Guideline Specification for the Replacement of Mainline Sewer Pipes By Pipe Bursting

Setting the Industry Standard for the Rehabilitation of Underground Utilities

The International Pipe Bursting Association (IPBA) is a division of NASSCO, (National Association Of Sewer Service Companies)
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4.3 The Contractor shall hold the Contracting Authority and Engineering Firm whole harmless in any legal action resulting from patent infringements

The chart below is a suggested guideline for the Contracting Authority to utilize in pre-qualifying Contractor experience requirements. It is intended as a guideline only.

Job Classification	Job Value	Minimum Requirements
A - Routine	$500,000 or less	Verification by the manufacturer that Contractor personnel are trained on the use of the equipment.
B - Challenging to Moderately Difficult	$1,000,000 or less	Verification by the manufacturer that Contractor personnel are trained on the use of the equipment. A minimum of 5,000 feet of experience in Class A or more difficult jobs.
B - Challenging to Moderately Difficult	$1,000,000 or more	Verification by the manufacturer that Contractor personnel are trained on the use of the equipment. A minimum of 5,000 feet of experience in Class A or more difficult jobs.Cumulative Class A and B Income of $1,000,000
C - Difficult to Extremely Difficult	$1,000,000 or less	Verification by the manufacturer that Contractor personnel are trained on the use of the equipment. A minimum of 10,000 feet of experience on Class B jobs, to include 3,000 feet of 20" or larger diameter
C - Difficult to Extremely Difficult	$1,000,000 or more	Verification by the manufacturer that Contractor personnel are trained on the use of the equipment. A minimum of 10,000 feet of experience on Class B jobs, to include 3,000 feet of 20" or larger diameter. Cumulative Class B and C Income of $1,000,000

5.0 Quality Assurance

The Contractor is solely responsible for quality assurance during the length of the project. The contractor is be responsible for any costs associated with corrective measures required to replace or repair items not meeting the quality standards specified by the Contracting Authority.

6.0 Submittals

The Contractor shall submit the following items for review and approval by the Contracting Authority in accordance with the Contract Documents. Approval of the submittals by the Contracting Authority shall be obtained prior to ordering pipe materials and/or the start of the pipe replacement process.

6.1 Certifications of training by the pipe bursting systems manufacturer stating that the operators have been fully trained in the use of the pipe bursting equipment by an authorized representative of the equipment manufacturer. Alternately the contractor may provide a letter of intent of training, to include course outline, from an authorized representative of the equipment manufacturer.

6.2 Contractors not licensed by British Gas must possess such a license prior to the start of the project. Alternately the Contractor my provide proof of payment to be made by a licensed Equipment Manufacturer.

6.3 Certifications from the pipe manufacturer of training in the proper method for handling and installing the new pipe.

6.4 Certifications of training by the pipe fusion equipment manufacturers that the operators have been fully trained in the use of the fusion equipment by an authorized representative of the equipment manufacturer.

6.5 Detailed construction procedures, and layout plans to include sequence of construction.

6.6 Locations, sizes and construction methods for the service reconnection pits.

6.7 Methods of construction, reconnection and restoration of existing service laterals.

6.8 Detailed descriptions of the methods of modifying existing manholes.

6.9 Detailed procedures for the installation and bedding of the new pipe in the launching and receiving pits.

6.10 Sewer bypass plans, methods and list of equipment to be utilized.

6.11 Description of the method to remove and dispose of the host pipe, if required.

6.12 The safety plan in conformance with the Contract Documents and OSHA regulations.

6.13 Manufacturer's technical date showing complete information on material composition, physical properties and dimensions of the new pipe and fittings. Manufacturer's recommendations for transport, handling, storage, and repair of pipe and fittings shall be included.

6.14 Traffic control plans.

6.15 Project schedule.

6.16 Contingency plans for the following potential conditions:

a. Unforeseen obstruction(s) causing burst stoppage, such as unanticipated change(s) in host pipe material, repair section(s), concrete encasement(s) or cradle(s), buried or abandoned manhole(s) or changes in direction not depicted on maps provided by the Contracting Authority.

b. Substantial surface heave occurs due to the depth of the existing pipe vs. the amount of upsizing

c. Damage to existing service connections and to the replacement pipeline's structural integrity and methods of repair.

d. Damage to other existing utilities.

e. Loss of and return to line and grade.

f. Soil heaving or settlement.

7.0 Delivery Storage and Handling of Pipe and Materials

7.1 The Contractor shall transport, handle, and store pipe and fittings as recommended by manufacturer.

7.2 New pipe and fittings that are damaged before or during installation it shall be repaired or replaced, as recommended by the manufacturer or required by the Contracting Authority. The costs of such repair or replacement shall be borne by the Contractor and be accomplished prior to proceeding with the project.

7.3 The Contractor shall deliver, store and handle other materials as required to prevent damage. Materials that are damaged or lost shall be repaired or replaced by the Contractor at no additional expense to the Contracting Authority

8.0 Methods of Pipe Bursting

The most commonly used methods for pipe bursting are static and impact force. Static systems are hydraulic, while impact systems generally involve a combination of pneumatic and hydraulic technology. The main difference between methods is the manner in which the force is generated and transferred to the host pipe during the bursting operation.

The pipe bursting tool shall be designed and manufactured to force its way through existing pipe materials by fragmenting the pipe and compressing the old pipe sections into the surrounding soil as it progresses. The bursting unit shall generate sufficient force to burst and compact the existing pipeline. See manufacturer's specifications for what size tool should be used in what diameter of pipe, as well as parameters of what size tool for percentage of upsize allowed.

The pipe bursting tool shall be pulled through the sewer by a winch or rod located at the upstream manhole. The bursting unit shall pull the polyethylene (PE) pipe with it as it moves forward. The bursting head shall incorporate a shield/expander to prevent collapse of the hole ahead of the new pipe insertion. The pipe bursting unit shall be remotely controlled. Replacement pipe that is sectional shall be pushed as well as pulled behind the bursting head.

The bursting action of the tool shall increase the external dimensions sufficiently, causing breakage of the existing pipe at the same time expanding the surrounding ground sufficiently to pull or pull/push in the new pipe.

9.0 Pipe Materials

Polyethylene Plastic Pipe shall be high-density polyethylene pipe and meet the applicable requirements of ASTM F714 Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter or AWWA C906, ASTM D1248 and ASTM D3350. (See Appendix 4) Other pipe materials, if specified, shall be defined in Section 9.6.

9.1 The Contractor shall install a new pipe sufficient in diameter to renew the sewer to the required flow capacity as specified by the Contractor Authority. (See Appendix 6 - Comparative Flow Characteristics)

9.2 The Contractor shall install pipe made of virgin materials. Rework pipe obtained from the manufacturer may be installed with the consent of the Contracting Authority.

9.3 The new pipe shall be homogenous throughout and shall be free of visible cracks, holes, foreign material, blisters, or other deleterious faults.

9.4 Dimension Ratios: The wall thickness (SDR) of the new HDPE pipe shall conform to the recommendations of the Pipe Manufacturer or as approved by the Contracting Authority.

9.5 The material color of the new pipe shall be as shall be as specified by the Contracting Authority.

9.6 Other Pipe Materials

a. Vitrified Clay Pipe (VCP): VCP Micro tunneling pipe shall meet the requirements of ASTM C1208 and the Standard Practice for Installing Vitrified Clay Pipe Lines.

b. Reinforced Plastic Mortar Micro Tunneling Pipe. (RPM): RPM pipe shall meet the requirements of ASTM D3262 or AWWA C950.

c. Steel Pipe: Steel Pipe shall meet the requirements of AWWA C200.

d. Ductile Iron Pipe: Ductile Iron Micro Tunneling Pipe shall meet the requirements of AWWA C110 and shall be specifically designed for jacking by the pipe manufacturer.

e. Polyvinyl Chloride (PVC) Pipe: Polyvinyl Chloride Pipe shall be a restrained joining type such as Certa-Lok™ or Yelomine™ and conform to the requirements of ASTM D2241 and/or AWWA C900 or C905, with a DR11 rating.

10.0 Material Testing

The Contractor shall notify the Contracting Authority at the completion of each burst segment. The Contracting Authority may, at its option, conduct an inspection of the new pipe to determine the condition of the pipe subsequent to the burst.

Defects, which in the opinion of the Contracting Authority affect the integrity of strength of the pipe, shall be repaired or replaced by the Contractor at no additional cost to the Contracting Authority.

11.0 Locating Utilities

The Contracting Authority shall provide the Contractor with all documents relating too the location of utilities adjacent to the pipe to be replaced. The Contractor shall, prior to starting work, verify the location of all adjacent utilities. The minimum clearance from other utilities shall be approximately two feet. The Contracting Authority may at its discretion reduce the minimum clearance.

The Contractor shall expose all interfering and crossing utilities by spot excavating at the planar intersection of the pipe and removing the soil from around the utility. The cost of exposing these utilities shall be borne by the Contracting Authority.

12.0 Sub-Surface Conditions

When Pipe Bursting is specified, the Contracting Authority will furnish the Contractor with all the necessary information listed in the Contract Documents.

The Contractor shall verify this information in the field. All additional subsurface investigations deemed necessary by the Contractor to complete the work shall be included in the Bid Proposal at no additional cost to the Contracting Authority. Copies of all reports and information obtained by the Contractor shall be provided to the Contracting Authority.

The minimum depth of cover over the installed pipe shall be ten times the amount of displacement from the diameter of the existing pipe or 3 feet (0.9lm) from the top of the existing pipe, whichever is greater. The Contractor may, with the prior approval of the Contracting Authority reduce the minimum depth of cover.

A minimum amount of ground heaving may be allowed, as determined by the Contracting Authority, if soil conditions are not favorable and up-sizing of the pipe is required. Unless otherwise noted in the Contract Documents, settlement or heaving of the ground surface during or after construction will not be allowed. The Contractor is solely responsible for the costs for repairing any surface heaving unless specified otherwise in the contract documents

13.0 Locating Service Connections

The Contractor shall locate all and expose all sewer service connections prior to pipe insertion to expedite reconnection. The Contractor shall exercise due diligence in excavating the existing pipe sufficiently to allow for uniform circumferential expansion of the existing pipe through the service connection pit. Upon commencement of the bursting process, pipe insertion shall be continuous and without interruption from one entry point to another, except as approved by the Contracting Authority. Upon completion of insertion of the new pipe, the Contractor shall expedite the reconnection of services to minimize any inconvenience to the customers.

14.0 Pipe Joining

The polyethylene pipe (HDPE) shall be assembled and joined at the site using the butt-fusion method to provide a leak proof joint. Threaded or solvent-cement joints and connections are not permitted. All equipment and procedures shall be used in strict compliance with the manufacturer's recommendations.

Fusion shall be preformed by technicians certified by a manufacturer of pipe fusion equipment.

The butt-fused joint shall be true alignment and shall have uniform rollback 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 or greater than that of the pipe. All joints shall be subject to acceptance by the Contracting Authority prior to insertion.

The Contractor shall cut out and replace defective joints at no additional cost to the Contracting Authority. Any section of the pipe with a gash, blister, abrasion, nick, scar, or other deleterious fault greater in depth than ten percent (10%) of the wall thickness (ASTM 585), shall not be used and must be removed from the site. However, a defective area of the pipe may be cut out and the joint fused in accordance with the procedures stated above. In addition, any section of the pipe having other defects such as concentrated ridges, discoloration, excessive spot roughness, pitting, variable wall thickness or any other defect of manufacturing or handling as determined by the Contracting Authority shall be discarded and not used.

Terminal sections of pipe that are joined within the insertion pit shall be connected with a mechanical coupling (e.g. a full circle stainless repair clamp), Electro Fusion Couplings (e.g. Central Plastics or equivalent) or a non-shear restraint coupling. All connections shall be in conformance with the manufacturer's installation procedures.

15.0 Bypassing of Flows

The Contractor shall be responsible for continuity of sanitary sewer service to each facility connected to the section of sewer main during the execution of the work, and shall also bypass the main sewer flow around the pipe to be replaced, or into adjacent sanitary sewers, if available. The pumps and the bypass lines shall be of adequate capacity and size to handle all flows without sewage backup to private property. The Contractor shall be solely responsible for clean-up, repair, property damage costs and claims resulting from failure of the diversion system.

The Contractor shall submit to the Contracting Authority for approval a description of the bypass pumping method. The Contractor, at the sole discretion of the Contracting Authority, may plug the main line sewer at an existing upstream Manhole or by any other method specified in the contract documents and approved by the Contracting Authority.

The Contractor shall submit to the Contracting Authority specifications for all pumping equipment to be used on the job (including all sizing calculations) and a list of all backup pumping equipment to be held in reserve on the job site. 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 reconstruction item.

16.0 Lubrication

Lubrication shall be used if in the opinion of Contractor such lubrication is necessary to ensure the successful completion of the job. The Contractor shall use a lubricant approved by the Contracting Authority.

17.0 Service Reconnection

The Contractor, after a suitable relaxation period shall reconnect all service connections as approved by the Contracting Authority.

The installed pipe shall be allowed the manufacturer's recommended amount of time (Appendix 4 - High Density Polyethylene (PE) Pipe), but not less than four (4) hours, for cooling and relaxation due to tensile stressing prior to any reconnection of service lines.

Service connections shall be reconnected to the pipe by using connectors approved by the pipe manufacturer and in conformance with the specified installation procedure. Service connections shall be wrap type around saddle connections (e.g. FERNCO or equivalent), Cast Iron w/ Gasket, T Connection (e. g, Inserta-T or equivalent or Electro Fusion (e.g. Central Plastics, Phillips Driscopipe, Plexco or equivalent)

Connections to the existing service pipe shall be made using flexible couplings. All flexible couplings shall conform to ASTM C425. Joint deflection limits and lateral connections shall meet the maximums indicated in ASTM C12 and C425.

The slope of the existing lateral toward the newly installed sewer main shall be maintained at the existing percent. For reconstructed laterals, a minimum slope of two percent (2%) or as specified by the Contracting Authority is required.

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 Fowler Manufacturing Co or equivalent and installed using procedures and equipment as referenced in manufacturer's written installation instructions.

Connection Types Available for All Mainlines

TYPES	GASKETTED BELLSDR 35	GASKETTED BELLIPS/SCH 40
PVC Hub	ASTM D3034 SDR 35	ASTM D3034 SDR 26
Rubber Boot	ASTM C443	ASTM C443
Band	301 SS	301 SS
Screw	305 SS	305 SS
Housing	301 SS	301 SS
Gasket	ASTM F477	ASTM F477

18.0 Restoration

18.1 Restoration of Manholes
The Contractor shall restore all manholes and associated surface areas to their original condition or as required by the Contracting Authority and specified in the description of work

Prior to restoring manholes the installed pipe shall be allowed the manufacturer's recommended amount of time, but not less than four (4) hours, for cooling and relaxation due to tensile stressing prior to the sealing of the annulus or backfilling of the insertion pit. Sufficient excess length of new pipe, but not less than two (2) to 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 Electro Fusion coupling or equivalent. The electro fusion couplings shall be slipped over pipe ends against manhole wall and fused in place. Installation of electro fusion couplings shall be done in accordance with the manufacturers recommended procedures.

Following the relaxation period, the newly installed pipe shall be restrained and sealed at the Manhole in accordance with the manufacturers recommended procedures and with a material approved by the Contracting Authority.

Restoration of the bottom of the Manhole shall be done as follows:

a. For restorations less than or equal to three inches grout shall be used. The grout design mix shall meet or exceed 500 psi (3,447 kPa) compressive strength at 28 days. The Contractor may, with the approval of the Contracting Authority, incorporate grout additives to improve flow properties, provided that the minimum compressive strength requirements are met.

b. For restorations greater than three inches concrete shall be used. Concrete shall be as specified in the Contract Documents.

18.2 Restoration of Pits
The Contractor shall restore all lateral, launching pits and associated surface areas to their original condition or as required by the Contracting Authority and specified in the description of work.

Prior to backfilling lateral and launching pits the Contractor shall ensure that the new pipe is properly supported and on the required grade. Stone or other suitable material, approved by the Contracting Authority, shall be used immediately under the new pipe as support in order to avoid sagging after backfill and compaction.

19.0 Field Testing

The Contractor shall after the existing sewer is completely replaced perform an internal inspection with a television camera and videotape. The finished tape shall be continuous over the entire length of the sewer between two manholes or as specified by the Contracting Authority.

The newly installed pipe shall be visibly free of defects, which may affect the integrity or strength of the pipe. If in the opinion of the Contracting Authority such defects exist the pipe shall be repaired or replaced at the Contractor's expense.

Any section of the pipe with a gash, blister, abrasion, nick, scar, or other deleterious fault greater in depth than ten percent (10%) of the wall thickness shall not be used and must be removed from the site.

20.0 CCTV Inspections

The Contractor shall perform post installation internal television inspections as required by the Contracting Authority. Each reach of sewer shall have audio description with appropriate stationing of services indicated. The data and stationing are to be on the video. All such inspections shall be performed by personnel trained in locating breaks, obstacles and service connections by closed circuit color television.

Post construction video tapes are to be submitted to the Contracting Authority for review prior to final payment. Should any portion of the inspection tapes be of inadequate quality or coverage, as determined by the Contracting Authority, the Contractor will have that portion video taped at no additional expense to the Contracting Authority. All original video tapes remain property of the Contracting Authority. The Contractor may, at the discretion of the Contracting Authority retain second copy.

21.0 Measurement and Payment

The Contractor shall complete an application for payment for work accomplished up to the date stated in the application for payment. The application for payment shall be submitted no more than once per month or as otherwise agreed to by the Contracting Authority

Payment shall be based on the Payments Schedule and paid in accordance with the terms and conditions of the contract

The price per foot installed of the pipe specified shall include full compensation for furnishing all labor, materials, tools, equipment and back up equipment (necessary for pipe bursting, pipe; transportation and technical competence, saw cutting, traffic control, excavation, shoring and backfilling per the manufacturers' instructions and/or per the Contract Documents; off-site disposal of all refuse and excess material; de-watering as necessary; bypassing sewer mains and live service connection flows; service reconnections; rebuilding existing Manhole inverts, bottom and channel to match newly installed pipe; CCTV inspection, temporary and permanent restoration of surfaces and pavement and all appurtenant work.
Pipe shall be measured along the longitudinal axis between the ends as laid, shall include the actual pipe in place and shall exclude the inside dimensions of the Manholes.

Replacement and modification of the Manhole inverts and bottoms shall be considered as part of the trenchless pipe replacement operation, and no additional compensation will be allowed.

Alternately payment shall be based on a payments schedule. Such a schedule to be developed by the Contracting Authority and included in the Request for Proposal (RFP), Request for Quote (RFQ) or Invitation to Bid (ITB). An example of a payments schedule can be found in Appendix 3 - Sample Bid Tabulation Payments Schedule.

APPENDIX 1
TYPES OF PIPE BURSTING EQUIPMENT

General

Various types of specialized equipment are utilized in pipe bursting projects. The various types of equipment are generally unique to each of the generic methods. The main difference between methods is the manner in which the force is generated and transferred to the host pipe during the bursting operation.

Static Pipe Bursting

Static Pipe Bursting uses static forces that are generated using potential energy. A pulling force is applied to a tapered or blunt nosed bursting head through the rods, chain or cable and is simply pulled through the old pipe. This causes the pipe to fail in tension by the radial force applied to the pipe wall from by bursting head within the pipe. As the bursting head advances, the old pipe is fragmented and the new pipe line is simultaneously installed. The static pipe bursting winch equipment is modeled after high-powered hydraulic jacks, mounted horizontally, or a high tension drum type of winch. Winching forces of up to 225 tons are typical for this method. This method is used in pipes 4-inches to 40-inches in diameter or larger.

Pneumatic Pipe Bursting

Pneumatic Pipe Bursting is done by creating an impact load in the pipe by applying a "hoop" stress into the pipe causing it to burst in tension. This technique uses a pneumatic bursting head with a properly sized expander, and relies on percussive hammering action to break out the old pipe in which the tool travels. Simultaneously the new replacement pipe is installed into the space created by the pneumatic bursting head and expander. A winch cable is attached to the nose of the bursting head to maintain correct line and grade by providing constant pulling tension and enhancing the percussive force. Winching forces up to 20 tons are typical for this method. This technique is primarily aimed at the replacement of gravity pipes as well as pressure pipes, and has been used in diameters ranging from 4-inches to 54-inches or larger.

Hydraulic Pipe Bursting

Rather than the pipe being burst from the transfer of a pulling or hammering radial force into the plane of the pipe diameter, the bursting head diameter expands, fragmenting the pipe from the inside.

The bursting head is equipped with "petals" which open and close under hydraulic pressure. Using hydraulic cylinders, the bursting head first expands to crack the host pipe, then contracts to allow the winch to pull the pipe string forward, while tension is applied to the nose of the head using a winch cable to maintain directional stability. Hydraulic bursting is primarily used for on-line replacement of sewers and gravity pipelines 6-inches to 20-inches in diameter or larger.

APPENDIX 2
PARAMETERS and CONDITIONS

Host Pipe Suitable for Bursting

1. Vitrified Clay Pipe (VCP) in diameters 4-inch to 42-inch commonly used in sewers and other utilities is very brittle and can be readily burst. The ability to fracture the pipe and

compact the fragments into the surrounding soil make it an ideal pipe to burst. It should be noted that concrete encased point repairs, and at times concrete adjacent to the manholes or structures, may slow-up or stop the bursting process.
2. Concrete Pipe of all sizes has been used in all utilities, except gas service, and may or may not have steel reinforced cage. Normally, 12-inch diameter and less is non-reinforced concrete pipe and fractures similar to VCP. The amount of reinforcement, i.e. single or double cage will dictate the burst type selection and success.

3. Cast Iron Pipe (CIP) has been used in all utilities except telephone service and can be very brittle but slightly different than VCP. Although fracturing easily, it does require special lead equipment to protect the winch rope from possible damage. Bell and spigot type joints for CIP require a blade-type nose extension to help crack the large cross section of material contained in the joint, i.e. lead, jute or hemp, asphalt and/or elastomeric materials. A HDPE new pipe should have a DR 17 or lower to prevent sharp fragments from damaging the pipe.

4. Asbestos Cement (AC) pipe has been used on all utilities and has good bursting features, similar to VCP. AC pipe contains asbestos material which is carcinogenic. Therefore, pipe bursting is much safer than dig-up and replace.

5. Plastic Pipes (i.e. PVC, PE, ABS, et al) possess varying degrees of material characteristics. Most plastics must be split longitudinally using special cutting blades on nose extensions. This may not permit sufficient soil expansion causing higher friction on the new pipe being pulled in. Normally the fragments are strips and do not cause damage to the new pipe.

6. Steel and ductile iron pipe (DIP) must be split by blades. This process is used in lieu of ripping, bursting or tearing the metal pipe. The new pipe is then pulled into the expanded host pipe.

Host Pipe Size

Host pipe size will affect both hammer/expander combinations and winch selection. Small diameter host pipe in difficult soil conditions can present problems because a larger, more powerful hammer will not fit inside the host pipe. Special nose tools can be adapted to solve these problems.

Host Pipe Depth

The depth of the host pipe affects the bursting process in a number of ways, such as:

1. Existence of groundwater or more groundwater depth requires dewatering or additional dewatering.

2. Soil expansion subsequent to the pipe burst may become more difficult due to the additional soil weight.

3. Depending upon the type of soil, upsizing new pipe may require additional soil expansion.
4. Entrance and exit pits will require additional shoring due to required safety procedures.

5. The magnitude of an allowable bend in alignment may require reduction due to the additional soil load.

Surrounding Soil Types

The type of soil surrounding the host pipe should be identified. Some soil types are easily expanded and remain in the expanded size permitting relative ease for new pipe pull-in. Other soils may be loose and/or running, and may require the use of Bentonite or polymers that provide some structural support, permitting new pipe pull-in. Very weak soils may not support the weight of the pipe bursting equipment and these should be avoided.

New Pipe and Size

Most pipe bursting projects utilize fused lengths of HDPE pipe. The HDPE wall thickness is identified by the use of its dimensional ratio (DR) for a given size. The DR number is obtained by dividing the wall thickness (t) into the pipes outside diameter (OD) value (i.e. - the lower the DR, the greater the wall thickness). Other pipe material types have been used and these are shown in Section 9.0 of this specification.

The ability to up size or install a new pipe larger in diameter than the host pipe is unique to pipe bursting. The amount of up size is limited by a combination of all the host pipe parameters as shown in the Project Design Chart in Section 1 of this specification. Generally, one or two up sizes can be accomplished (e.g. - 6-inch to 8-inch or 8-inch to 10-inch constituting a 33% to 67% increase in diameter).

Service Excavations

In sewer application, service laterals are located by closed circuit television (CCTV) inspection of the host pipeline. In gas applications, locating devices are used. It is recommended that all service laterals be exposed prior to bursting to reduce damage and permit a reduction in time for service reinstatement. Excavation of the service lateral pits shall allow for equal 360 degree expansion or bursting of the existing pipe.

Launching and Exit Pits

Pits are usually located outside of heavy traffic areas, e.g. intersections, etc., and generally near manholes to permit gradual

entry of the burst equipment and new pipe into the host pipe. Launch pits should, as a rule of thumb, be 2.5X the depth of the existing pipe. Steep entries may put excessive strain and friction on the new pipe.

Exit pits must be sized to permit pipe bursting equipment removal and allow manhole connections to the new pipe.

The pipe shall be bedded and installed within the launching and exit pits to correct line and grade.

Burst Length

Most proposed sewer burst lengths are manhole to manhole. Longer bursts are possible, but are heavily dependent on the size of the old pipe, up sizing, depth and soil conditions. See Project Design Classifications in Section 1 of this specification.

The use of lubricants is usually recommended as a method that permits larger burst lengths.

Manhole Preparation

Entry and exit holes in the manhole must be enlarged permitting the pipe bursting equipment and new pipe to pass through and remain on grade. This may also necessitate manhole invert modifications.

General Guidelines for the use of Lubricants

1. When the new pipe is equal to or greater than 2 times the diameter of the existing pipe

2. Burst length exceeds 300 feet

3. Diameter of new pipe exceeds 12 inches

4. Host pipe is under groundwater

5. Free flowing soil conditions

6. As recommended by the pipe bursting equipment manufacturer.

Project Considerations

The following variables should be considered when planning a pipe bursting project, method and the length of the run

1. The depth of the existing pipe and the replacement pipe

a. The minimum depth of cover over the installed pipe using this process shall be two (2) to three (3) times the diameter of the replacement pipe or 3 feet (0.9lm), whichever is greater. With prior approval of the ENGINEER, the minimum depth of cover may be reduced.

2. Host pipe material, and accurate condition assessment (Current CCTV Inspection)

3. Diameter and profile of host pipe

4. Soil condition and types

5. Topography of the ground subsurface above the line to be replaced.

6. Adjoining utilities and services

a. Minimum clearance from the other utilities shall be approximately two feet or greater. With prior approval of the ENGINEER, the minimum clearance may be reduced. All interfering and crossing utilities must be located and may need to be exposed prior to bursting.

7. Service excavations

8. Product pipe material

APPENDIX 3
SAMPLE BID TABULATION PAYMENTS SCHEDULE

The example below is to be used as a guideline in developing a payment(s) schedule for a pipe-bursting project. The actual payments schedule is based on the Contracting Authority's project specification.

Bid Item Description	Qty	Unit	Spec #	SC#	Unit $	Total $
Pipe Bursting 6" - 8" Sewer to 9.05" OD SDR 19, HDPE Pipe (0' - 4' Deep)	500	LF	223.1		X	500X
Pipe Bursting 6" - 8" Sewer to 9.05" OD SDR 19, HDPE Pipe (4' - 8' Deep)	750	LF	223.1		X	750X
Pipe Bursting 3" - 4" Service Lateral to 4.5" OD SDR 17, HDPE Pipe (0' - 4' Deep)	50	LF	223.2		X	50X
Pipe Bursting 3" - 4" Service Lateral to 4.5" OD SDR 17, HDPE Pipe (4' - 8' Deep)	50	LF	223.2		X	50X
Adjust/Reset Manhole Frame and 32" Diameter Cover, Up to One Foot	1	EA	224		X	X
Adjust/Reset Manhole Frame and 32" Diameter Cover, Excess Over One Foot	1	VF	224		X	X
Lateral Connection (PVC to PVC) @ 8" - 12" HDPE (0' - 4' Deep)	12	EA	225.1		X	12X
Lateral Connection (PVC to PVC) @ 8" - 12" HDPE (4' - 8' Deep)	24	EA	225.1		X	24X
Connection to Existing Manhole 6" Service Lateral	8	EA	220.1		X	8X
Connection to Existing Manhole (New HDPE Pipe)	9	EA	220.1		X	9X
Soil Backfill	200	CY	242.1	1	X	200X
Sod Replacement	50	SY	242.2	2	X	50X
Pavement Removal	75	SY	242.3	1	X	75X
Remove Curb and Gutter	25	LF	242.3	1	X	25X
Install City Standard Pavement	75	SY	242.4	3	X	75X
Install City Standard Curb and Gutter	25	LF	242.4	3	X	25X
Open Cut Work	1	CE	250			
General Conditions (Max X% of Total Bid)	1		200			
Payment and Performance Bond (Max X% Total Bid)	1		201			
Testing Allowance	1		203			
Total Bid						$XXX

LF = Linear Feet; EA = Each; V F = Variable Footage
CY = Cubic Yard; SY = Square Yard; CE = Contractor Estimate

APPENDIX 4 - High Density Polyethylene (PE) Pipe

The following links are provided as a source of information on PE pipe. IPBA makes no claim that this list is comprehensive nor is it responsible for the content provided on the sites.

Chevron Phillips Chemical Company:
http://www.cpchem.com

ISCO Industries:
http://www.isco-pipe.com

APPENDIX 5 - British Gas Patents

For information on British gas patents contact:

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