe into the system.

It should be noted that items C through O are intended to be accomplished within a single 10 hour day to eliminate the need for temporary services. The length of pipe to be burst per run should be chosen to conform to this time frame.

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2.0 Prior to pipe bursting

2.1 Contractor Pre - Qualifications

In order to assure quality execution of the method, the contractor shall upon request of the Authority provide the following:

a. Experience - the contractor shall provide documented evidence of:
   1. Properly trained in the operation of pipe bursting equipment by manufacturer.
   2. Performing chlorination of potable water mains per AWWA standards on at least two (2) projects.

b. Certification
   1. Certificate of training endorsed by the manufacturer of the pipe bursting equipment, Earth Tool Company. LLC, (800) 331-6653 (USA), +1 262.567.8833 (INT).
   2. Certificate of training endorsed by the manufacturer of thermal fusion equipment in butt fusing of HDPE pipe, in lieu of certificate, evidence of training may be substituted.
   3. Certificate of training endorsed by the supplier or manufacturer of HDPE electro-fusion fusion couplers to be used in the method. In lieu of certificate, evidence of training may be substituted.

c. Hygiene competency statement by contractor that all employees are medically cleared to work on restricted operations and have been trained in hygienic procedures.

d. Personnel overseeing Pre-chlorination process shall be trained and qualified in process.

2.2 Pipe Specifications

a. High Density Polyethylene Pipe shall be AWWA C906 (HDPE)

b. Pipe must conform to ASTM F714 and NSF 61

c. HDPE resin shall be PE3408 characterized by ASTM D3350

d. All pipe shall be made of virgin material, no rework except that obtained from manufacturers own production.

e. Pipe shall be homogeneous throughout and free of visible cracks, holes, foreign material, blisters or other faults.

f. Pipe shall be a minimum of SDR 11 wall thickness or as directed by the Authority.

g. Cuts or gouges, per ASTM F585 are acceptable up to 10% of wall thickness. Beyond 10% of wall, damage must be removed by cutting the damaged section from the pipe string and butt fusing the ends.

h. Stripe along the length of the pipe shall be of the color designated by the Authority to identify the applicable service (commonly a blue stripe).

2.3 Other Product Specifications

a. Fittings for pressure systems shall be ductile iron with a minimum rating of 100 PSI or per the Authority specification.

b. Stiffener inserts per ASTM 240 shall be used for all fittings and connections to HDPE pipe. Stiffeners shall be 304 Stainless Steel and be of wedge type design.

c. Service Connection Fittings shall be HDPE electro-fusion type with a minimum working pressure of 100 PSI or per the authority specification. Connection Fittings shall meet AWWA C906. Service Saddles may be Self Tapping.

2.4 Product Compliance

a. Certificate of compliance shall be supplied to the Authority that the Product Pipe is per specification 2.2. or as specified by the Authority.

b. Certificate of compliance shall be supplied to the Authority that the Product other than Pipe is per specification 2.3. or as specified by the Authority.

2.5 Product Handling

a. Pipe transport and handling shall be per manufacturer's recommendation and/or local authority recommendations.

b. Product other than pipe must be stored and handled per manufacturer's recommendations.

2.6 Documentation and Planning

a. Contractor shall submit a plan to the Authority on a marked up copy of the construction plans prior to any excavation including:
   1. Pit locations for pipe insertion and burst machine location.
   2. Pit locations for service re-connects.
   3. Schedule of when various sections are to be rehabilitated.
   4. Distances of each pull.
   5. Isolating points used to seal the system during the pipe burst.

b. Construction drawings provided by the Authority shall be marked by the contractor to show locations of services, fittings, fire hydrants and other reconnects. These markups shall be done the day of the actual placement. A set of marked up plans shall be returned to the Authority within 15 days of completion of the job or per the local authority standard code of practice.

c. Chlorination Submission Documents, pipes Pre-Chlorinated with intent to install under this specification must have a log sheet placed in a sealed waterproof envelope attached to the pipe at the start of the Chlorination process. This sheet makes up the Chlorination Submission Documents and shall be delivered to the Authority at the same time as the marked up construction drawing. Information on the log sheet shall at a minimum include:
   1. Date of Swabbing.
   2. Date of Chlorinating and amount of chlorine used.
   3. Date of Samplings.
   4. Results of Sample tests.
   5. Date of pipe installation.

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6. Date of Pressure Test
7. Makeup water details (if any)
8. End test pressure
9. Final pressure test results
10. Location of installation

2.7 Notification of Regulatory Authority

Prior to commencement of construction, the water provider and the Contractor shall notify the local regulatory agency (Dept. of Natural Resources, or other) having jurisdiction over the potable water system to be rehabilitated. Specifications for construction processes and/or plans shall be provided to the agency as they require.

2.8 Interruption of Service to End Users

a. Interruption of service to end users shall be minimized through the efforts of the contractor and use of the method outlined with in. Outages shall be limited to 8:00 AM to 6:00 PM Monday through Friday. No interruption shall be permitted between 6:00 PM and 8:00 AM or on Saturday, Sunday or legal holidays with out the approval of the Authority.

b. Only one (1) line segment may be shut down for rehabilitation at any one moment.

c. End users shall be notified by the contractor in a manner approved by the Authority. Notice shall be provided (7) days in advance if possible. Minimum permissible advance is 48 hours prior to service interruption.

2.9 Joining of Pipe

a. Fusing per Butt fusion methods in strict conformance to the pipe and/or fusing equipment manufacturers recommendations shall be used to join sections of High Density Poly-ethylene Pipe.

b. Fusing of 'sticks' of pipe shall be performed in the general vicinity of the pipe insertion pit or laydown yard.

c. Pipe supplied by the pipe manufacturer in a coil may be fused remote from the pipe insertion pit.

d. Solvent cement joints performed by anyone other than the manufacturer are unacceptable for any HDPE pipe or fitting.

2.10 Pre-Chlorination of Product Pipe

Chlorination of pipes prior to bursting shall be carried out per ANSI/AWWA C651-99 Standard for Disinfecting Water Mains. Any information here shall facilitate that method when performed on pipes not yet placed on grade. In general, the method includes the following:

a. Disinfect all equipment, tools, end caps, pipe fittings or product that may contact pipe.

b. Disinfection shall be carried out by immersing or rinsing items in a hypochlorus solution containing 1 to 5 percent chlorine measured by weight. See details of Chlorination solution in section 2.11.

c. Product pipe shall be fused into a string of sufficient length to complete the designated section or be coiled in a manner suitable for delivery on a pipe reel. Maximum allowable length is 1,200 feet.

d. The surface upon which the product pipe rests during Chlorination shall be relatively impervious such as asphalt, concrete or stone and free from visible contamination. Coiled pipe must be layed horizontally to allow all air to be expelled.

e. Swabbing, Chlorination and testing of the inside diameter of the pipe shall be accomplished by:

1. Swab being inserted at the lowest end of the pipe.
2. Calcium Hypochlorite tablets or granules as described in section 2.11. shall be placed behind the swab.
3. Pressure tight end cap shall be mounted to the low end of the pipe either by fusing or mechanically assembled to the pipe.
4. Potable water shall be introduced through this end cap at a controlled rate such that the swab is propelled at a velocity less than or equal to one foot per second. All air is to be dispelled from the pipe.
5. Upon discharge of the swab from the elevated end of the pipe, the elevated end shall be capped with a pressure tight seal. This seal having a tapped access hole of size at least 1.25" NPT or incorporating the ability to leak (purge) air or water at will by adjustment of clamping bolts. Additional potable water should be added after capping to ensure that no air remains between the caps.
6. Pressure testing of the pipe section should be performed per details in section 2.11 upon placement of the second end cap.
7. Chlorinated solution should be maintained in the pipe for a minimum of 24 hours prior to flushing when water temperature is above 41°F (5°C), 48 hours when water temperature is 41°F (5°C) or less. Time for retention of the chlorinated solution shall not be significantly over designated holding time so as to prevent damage to the pipe or end caps.
8. After designated holding time, the pipe shall be drained, flushed and filled with potable water so as to expel the highly chlorinated solution. The spent Chlorinated solution shall not be allowed to enter any water shed, a sanitary sewer or any other area where environmental damage may occur without neutralizing it in an industry acceptable manner. Flushing water shall be from a source known to be of drinking water standard.
9. Test samples shall be taken from each end of the pipe on consecutive days, 24 hours apart. Samples shall be tested by a state certified lab within 30 hours of being taken.
10. Failure of any sample to pass a bacteriological test should result in the related section of pipe being re-flushed and retested. Should any sample again fail, the section must be chlorinated before retest.
11. Time before re-connection of a passing pipe section shall be limited to 14 days from the last sampling. After this time the pipe must be retested to be acceptable for use.
12. Drain the section of pipe prior to Pipe bursting. The pipe shall be drained on the day of the pipe bursting, and sealed after draining and for the pipe bursting process.

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13. Swabs should be designated by the manufacturer as suitable for potable water system use. Swabs are to be manufactured by Knapp Industries or be of equivalent design.

2.11 Chlorination Solutions

a. Acceptable forms of chlorine include Calcium Hypochlorite con forming to ANSI/AWWA B300, preferably in 5 gram tablets, alternately in granular form. Material must be stored per manufacturer's recommendations.

b. Unacceptable forms of chlorine include Calcium Hypochlorite intended for swimming pool use.

c. Calcium Hypochlorite tablets shall be placed behind the swab in quantity based on pipe size and length per ANSI/AWWA C651-99 AWWA Standard for Disinfecting Water Mains.

d. Calcium Hypochlorite in granular form shall be placed behind the swab in quantity based on pipe size and length per ANSI/AWWA C651-99 AWWA Standard for Disinfecting Water Mains.

e. Solutions acceptable for pipe chlorination shall be acceptable for disinfection of equipment, tools, end caps, pipe fittings or product that may contact pipe.

f. Dilute Chlorinated solutions over 7 days old shall be disposed of properly and not used as a disinfection agent. See section 2.9e.8, for appropriate disposal.

2.12 Hydrostatic Pressure Testing

a. Maximum allowable test pressure as referenced by PPI TR-31 shall be 1.5 times the pipe rated operating pressure at the lowest point in the section under test or that of the lowest rated pressure component such as flanges, valves, fittings etc.

b. Air trapped in the product pipe must be purged before test.

c. At the discretion of the Authority, the test method used may be either a Monitored Make-up Water Test or a Non-monitored Make-up Water Test. Either test shall be performed above ground without fittings prior to pipe bursting. If damage to the product pipe occurs during bursting that requires a fused joint repair, the Authority may require re-test, with or without fittings after bursting.

d. Monitored Make-up Water Test shall be comprised of two stages.

1. Initial expansion and stabilization stage. The initial test pressure is applied and the system is allowed to stand without make-up water during a 2 to 3 hour period. During this time the pipe is allowed to expand and stabilize.

2. Test stage, after the stabilization is complete, the system is pumped back to test pressure and allowed to sit for 2 additional hours. Water is then added until the test pressure is attained. Water added shall not exceed that of Table 6.1.

e. Non-monitored Make-up Water Test shall be comprised of two stages.

1. Initial expansion and stabilization stage. The initial test pressure is applied and the system is allowed to stand without make-up water during a 2 to 3 hour period. During this time the pipe is allowed to expand and stabilize.

2. Test stage. After the stabilization is complete, the system is pumped back to test pressure and then reduced by 10 PSI. The pressure shall remain steady, not falling more than 5% from reduced pressure during a one hour test period.

3. Total time allotted for test shall not exceed 8 hours. If successful test can not be completed in this period, then the test section must be de-pressurized and allowed to relax for a minimum 8 hours before retest.

f. Re-test after repair. Should the Authority require test after repair per 2.2g., refer to Equation 6.2 for Leakage Allowance due to fittings for the Monitored Make-up Water Test.

g. Final Pressure Test shall be comprised of two stages. This test to be performed after product pipe is installed on grade, all taps have been made and all fittings have been installed, but prior to connection to main.

1. Initial expansion and stabilization stage. The test section is pumped to mains pressure and the system is allowed to stand without make-up water during a 1/2 hour period. During this time the pipe is allowed to expand and stabilize.

2. Test stage. After stabilization is completed, the system is pumped back to mains pressure. All exposed taps shall be visually examined for leakage during the 15 minute duration of the test. Allowable pressure drop during test period shall not exceed 5 PSI. No visible leaks are allowable.

h. Manifest shall be filled out with all pressure test results.

3.0 Pipe Bursting Operation

The pipe bursting operation described within provides guidance on the basic process. It is to be understood that the need to make exceptions or additions to this process are common. These changes are made to accommodate non standard conditions. The contractor experience requirements make it reasonable to put the responsibility of devising these exceptions upon the contractor.

3.1. Pit Location and Excavation

a. Burst Pit and Insertion Pit locations shall be placed such that excavations are minimized. This may be accomplished by placing either or both of these pits at the point of a service connection.

b. Service connection pits may be excavated before, during or after the bursting operation at the option of the contractor.

c. All pits shall be shored to ensure worker safety per OSHA or other local regulations.

d. All pits shall be roped off and or covered when not active per OSHA or local regulations to ensure public safety.

e. Traffic Control shall be accommodated for by Contractor or as agreed to by Authority. Safe traffic passage around pit excavations that are located in or adjacent to streets or highways shall meet requirements of Authority and/or Department of Transportation and/or Law Enforcement Agency controlling street or highway where pit excavation is located. Parking of related employee vehicles, trucks and auxiliary and equipment shall be such that congestion and traffic delays are minimized.

f. Utilities intersecting the host pipe shall be exposed using an excavation technique appropriate for the utility. This Utility Crossing Pit shall exist prior to commencement of bursting. Man

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entry shoring is not required however appropriate safety precautions should be made.

3.2 Bursting Machine Location and Shoring

Bursting machines of the static pull style require preparation and planning for the bursting pit that they are to operate from.

a. Burst pit shall be shored in accordance to 3.c.

b. Forward face of the Burst Pit, or the surface that the machine bears against while pulling back, shall be shored in workman like manner. This shoring shall maintain perpendicular burst machine alignment to the pipe during pullback. Any loss of perpendicular alignment during pull shall result in stopping of the bursting process and improvement of the forward face shoring. Excavation of the forward pit face, such that the rear of the burst machine sits 2 to 3 inches lower than the front upon setup may help to maintain alignment during bursting.

c. Rearward shoring shall be provided to react rod thrust forces during payout. While these forces are substantially lower than pullback forces, shoring must be used to stabilize the bursting machine so as to maintain perpendicular alignment of the machine during payout. The weight of the machine can not be depended on to react thrust forces. Host pipe at rear face of pit may only be utilized for rearward shoring if scheduled for replacement.

d. Pipe face for Cast Iron, Ductile Iron or PVC shall be cut off using a saw or similar device to produce a square face for the bursting machine forward face to bear against. Final separation of cast iron pipe with a wedge may provide a clean face. Asbestos Concrete may be broken with a hammer. Host pipe shall be removed in sufficient length to accommodate burst machine.

e. Burst machine must be positioned so as to have rod centerline at approximate centerline of host pipe.

f. Rod Box delivery and removal between temporary rod storage location and Burst Pit must be accommodated for with appropriate lifting equipment and techniques. Additionally, movement and or placement of lifting machine must be included in Traffic Control plans.

3.3 Rod Payout Operation

a. Rod payout is the process of assembling a string of rods and pushing them in a step wise manner from Burst Pit, through the interior of the host pipe to Insertion Pit.

b. Lifting of rod boxes into or out of the Burst Pit shall be per per formed per OSHA or other applicable requirements with respect to equipment and method.

c. Threads shall be cleaned of foreign matter before assembly.

d. Counting of Rods during payout, or quantity of rods per box shall be monitored such that the operator is aware of the distance between the burst machine and lead end of the rod string.

e. Thrust force should be monitored by the operator. Should an unexpected sudden and significant increase in thrust force be experienced, the process shall be halted. The operator or contractor shall review the results of 3.3e.1.with the Authority to remedy per 3.3e.2. in an attempt to determine if offsets, valves or other features or obstructions exist that may cause the rod string to leave the pipe.

1. Front end of the rod string should located by distance from the Burst Pit. Location should be painted and compared to as built plans.
2. Appropriate action should be taken to remedy the cause. This action may include an additional pit at the obstruction to determine the cause, and remove or accommodate for the obstruction. The decision may be to continue thrusting if the obstruction is believed to be encrustation.

e. Host pipe in the Insertion Pit shall be cut or broken prior to arrival of the rod string. Sufficient length shall be removed so as to allow the Burst Tooling to enter the host pipe and bend the product within the allowable radius specified by the pipe manufacturer. The second end of the host pipe in the Insertion Pit shall be positioned or worked so as not to damage the product pipe as it travels through the Insertion Pit.

f. Workmen shall not enter the Insertion Pit when the rod string is nearing the Pit. A workman shall be in visual or radio contact with the burst machine operator so as to have the payout halted in a position that allows attachment of the Burst Tooling without subsequent repositioning.

3.4 Tooling and Attachment

a. Tooling style shall be chosen based on anticipated properties of host pipe and host pipe repairs.

1. Cast Iron or Asbestos Concrete host pipe anticipated to be free of either Ductile Iron repair sections or Dressor Style Couplings may use a simple conical burst head with a single or double longitudinal blade.
2. Ductile Iron, PVC or host pipe with Ductile Iron repair sections or Dressor Style Couplings require use of a rolling blade cutter (slitter) ahead of the conical expander.

b. The Product Pipe shall be moved into position for attachment to the rod string. Appropriate traffic or pedestrian control will be exercised along the path of the Product Pipe.

c. The lead and second rod shall be painted orange or yellow so as to give notice to the burst machine operator position of the Burst Tooling.

d. Attachment of the Burst Tooling to the rod shall be through the use of a removable pin joint allowing the tooling to pivot at least 45 degrees to the rod axis.

e. Burst head diameter must be a minimum of 15% over size to the outside diameter of the Product Pipe. Actual size is left to the discretion of the contractor.

f. Attachment of the Product pipe to the Burst Tooling shall be with a swivel that permits rotation to relieve torsional (twist) stress on the Product Pipe.

g. Burst Head shall slide on the rod string such that the rear of the burst head overlaps the forward end of the Product Pipe to lessen the chance of damage to the Product Pipe.

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3.5 Pullback Operation

a. Prior to commencement of pullback, there will be visual or radio contact between an observer stationed adjacent to the Insertion Pit, the Burst Machine operator and a Product Pipe Observer stationed strategically along the length of the product pipe to watch for product pipe entanglement with above ground obstructions.

b. The Burst Machine operator will begin the pullback with the OK of the Insertion Pit Observer. Progress will be made at a slow rate until the Observer sees the Burst Tooling has completely entered the Host Pipe.

c. Pipe progress will be monitored for the 1st 20 feet of pullback by the Insertion Pit Observer and the Product Pipe Observer.

d. As the Burst Tooling nears any Utility Crossing Pit, an observer in radio or visual contact with the Burst Machine Operator will monitor and control movement of the Burst Tooling past the utility.

e. Should the forward shoring upon which the bursting machine bears yield sufficiently to bring the Bursting Machine out of square to the host pipe, the shoring will be reworked according to 3.2.b.

3.6 Tooling Removal

a. Burst Machine Operator shall note rod count and anticipate entry of painted rods into the Burst Pit. As the Pin Joint Connection nears the Burst Machine forward face, the burst is to be halted. Load on the forward face is relieved by reversing the rod direction slightly.

b. The Burst Machine Shore Plate is to be removed, allowing the tooling to enter a cage or the hull of the Burst Machine. The tooling string will be disassembled and removed, in sections if necessary until the Product Pipe face has been pulled beyond the face of the Burst Pit. The distance past the face of the Burst Pit shall be at the discretion of the contractor anticipating longitudinal shrinkage and length required for connection/fusing.

4.0 After Pipe Bursting

Upon completion of pipe bursting, certain tasks must be followed through in order to complete the overall process.

4.1 Pit condition prior to taps or joining system

a. Maintaining sanitary conditions within the product pipe after pipe bursting must take high priority. Should any foreign matter, including ground water be allowed to enter the pipe interior, the condition of the pipe is no longer suitable for connection to the system. For this reason connections may not be made in standing water. Such water must be pumped or bailed prior to making the connection or unsealing the pipe. Areas under connections should be excavated at least 12" below the pipe invert.

b. Before joining a surface and before any special surface preparation to accommodate that joining, external surfaces should be clean and dry. Dust may be removed by wiping with a clean, lint free cloth. Heavier deposits must be washed from the surface with soap and water and dried with a clean, lint free cloth.

c. Incidental exposure of the interior of the pipe to any foreign matter shall require that one of the two following remedies be carried out:

   1. Complete chlorination per AWWA specifications for buried pipe.
   2. Localized contamination at the end of the pipe may be removed and the contaminated interior surface of the pipe wiped with a solution of 1 to 5% hypochlorite disinfecting solution.

4.2 Service Taps and Service Lines

a. Service taps shall be of a type approved by the Authority and must meet AWWA C906. Construction of taps shall be per the manufacturer's recommendation. Acceptable choices include:

   1. Electro-fusion type saddles with a minimum working pressure of 100psi.
   2. Socket Fusion

b. Replacement or rehabilitation of service lines, if required, shall be according to contract.

4.3 Final Hydrostatic Test

Final Hydrostatic test shall pass when performed per 2.12g.

4.4 Service Reinstatement

Prior to connection of the newly installed pipe, the section of pipe shall be fully flushed using potable water. Following flushing, the newly installed section may be connected to the main at both ends and service reinstated.

4.5 Backfill and Surface Reinstatement

a. Backfill used to restore pits shall be per applicable sewer and water construction standards applicable in the municipality.

b. Lawn restoration shall be per applicable sewer and water construction standards applicable in the municipality.

c. Asphalt, concrete or other roadway surface restoration shall be per applicable sewer and water construction standards applicable in the municipality.

4.6 Documentation Finalization

Within (15) days of completion of the job, all records including manifests, marked up construction plans or documents pertinent to describing the system as installed shall be provided to the Authority.

5.0 Definitions

A

Authority: Qualified person or persons representing the customer or contractee (such as the municipality). This person may be a city engineer, inspector or other technical professional designated by the contractee to represent their best interests in execution of the contracted job.

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AWWA: American Water Works Association, see www.awwa.org

ASTM: American Society for Testing and Materials, see www.astm.org

B

Burst Head: Conical shaped portion of burst tooling used to expand fractured pipe and surrounding soil to accommodate product pipe.

Burst Pit: Excavation where Static Pull Pipe Bursting Machine is located. The product pipe is pulled toward this pit.

Burst Tooling: Tooling designed to crack the host pipe, expand the remains of the host pipe and surrounding soil so as to allow passage of the product pipe.

C

Chlorination Submission Documents: Written log attached to section of pipe detailing processes related to Pre-Chlorination and Hydrostatic Testing.

D

Dressor Coupling: Commonly used repair coupling, see www.dresser-couplings.com

Ductile Iron Pipe: Centrifugally cast pipe with superior tensile and yield strength, high ductility (malleability) and impact resistant properties.

E

Electrofusion: Joint or saddle that connects two sections of HDPE pipe. These joints contain internal heating elements to facilitate a heat fused joint.

I

Insertion Pit: Excavation where product pipe enters the host pipe and bursting begins. Product pipe is pulled through the insertion pit towards the burst pit. Nominal depth of insertion pit is 2.5 to 3.0 times depth of host pipe.

H

HDPE: High Density Poly-Ethylene, plastic material from which product pipe is manufactured.

Host Pipe: Existing pipe buried in the ground that will be rehabilitated by bursting (cracking) and pulling in a new replacement pipe (product pipe).

M

Manifest: Written log attached to section of pipe detailing processes related to Pre-Chlorination and Hydrostatic Testing.

P

Product Pipe: Newly installed pressure pipe, made from HDPE.

PPI: Plastic Pipe Institute, see www.plasticpipe.org

R

Rod String: Assembled string of rods that extend from Burst pit to insertion pit and serve to transmit tensile pullback forces to burst tooling.

U

Utility Crossing Pit: An excavation created at any point where another buried utility crosses the burst path.

6.0 Tables and Equations

6.1 Makeup Water Allowance Table

Nominal Pipe Size in Inches	2	4	6	8	10	12	14	16	18	20	22	24	30
Makeup Water Allowance (Gallon/100 ft)	.1	.2	.6	1.0	1.3	2.3	2.8	3.3	4.3	5.5	7.0	8.9	12

6.2 Allowance for Leakage Due to Fittings Equation

L = [ND(P^.50)]/[7,400]

Where:

L = Maximum allowable leakage, Gallons/Hour

N = Number of joints in the tested pipe (connections for pipes or fittings, not fuse joints)

D = Nominal inside diameter of pipe, Inches

P = Test Pressure, PSI

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