

SECTION 02734
PIPE BURSTING

PART 1 – GENERAL

1.01 WORK INCLUDED

- A.** Sewer renewal using the pipe bursting method has been developed to enable a range of relatively small sewer pipe to be replaced without open-cutting.
- B.** The scope of work requires the Contractor to provide all materials, labor, equipment, and services necessary for bypass pumping, and/or diversion of sewage flows, rehabilitation of existing sanitary sewers by bursting the existing pipe and inserting a high density polyethylene pipe (HPDE), reconnection of active sewer lateral connections, anchoring new pipe, and initial and final cleaning & CCTV inspection and final testing of the pipe system.
- C.** The sewer replacement work details include:
 - 1. Site Planning and Preparation**
 - a. Perform Site Investigation.
 - b. Perform Initial Cleaning and Close Circuit TV Inspection.
 - c. Formulate and execute plans for launching pit excavation, layout for sewer by-pass pumping system, marking existing utilities, laterals, cleanout, etc.
 - 2. Pipe Installation**
 - a. Excavate Launching Pit.
 - b. Install Sewer By-Pass Pumping System.
 - c. Excavate to Relieve Affects of Bursting to Existing Utilities.
 - d. Excavate to Expose All Active Laterals.
 - e. Temporary Disconnect / Plug All Active Laterals Connections.
 - f. Install New Sewer Pipe by Pipe Bursting Method.
 - g. Anchor Pipe and Seal Manholes.
 - h. Replace Existing Active Laterals, Cleanouts, and Lampholes.
 - i. Reconnect All Active Lateral Connections to New Sewer Main. Disconnect and plug all inactive laterals.
 - j. Perform Final Cleaning and Close Circuit TV Inspection.
 - k. Remove Sewage By-Pass System.
 - l. Backfill and Restore Excavations.
 - 3. Cleanup and Restore Existing Surface Condition and Structures.**
 - 4. Repair Defective Work Per Engineer's Final Inspection.**

- C. The Contractor is responsible for proper and accurate installation of the new sewer pipe regardless of the method described in this section and the following subsections. The Contractor shall ensure that the new pipe's vertical and horizontal alignment is as indicated on the plans and in accordance with these specifications.
- D. Supplying all labor, materials, equipment and apparatus not specifically mentioned herewith or noted on the plans, but which are incidental and necessary to complete the work specified.

1.02 APPLICABLE PUBLICATION

- A. Reference Specifications: This specification references American Society for Testing and Materials (ASTM) and American Welding Society (AWS) standard specifications, which are made a part hereof by such reference and shall be the latest edition and revision thereof. Conformance to the following shall be required.

ASTM D-1238	Measuring Flow Rates of Thermoplastics by Extrusion Plastometer
ASTM D-1248	Specification for Polyethylene Plastics Molding and Extrusion Materials
ASTM D-1505	Density of Plastics by the Density-Gradient Technique
ASTM D-1599	Test for Short Term Rupture Strength of Plastic Pipe, Tubing and Fittings
ASTM D-1693	Test for Environmental Stress-Cracking of Ethylene Plastics
ASTM D-1928	Preparation of Compression Molded Polyethylene Test Samples
ASTM D-2122	Determining Dimensions of Thermoplastic Pipe and Fittings
ASTM D-2321	Underground Installation of Thermoplastic Flexible Sewer Pipe
ASTM D-2657	Practice for Heat-Joining Polyolefin Pipe and Fittings
ASTM D-2837	Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials
ASTM D-3035	Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter (Up to 6" IPS)
ASTM D-3261	Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
ASTM D-3350	Specification for Polyethylene Plastic Pipe and Fittings Material
ASTM F-585	Practice for Insertion of Flexible Polyethylene Pipe into Existing Sewers
ASTM F-714	Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter (3" IPS and larger)
AWS D1.1	AWS Standard Qualification Procedure

1.03 WARRANTY AND QUALITY ASSURANCE

- A. General Bid Requirements:

1. The bidder, or his/her Sub-contractor, shall be properly licensed and trained to perform pipe bursting, having at least 10,000 lineal feet of successful installation in the United States within the last 2 years, in pipelines ranging from 4 to 12 inches. Documentation of the licensing and experience and details of two years minimum training of the on-site foreman and the installers who will perform the actual pipe bursting system, shall be provided with the bid.

- B.** The Contractor shall provide to the City a warranty to be in force and effect for a period of one (1) year from the date of acceptance by the City. The warranty is inclusive of the Contractor to repair or replace the pipe should failure result from faulty material or installation.
- C.** Correction of failed HDPE pipe deemed unacceptable, as a result of the post video inspection shall be the responsibility of the Contractor, at no extra cost to the City. Method of correction/repair shall be approved by the City.
- D.** The finished HDPE pipe shall be continuous over the entire length of run between the launching and receiving pits and shall be free from visual defects.
- E.** The Contractor shall carry out the operations in strict accordance with all applicable OSHA regulations.
- F.** Delivery, Storage and Handling
 - 1. Transport, handle, and store pipe and fittings as recommended by manufacturer.
 - 2. If pipe and fittings become damaged before or during installation, it shall be repaired as recommended by the manufacturer or replaced as required by the Engineer at the Contractor's expense, before proceeding further.
 - 3. Deliver, store, and handle other materials as required to prevent damage.
- G.** Only those tools designed for the aforementioned procedures, and approved by the pipe manufacturer or supplier and the ENGINEER, shall be used for assembly of pipe fittings to ensure proper installation. The heater plate shall be equipped with suitable means to measure the temperature of plate surfaces and to assure uniform heating such as thermometers or pyrometers.
- H.** The CONTRACTOR shall televise the installed pipe after existing services have been reconnected and manhole work has been completed. The original television inspection files in Wincan version 8 format shall be provided to the ENGINEER. The CONTRACTOR shall repair all damages found during the review of the final video inspection. The damages shall include but not limited to sags, leaks, cracks, unsecured joints, visual defects, and others which in the opinion of the ENGINEER are not acceptable and would impair the serviceability of the new piping system.

1.04 SUBMITTALS

- A.** Submit the following Contractor's Drawings:
 - 1. Shop drawings, catalog data and manufacturer's technical data showing complete information on material composition, physical properties, and dimension of pipe and fittings. Include manufacturer's recommendation for handling, storage, and repair of pipe and fittings if damaged.
 - 2. The Contractor shall prepare and submit for the Engineer's approval a detailed description of the Pipe Bursting Plan, including materials and equipment, lateral reconnection, bypass pumping system, plan of operation, schedule of work, etc. No work shall begin prior to approval by the Engineer of the Contractor's Pipe Bursting plan. The followings should be included:

- a. Detail drawings and written description of the entire construction procedure to bypass sewage flow, install pipe, reconnection of sewer house connections.
 - b. Working drawings for showing excavation locations, dimensions, sheeting and shoring, method of dewatering, and other utilities that may be affected; width and length of working area, access pit, and portion of existing sewer to be removed to conduct the work; sewage flow by-pass; and maintenance of traffic.
 - c. Design of the sheeting and shoring for the excavations, and dewatering shall be the Contractor's responsibility.
- B.** Television inspection reports and video tapes made prior to and after pipe insertion. (See Section 02732 for details of submittals).
- C.** Grout and design mixes and grout testing reports.
- D.** Certification:
1. Certification by the manufacturer that all pipe and fittings furnished under this specification were manufactured, sampled, tested, and inspected in accordance with ASTM D3350 and ASTM F714. Certification shall be signed by an authorized agent of the manufacturer.
 2. The CONTRACTOR performing the pipe installation shall be certified by the pipe bursting system manufacturer that the CONTRACTOR is a licensed installer of the manufacturers' system.
 3. Polyethylene pipe jointing shall be performed by personnel trained in the use of joint fusion and stab joint equipment and recommended methods for pipe bursting connection. Personnel directly involved with installing the pipe shall receive training in the proper methods for handling, inserting, trimming, and finishing the pipe. The Contractor shall provide a certification of training and experience for each fusion and installing crew member.
 4. The Contractor shall perform trial fusion welds and submit samples to the owner for review prior to installation of the pipe. Full penetration welds shall provide homogenous material across the cross section of the weld. The fusion machine employed for the trial welds shall be the same machine to be utilized for the installation work.
 5. Fusion equipment shall be operated only by technicians who have been certified by the pipe manufacturer or supplier who have a minimum of two (2) years of experience fusion welding 4-inch or larger diameter pipelines. The technician's experience shall be documented in the HDPE pipe material.
- E.** The CONTRACTOR shall submit a sewage bypass pumping and/or diversion plan for review by the ENGINEER at least 10 days prior to pipe installation. The sewage bypass pumping and/or diversion plan shall include an emergency response plan to be followed in the event of a failure of the bypass pumping and/or diversion system. The CONTRACTOR shall notify the ENGINEER 24 hours prior to commencing the bypass pumping operation. The CONTRACTOR'S plan for sewage bypass pumping and/or diversion shall be satisfactory to the ENGINEER before the CONTRACTOR shall be allowed to commence sewage bypass pumping and/or diversion.

- F. **As-built drawings:** The CONTRACTOR shall indicate and draw, with clear and accurate dimensions, on plans the as-built locations of newly installed sewer mains, laterals and cleanouts.

1.05 JOB CONDITIONS

- A. Note and conform to conditions and requirements indicated and specified under Section 02202 of these Specifications.
- B. Contractor shall conduct operations and schedule cleanup in a manner to cause the least possible obstruction and inconvenience to traffic, pedestrians and to adjacent property owners or tenants.

PART 2 - PRODUCTS

2.01 GENERAL

- A. The CONTRACTOR shall provide polyethylene pipe as specified. The pipe shall be made to diameter and tolerances in accordance with ASTM D3035. The minimum ratio of orthogonal diameters prior to installation shall be 0.95. All pipe shall be made from virgin grade material. The pipe shall be of the diameter and class shown or specified and shall be furnished complete with all fabricated fittings, and other appurtenances as necessary for a complete and functional system.

2.02 HDPE PIPE, JOINTS AND FITTINGS

- A. Unless approved otherwise by the Engineer, pipe and fittings shall be **SDR 17**, Extra High Molecular Weight, High Density Polyethylene PE 4710, Cell Class PE445574C, per ASTM D3350. Pipe shall be co-extruded using a melt homogenizing/plasticating extruder and appropriate die.
- B. The pipe and fittings materials shall meet the requirements for Type III, Class C, Category 5, Grade P34 material as described in ASTM D1248. Pipe and fittings shall be made in conformance with ASTM F714 and ASTM D3261 as modified for the specified material. The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same specification from the same raw material pipe.

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- 1. Pipe, fittings, and joints shall meet or exceed the following physical properties:

ASTM

Nominal

<u>Property</u>	<u>Test Method</u>	<u>Value</u>
Density, gm/cc	D 1505	0.96
Melt Index, gm/10 min.	D 1238-E	0.10
High Load Melt Index, gm/10 min.	D 1238-F	12.0
Tensile Strength @ Break, psi	D 638	4,500
Tensile Strength @ Yield, psi	D 638	>3,400
Elongation, %	D 638	>700
Flexural Modulus, psi	D 790	136,000
Environmental Stress Cracking Resistance F20' Hours (100°C)	D 1693 (Cond. C)	>5,000
Brittleness Temperature, ^o	D 746	<-103
Melting Point, ^o F	D 789	261
Vicat Softening Temperature, ^o F	D 1525	255
Hardness, Shore D	D 2240	64
Volume Resistivity,ohm-cm	D 991	2.6X10(16 th)
ASTM D 1248 Classification:	Type III Class C Category 5 Grade P 34	
ASTM D 1248 Classification:	445574C	
RECOMMENDED HYDROSTATIC DESIGN STRESS:	800 psi @ 73.4°F 400 psi @ 140°F	

2. Pipe and Fittings Markings:

- a. Pipe shall be marked at 3-foot intervals or less with the manufacturer's name (or trade mark), the designation ASTM D3350 and ASTM 714, including the year of issue, the letters "PE" followed by the cell classification number of the raw material compound used and the polyethylene grade per ASTM D1248, and the Hydrostatic Design Basis in hundreds of psi; the nominal pipe size in inches, the dimensional ratio, and the manufacturer's code identifying the resin manufacturer, lot number, and date of manufacture.
- b. Fittings shall be marked with the manufacturer's name (or trade mark), the designation ASTM D3350 and ASTM 714, and the manufacturer's code identifying the resin manufacturer, lot number, lot number, and date of manufacture.

3. Pipe and Fittings shall be homogeneous throughout and free of:
- a. Serious abrasion, cutting, or gouging of the outside surface extending to more than 10 percent of the wall thickness in depth.
 - b. Cracks
 - c. Kinking (generally due to excessive or abrupt bending)
 - d. Flattening
 - e. Holes
 - f. Blisters
 - g. Other injurious defects
- C. They shall be uniform in color, opacity, density, and other physical properties. Any pipe and fittings not meeting these criteria shall be rejected.
- D. The average outside diameter and wall thickness of pipe and fittings shall conform to Table 1 when measured in accordance with ASTM D2122.

TABLE 1				
Nominal Size (inches)	Nominal OD (inches)	Minimum Wall Thickness SDR26 (inches)	Minimum Wall Thickness SDR17 (inches)	Minimum Wall Thickness SDR11 (inches)
3	3.5	0.135	0.206	0.318
4	4.5	0.173	0.265	0.409
5	5.563 5.375	0.214 0.207	0.327 0.316	0.506
6	6.625	0.255	0.390	0.602
7	7.125	0.274	0.419	0.648
8	8.625	0.332	0.507	0.784
10	10.75	0.413	0.632	0.977
12	12.75	0.490	0.750	1.159

E. Pipe and Fittings Color: Pipe and fittings shall conform to the following:

- 1. Inside: The inner wall shall be white, light green, light red (vitrified clay color), or natural. Yellow, black, and light purple are not acceptable.

2. Outside: The outer wall shall be black, white, light green, light red (vitrified clay color), or natural. Yellow and light purple are not acceptable.
3. Both the inside and outside may be the same color.

F. Joints:

1. Pipe lengths shall be assembled in the field with butt-fused joints in accordance with ASTM D 2657 and the pipe manufacturer's written instructions shall apply. Butt-fused joints shall have internal bead projections of not more than 1/4 inch. Bead projections on the outside and inside of the pipe shall be removed. Joint strength shall be equal to or greater than the pipe and shall indicate a ductile rather than brittle fracture when tested.
2. Joint with Fusion Equipment: The fusion machine shall have hydraulic pressure control for fusing two pipe ends together and shall be equipped with gauges to monitor fusion pressures. The machine shall be equipped with an electric or gasoline engine powered facing unit to square and trim the pipe ends smooth and provide full surface contact with the heating plate. The heating plate on the fusion machine shall be electrically heated and thermostatically controlled with a temperature gauge and be capable of maintaining 500°F with a tolerance of 10°F. Fusion temperature shall be as recommended by the pipe manufacturer.

2.03 PVC PIPE, JOINTS AND FITTINGS

- A.** Shall conform to Section 02730-Sanitary Sewers of these specifications

2.04 SANITARY SEWER LATERALS

- A.** Contractor shall verify location and diameter of all active laterals.
- B.** Sanitary sewer lateral shall be installed to conform to the City's Standard Details or modified herein as shown in the Contract Drawings. Connections to the HDPE main shall be performed using electrofusion wye saddles.
- C.** Heat fusion electrofusion wye saddles shall be made of polyethylene pipe compound that meets the requirements of ASTM D1248, Class C and suitable for fusion welding to polyethylene pipe. Fusion saddles shall be electrofusion wye saddle as manufactured by Central Plastics Company, Driscopipe, Miller, Dupont or approved equal.
- D.** Connections to the existing sewer house connection pipe shall be made using sleeved stainless steel flexible couplings. All flexible couplings shall conform to ASTM C425 and be manufactured by Fernco Joint Sealer Co., DFW Plastics, Inc. or approved equal.
- E.** For laterals shown to be constructed using open cut method, the Contractor shall conform to Specification Section 02730 Sanitary Sewers.

2.05 SANITARY SEWER CLEANOUTS

- A.** Install sanitary sewer cleanouts per project details and specifications.

- B. Wye branches and risers for sanitary sewer cleanouts shall conform to the City's project details.
- C. Cleanout box shall be Christy concrete type F08 Curb Valve Box with F08R lid marked "SEWER" when installed in location not subject to vehicular loading.
- D. When installed in location subject to vehicular loading, cleanout box shall be Christy concrete type G05T Traffic Valve Box with G05CT Traffic Lid marked "SEWER" and shall be provided with 8" concrete base.

2.06 GROUT

- A. The grout design mix shall meet or exceed 500 psi compressive strength at 28 days tested accordance with ASTM C495 or C109. Contractor may incorporate grout additives to improve its flow properties, provided the minimum compressive strength requirements are met.

2.07 EQUIPMENT

- A. External and Internal Bead removers shall be McElroy Manufacturing, Inc. or equal.
- B. Bursting head/mechanism must be capable of pipe bursting existing repair section of cast iron pipe with minimal damage to the immediate and above ground environment and structures.

PART 3 - EXECUTION

3.01 GENERAL

- A. This section is intended to provide the Contractor with general guidance on the methods to be used to install the sewer pipe using the pipe bursting method. Nothing contained herein shall relieve the Contractor from completing the pipe bursting operation in the most feasible, efficient and safe manner, using required materials to the lines and grades shown on the plans and to the requirements of these specifications.

3.02 SITE INVESTIGATION

- A. Prior to pipe bursting operation, the Contractor shall perform a careful site investigation to locate and record possible surface obstructions, locate and mark active and inactive sewer laterals; and formulate and submit plans to replace the pipe, to reconstruct all sewer laterals, and to restore all structures and plants that would be damaged by the project work.

3.03 PREPARATION

- A. Preliminary Site Work
 - 1. Excavation of launch areas, etc. shall be carried out according to the planned schedule submitted to the Engineer prior to commencement of work.

2. Installation of by-pass pumping equipment shall be complete and operational.
3. All buried utilities adjacent to the line of operation shall be reviewed and where necessary excavated to relieve transient loading during the insertion operation.
4. Excavations for all active house connection laterals shall be completed before the insertion of the new pipe. Manhole positions along the line of insertion and lateral excavations will be used to check progress as the head passes these points.
5. Any heavy concrete reinforcement present along the line of insertion shall be broken out prior to the operation to allow steady and free passage of the expander.

B. By-Pass Sewage

1. The Contractor shall furnish, install, and operate pumps, plugs, conduits, and other equipment to divert the flow of sewage around the pipeline reach in which work is to be performed. The plug shall be provided with a tag line. The pumping system shall be of sufficient capacity to handle existing flow plus additional flow that may occur during a rainstorm. If pumping is required on a 24-hour basis, engines shall be equipped in a manner to keep noise to a minimum. Standby pumps shall be provided as required. Pumping shall be done by the Contractor in such manner as will not damage public or private property or create a nuisance or health menace. The pumped sewage shall be in an enclosed hose or pipe and shall be reinserted into the sanitary sewer system. Sewage shall not be allowed to free flow in gutters, streets or over sidewalks, etc. Nor shall any sewage be allowed to flow into the storm inlets or conduits. After the work has been completed, flow shall be restored to normal.
2. The Contractor shall be responsible for continuity of sanitary sewer service (i.e. building laterals) to each facility connected to the section of sewer during the execution of the work. **Building laterals shall not be disconnected or plugged overnight**; that is continuing service on the laterals should not be interrupted during the peak flow period from 5 P.M. the day before to 9 A.M. the next day.

C. Cleaning and Closed Circuit TV Inspection for Sewer Pipe

1. Prior to pipe bursting operation, the Contractor shall perform an initial sewer cleaning and closed circuit TV (CCTV) inspection according to Section 02732 of this Specification to determine the general condition of the sewer, to remove any obstruction and debris, to determine defective pipe sections for point repairs, to log the location of all house laterals and to verify location of active house laterals.

D. Excavation

1. Existing utilities shall be located and protected as required by utility owners.
2. Excavation, dewatering, sheeting, shoring, and bracing shall be in accordance with FED-OSHA 29 C.F.R., Part 1926 Sub-Part P. Sewer house connections shall be exposed prior to pipe installation operation.

3. Access excavations shall be provided as required to facilitate the pipe bursting insertion. When practicable, they shall be located where interference to vehicular traffic and inconvenience to the public is minimized. Access excavations shall coincide with sewer house connections, changes in the sewer line and grade and to provide access to the sewer in both directions. Excavations that have pull or push equipment installed shall have adequate support provided to prevent damage to adjacent areas.

E. Locating Existing Sewer Lateral Connection

1. Upon completion by the Contractor of CCTV inspection, the Contractor shall mark in the field the location of the existing sewer lateral connection.
2. The Contractor shall expose the existing sewer lateral connection and make arrangements with the resident to access all the plumbing fixtures in each house and perform dye tests when necessary or other means to determine if the exposed sewer lateral connection is active. If access to the house fixtures is denied by the resident, the exposed sewer lateral connection shall be assumed active unless otherwise directed by the Engineer and shall be reconnected in accordance with these specifications.
3. All inactive sewer laterals shall be plugged at the sewer main.

3.04 PIPE BURSTING AND PIPE INSTALLATION

A. Site Organization

1. Excavation of launch pits shall be situated to provide minimum inconvenience to residents, businesses or traffic. Launch excavation will be situated to give maximum possible advantage to the insertion operation but more importantly to give minimum inconvenience to traffic and pedestrian users. Launch pits shall not be located in the easement areas and private property without permission of the homeowner and the Engineer.
2. Dimensions will vary with depth of cover and size of pipe and also pipe wall thickness. These latter parameters, together with ambient temperature, control the pipe bend radius and the pipe manufacturer's recommendations must be used to obtain the slit trench length.
3. A sump hole in the base of the excavations should be provided to allow pumping of water from the excavation.
4. Layout of a temporary by-pass pumping system to isolate the working area should take into account the location of pumps and pipes, possible pump failure contingency and avoidance of blocking entrances to homes, drives, bus stops, etc. Equipment used should be selected to give minimum noise levels and emission of fumes. All costs for this time are included in the bid price per linear foot of replacement.

5. Where buried utilities are known to exist, surface marking should be carried out and where necessary local excavations made to relieve the possibility or transferred loading. This is especially important in the case of gas mains which should be at least one foot away from the line of work. If nearer than this, special arrangements must be made with the local gas utility to comply with codes of practice.
6. Existing manholes shall be utilized where-ever practical. Remove manhole inverts and bottoms to permit access for installation equipment.
7. Support equipment used to perform the work shall be located away from buildings so as not to create a noise impact. Provide silencers or other devices to reduce machine noise as required to meet local requirements.

B. Pipe Installation

1. The Contractor shall remove internal bead.
2. Contact by radio shall be maintained between key positions at all times so that slowing down, stopping and starting can be effected when necessary.
3. The Contractor shall record the general progress, i.e. insertion rates in feet per minute, reasons for stoppages, signs of failure of equipment and road or other surface damage.
4. Particular care shall be exercised when passing buried utilities or when near building foundations.
5. At manholes or lateral excavations, the Contractor shall slow the rate of progress to examine the winch rope attachments on the head and the pipe retaining assembly at the rear of the head. Repairs and replacements in these positions are much easier than having to excavate to repair between positions.
6. Thread winch and associated lines through sewer section to be rehabilitated. Keep lines away from pedestrian and vehicular traffic.
7. For the method using sectional pipe, only existing manholes in the street may be used for launch and receiving access. Manholes in the easement area may be used only with the permission of the homeowner and the Engineer. Remove manhole invert and bottom as required.

3.05 ANCHORING PIPE AND SEALING MANHOLES

- A.** After the pipe has been installed in the entire length of the sewer section, anchor the pipe at manholes. The pipe shall protrude in the manholes for enough distance to allow sealing and trimming.

- B. Sealing the pipe at manholes providing a flexible gasket connector in the manhole wall at the end of the pipe, centered in the existing manhole wall. Grout the flexible connector in the manhole wall filling all voids the full thickness of the manhole wall.
- C. Restore manhole bottom and invert.

3.06 CLEANING SANITARY SEWERS

- A. Contractor shall flush and clean all sewer mains by means of pneumatic, sewer cleaning balls. The balls shall be of the appropriate size to fit the sewer pipe being cleaned. "Sewer Balling" operations shall be conducted by experienced personnel under the observation of the Engineer. The ball shall be introduced at the uppermost manhole and passed from manhole to manhole by means of a line with sufficient head of water to carry the ball along. The movement of the ball shall be controlled by a rope; care shall be exercised not to feed the ball too rapidly in order that all debris can be removed at each manhole.
- B. Each section of the sewer line shall be thoroughly cleaned before proceeding to the next section. Where sewer balls will not pass, flexible sewer rods with approved spears or cutters may be used to clear the obstruction. Where obstructions cannot be cleared by sewer rodding, the obstructions shall be removed by excavation at the Contractor's expense. The Contractor shall remove all debris from sewer lines using approved methods.
- C. Installation cost shall include cost for water for sanitary sewer flushing and cleaning operations.

3.07 TESTING SANITARY SEWERS

- A. Sanitary sewer systems including laterals, and sanitary sewer mains shall be tested for tightness after completion of all backfilling and prior to request for final inspection. Contractor shall notify the Engineer at least two (2) working days in advance of proposed testing dates. Tests of gravity sewers shall be made from end or manhole to manhole unless grades are flat enough to permit testing two or more sections at one time. Sections which fail to pass the tests shall be repaired or replaced, and the section retested until it falls within specified allowances.
- B. All water for sanitary sewer testing shall be provided and the tests performed by the Contractor in conformance with the following requirements:
 - 1. Mandrell Test
 - a. Pipes shall be tested for deflection by passing a mandrel through the pipe without obstruction.
 - b. The size of the mandrel shall be set at 92.5% of the base inside diameter of the pipe, as defined in ASTM 3034.
- C. Leakage Tests shall be performed per City Standard Specification Section 02730, "Sanitary Sewer" - Subsection 3.07, "Testing Sanitary Sewer".

3.08 MANHOLE INSPECTION

- A.** Manholes will be inspected after completion and within the guarantee period. Leakage and other defects that were a result of the Contractor's work shall be eliminated and repaired by the Contractor as required by the Engineer, at the Contractor's expense.

3.08 FINAL CLEANING AND CLOSE CIRCUIT TELEVISION INSPECTION (CCTV) REQUIREMENTS

- A.** Prior to final acceptance and final inspection of the pipe, the contractor shall flush and clean all parts of the newly installed HDPE pipes by removing all accumulated construction debris, rocks, gravel, sand and other foreign material from the pipe.

- B.** Perform final CCTV inspection per specification Section 02732 and Section 02737 after existing sewer mains and laterals are completely replaced/rehabilitated.

* * *

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ASTM D-1928	Preparation of Compression Molded Polyethylene Test Samples
ASTM D-2122	Determining Dimensions of Thermoplastic Pipe and Fittings
ASTM D-2321	Underground Installation of Thermoplastic Flexible Sewer Pipe
ASTM D-2657	Practice for Heat-Joining Polyolefin Pipe and Fittings
ASTM D-2837	Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials
ASTM D-3035	Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter (Up to 6" IPS)
ASTM D-3261	Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
ASTM D-3350	Specification for Polyethylene Plastic Pipe and Fittings Material
ASTM F-585	Practice for Insertion of Flexible Polyethylene Pipe into Existing Sewers
ASTM F-714	Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter (3" IPS and larger)
AWS D1.1	AWS Standard Qualification Procedure

1.03 WARRANTY AND QUALITY ASSURANCE

- A. General Bid Requirements:

1. The bidder, or his/her Sub-contractor, shall be properly licensed and trained to perform pipe bursting, having at least 10,000 lineal feet of successful installation in the United States within the last 2 years, in pipelines ranging from 4 to 12 inches. Documentation of the licensing and experience and details of two years minimum training of the on-site foreman and the installers who will perform the actual pipe bursting system, shall be provided with the bid.

- B.** The Contractor shall provide to the City a warranty to be in force and effect for a period of one (1) year from the date of acceptance by the City. The warranty is inclusive of the Contractor to repair or replace the pipe should failure result from faulty material or installation.
- C.** Correction of failed HDPE pipe deemed unacceptable, as a result of the post video inspection shall be the responsibility of the Contractor, at no extra cost to the City. Method of correction/repair shall be approved by the City.
- D.** The finished HDPE pipe shall be continuous over the entire length of run between the launching and receiving pits and shall be free from visual defects.
- E.** The Contractor shall carry out the operations in strict accordance with all applicable OSHA regulations.
- F.** Delivery, Storage and Handling
 - 1. Transport, handle, and store pipe and fittings as recommended by manufacturer.
 - 2. If pipe and fittings become damaged before or during installation, it shall be repaired as recommended by the manufacturer or replaced as required by the Engineer at the Contractor's expense, before proceeding further.
 - 3. Deliver, store, and handle other materials as required to prevent damage.
- G.** Only those tools designed for the aforementioned procedures, and approved by the pipe manufacturer or supplier and the ENGINEER, shall be used for assembly of pipe fittings to ensure proper installation. The heater plate shall be equipped with suitable means to measure the temperature of plate surfaces and to assure uniform heating such as thermometers or pyrometers.
- H.** The CONTRACTOR shall televise the installed pipe after existing services have been reconnected and manhole work has been completed. The original television inspection files in Wincan version 8 format shall be provided to the ENGINEER. The CONTRACTOR shall repair all damages found during the review of the final video inspection. The damages shall include but not limited to sags, leaks, cracks, unsecured joints, visual defects, and others which in the opinion of the ENGINEER are not acceptable and would impair the serviceability of the new piping system.

1.04 SUBMITTALS

- A.** Submit the following Contractor's Drawings:
 - 1. Shop drawings, catalog data and manufacturer's technical data showing complete information on material composition, physical properties, and dimension of pipe and fittings. Include manufacturer's recommendation for handling, storage, and repair of pipe and fittings if damaged.
 - 2. The Contractor shall prepare and submit for the Engineer's approval a detailed description of the Pipe Bursting Plan, including materials and equipment, lateral reconnection, bypass pumping system, plan of operation, schedule of work, etc. No work shall begin prior to approval by the Engineer of the Contractor's Pipe Bursting plan. The followings should be included:

- a. Detail drawings and written description of the entire construction procedure to bypass sewage flow, install pipe, reconnection of sewer house connections.
 - b. Working drawings for showing excavation locations, dimensions, sheeting and shoring, method of dewatering, and other utilities that may be affected; width and length of working area, access pit, and portion of existing sewer to be removed to conduct the work; sewage flow by-pass; and maintenance of traffic.
 - c. Design of the sheeting and shoring for the excavations, and dewatering shall be the Contractor's responsibility.
- B.** Television inspection reports and video tapes made prior to and after pipe insertion. (See Section 02732 for details of submittals).
- C.** Grout and design mixes and grout testing reports.
- D.** Certification:
1. Certification by the manufacturer that all pipe and fittings furnished under this specification were manufactured, sampled, tested, and inspected in accordance with ASTM D3350 and ASTM F714. Certification shall be signed by an authorized agent of the manufacturer.
 2. The CONTRACTOR performing the pipe installation shall be certified by the pipe bursting system manufacturer that the CONTRACTOR is a licensed installer of the manufacturers' system.
 3. Polyethylene pipe jointing shall be performed by personnel trained in the use of joint fusion and stab joint equipment and recommended methods for pipe bursting connection. Personnel directly involved with installing the pipe shall receive training in the proper methods for handling, inserting, trimming, and finishing the pipe. The Contractor shall provide a certification of training and experience for each fusion and installing crew member.
 4. The Contractor shall perform trial fusion welds and submit samples to the owner for review prior to installation of the pipe. Full penetration welds shall provide homogenous material across the cross section of the weld. The fusion machine employed for the trial welds shall be the same machine to be utilized for the installation work.
 5. Fusion equipment shall be operated only by technicians who have been certified by the pipe manufacturer or supplier who have a minimum of two (2) years of experience fusion welding 4-inch or larger diameter pipelines. The technician's experience shall be documented in the HDPE pipe material.
- E.** The CONTRACTOR shall submit a sewage bypass pumping and/or diversion plan for review by the ENGINEER at least 10 days prior to pipe installation. The sewage bypass pumping and/or diversion plan shall include an emergency response plan to be followed in the event of a failure of the bypass pumping and/or diversion system. The CONTRACTOR shall notify the ENGINEER 24 hours prior to commencing the bypass pumping operation. The CONTRACTOR'S plan for sewage bypass pumping and/or diversion shall be satisfactory to the ENGINEER before the CONTRACTOR shall be allowed to commence sewage bypass pumping and/or diversion.

- F. **As-built drawings:** The CONTRACTOR shall indicate and draw, with clear and accurate dimensions, on plans the as-built locations of newly installed sewer mains, laterals and cleanouts.

1.05 JOB CONDITIONS

- A. Note and conform to conditions and requirements indicated and specified under Section 02202 of these Specifications.
- B. Contractor shall conduct operations and schedule cleanup in a manner to cause the least possible obstruction and inconvenience to traffic, pedestrians and to adjacent property owners or tenants.

PART 2 - PRODUCTS

2.01 GENERAL

- A. The CONTRACTOR shall provide polyethylene pipe as specified. The pipe shall be made to diameter and tolerances in accordance with ASTM D3035. The minimum ratio of orthogonal diameters prior to installation shall be 0.95. All pipe shall be made from virgin grade material. The pipe shall be of the diameter and class shown or specified and shall be furnished complete with all fabricated fittings, and other appurtenances as necessary for a complete and functional system.

2.02 HDPE PIPE, JOINTS AND FITTINGS

- A. Unless approved otherwise by the Engineer, pipe and fittings shall be **SDR 17**, Extra High Molecular Weight, High Density Polyethylene PE 4710, Cell Class PE445574C, per ASTM D3350. Pipe shall be co-extruded using a melt homogenizing/plasticating extruder and appropriate die.
- B. The pipe and fittings materials shall meet the requirements for Type III, Class C, Category 5, Grade P34 material as described in ASTM D1248. Pipe and fittings shall be made in conformance with ASTM F714 and ASTM D3261 as modified for the specified material. The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same specification from the same raw material pipe.

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- 1. Pipe, fittings, and joints shall meet or exceed the following physical properties:

ASTM

Nominal

<u>Property</u>	<u>Test Method</u>	<u>Value</u>
Density, gm/cc	D 1505	0.96
Melt Index, gm/10 min.	D 1238-E	0.10
High Load Melt Index, gm/10 min.	D 1238-F	12.0
Tensile Strength @ Break, psi	D 638	4,500
Tensile Strength @ Yield, psi	D 638	>3,400
Elongation, %	D 638	>700
Flexural Modulus, psi	D 790	136,000
Environmental Stress Cracking Resistance F20' Hours (100°C)	D 1693 (Cond. C)	>5,000
Brittleness Temperature, ^o	D 746	<-103
Melting Point, ^o F	D 789	261
Vicat Softening Temperature, ^o F	D 1525	255
Hardness, Shore D	D 2240	64
Volume Resistivity,ohm-cm	D 991	2.6X10(16 th)
ASTM D 1248 Classification:	Type III Class C Category 5 Grade P 34	
ASTM D 1248 Classification:	445574C	
RECOMMENDED HYDROSTATIC DESIGN STRESS:	800 psi @ 73.4°F 400 psi @ 140°F	

2. Pipe and Fittings Markings:

- a. Pipe shall be marked at 3-foot intervals or less with the manufacturer's name (or trade mark), the designation ASTM D3350 and ASTM 714, including the year of issue, the letters "PE" followed by the cell classification number of the raw material compound used and the polyethylene grade per ASTM D1248, and the Hydrostatic Design Basis in hundreds of psi; the nominal pipe size in inches, the dimensional ratio, and the manufacturer's code identifying the resin manufacturer, lot number, and date of manufacture.
- b. Fittings shall be marked with the manufacturer's name (or trade mark), the designation ASTM D3350 and ASTM 714, and the manufacturer's code identifying the resin manufacturer, lot number, lot number, and date of manufacture.

3. Pipe and Fittings shall be homogeneous throughout and free of:
- a. Serious abrasion, cutting, or gouging of the outside surface extending to more than 10 percent of the wall thickness in depth.
 - b. Cracks
 - c. Kinking (generally due to excessive or abrupt bending)
 - d. Flattening
 - e. Holes
 - f. Blisters
 - g. Other injurious defects
- C. They shall be uniform in color, opacity, density, and other physical properties. Any pipe and fittings not meeting these criteria shall be rejected.
- D. The average outside diameter and wall thickness of pipe and fittings shall conform to Table 1 when measured in accordance with ASTM D2122.

TABLE 1				
Nominal Size (inches)	Nominal OD (inches)	Minimum Wall Thickness SDR26 (inches)	Minimum Wall Thickness SDR17 (inches)	Minimum Wall Thickness SDR11 (inches)
3	3.5	0.135	0.206	0.318
4	4.5	0.173	0.265	0.409
5	5.563 5.375	0.214 0.207	0.327 0.316	0.506
6	6.625	0.255	0.390	0.602
7	7.125	0.274	0.419	0.648
8	8.625	0.332	0.507	0.784
10	10.75	0.413	0.632	0.977
12	12.75	0.490	0.750	1.159

E. Pipe and Fittings Color: Pipe and fittings shall conform to the following:

- 1. Inside: The inner wall shall be white, light green, light red (vitrified clay color), or natural. Yellow, black, and light purple are not acceptable.

2. Outside: The outer wall shall be black, white, light green, light red (vitrified clay color), or natural. Yellow and light purple are not acceptable.
3. Both the inside and outside may be the same color.

F. Joints:

1. Pipe lengths shall be assembled in the field with butt-fused joints in accordance with ASTM D 2657 and the pipe manufacturer's written instructions shall apply. Butt-fused joints shall have internal bead projections of not more than 1/4 inch. Bead projections on the outside and inside of the pipe shall be removed. Joint strength shall be equal to or greater than the pipe and shall indicate a ductile rather than brittle fracture when tested.
2. Joint with Fusion Equipment: The fusion machine shall have hydraulic pressure control for fusing two pipe ends together and shall be equipped with gauges to monitor fusion pressures. The machine shall be equipped with an electric or gasoline engine powered facing unit to square and trim the pipe ends smooth and provide full surface contact with the heating plate. The heating plate on the fusion machine shall be electrically heated and thermostatically controlled with a temperature gauge and be capable of maintaining 500°F with a tolerance of 10°F. Fusion temperature shall be as recommended by the pipe manufacturer.

2.03 PVC PIPE, JOINTS AND FITTINGS

- A.** Shall conform to Section 02730-Sanitary Sewers of these specifications

2.04 SANITARY SEWER LATERALS

- A.** Contractor shall verify location and diameter of all active laterals.
- B.** Sanitary sewer lateral shall be installed to conform to the City's Standard Details or modified herein as shown in the Contract Drawings. Connections to the HDPE main shall be performed using electrofusion wye saddles.
- C.** Heat fusion electrofusion wye saddles shall be made of polyethylene pipe compound that meets the requirements of ASTM D1248, Class C and suitable for fusion welding to polyethylene pipe. Fusion saddles shall be electrofusion wye saddle as manufactured by Central Plastics Company, Driscopipe, Miller, Dupont or approved equal.
- D.** Connections to the existing sewer house connection pipe shall be made using sleeved stainless steel flexible couplings. All flexible couplings shall conform to ASTM C425 and be manufactured by Fernco Joint Sealer Co., DFW Plastics, Inc. or approved equal.
- E.** For laterals shown to be constructed using open cut method, the Contractor shall conform to Specification Section 02730 Sanitary Sewers.

2.05 SANITARY SEWER CLEANOUTS

- A.** Install sanitary sewer cleanouts per project details and specifications.

- B. Wye branches and risers for sanitary sewer cleanouts shall conform to the City's project details.
- C. Cleanout box shall be Christy concrete type F08 Curb Valve Box with F08R lid marked "SEWER" when installed in location not subject to vehicular loading.
- D. When installed in location subject to vehicular loading, cleanout box shall be Christy concrete type G05T Traffic Valve Box with G05CT Traffic Lid marked "SEWER" and shall be provided with 8" concrete base.

2.06 GROUT

- A. The grout design mix shall meet or exceed 500 psi compressive strength at 28 days tested accordance with ASTM C495 or C109. Contractor may incorporate grout additives to improve its flow properties, provided the minimum compressive strength requirements are met.

2.07 EQUIPMENT

- A. External and Internal Bead removers shall be McElroy Manufacturing, Inc. or equal.
- B. Bursting head/mechanism must be capable of pipe bursting existing repair section of cast iron pipe with minimal damage to the immediate and above ground environment and structures.

PART 3 - EXECUTION

3.01 GENERAL

- A. This section is intended to provide the Contractor with general guidance on the methods to be used to install the sewer pipe using the pipe bursting method. Nothing contained herein shall relieve the Contractor from completing the pipe bursting operation in the most feasible, efficient and safe manner, using required materials to the lines and grades shown on the plans and to the requirements of these specifications.

3.02 SITE INVESTIGATION

- A. Prior to pipe bursting operation, the Contractor shall perform a careful site investigation to locate and record possible surface obstructions, locate and mark active and inactive sewer laterals; and formulate and submit plans to replace the pipe, to reconstruct all sewer laterals, and to restore all structures and plants that would be damaged by the project work.

3.03 PREPARATION

- A. Preliminary Site Work
 - 1. Excavation of launch areas, etc. shall be carried out according to the planned schedule submitted to the Engineer prior to commencement of work.

2. Installation of by-pass pumping equipment shall be complete and operational.
3. All buried utilities adjacent to the line of operation shall be reviewed and where necessary excavated to relieve transient loading during the insertion operation.
4. Excavations for all active house connection laterals shall be completed before the insertion of the new pipe. Manhole positions along the line of insertion and lateral excavations will be used to check progress as the head passes these points.
5. Any heavy concrete reinforcement present along the line of insertion shall be broken out prior to the operation to allow steady and free passage of the expander.

B. By-Pass Sewage

1. The Contractor shall furnish, install, and operate pumps, plugs, conduits, and other equipment to divert the flow of sewage around the pipeline reach in which work is to be performed. The plug shall be provided with a tag line. The pumping system shall be of sufficient capacity to handle existing flow plus additional flow that may occur during a rainstorm. If pumping is required on a 24-hour basis, engines shall be equipped in a manner to keep noise to a minimum. Standby pumps shall be provided as required. Pumping shall be done by the Contractor in such manner as will not damage public or private property or create a nuisance or health menace. The pumped sewage shall be in an enclosed hose or pipe and shall be reinserted into the sanitary sewer system. Sewage shall not be allowed to free flow in gutters, streets or over sidewalks, etc. Nor shall any sewage be allowed to flow into the storm inlets or conduits. After the work has been completed, flow shall be restored to normal.
2. The Contractor shall be responsible for continuity of sanitary sewer service (i.e. building laterals) to each facility connected to the section of sewer during the execution of the work. **Building laterals shall not be disconnected or plugged overnight**; that is continuing service on the laterals should not be interrupted during the peak flow period from 5 P.M. the day before to 9 A.M. the next day.

C. Cleaning and Closed Circuit TV Inspection for Sewer Pipe

1. Prior to pipe bursting operation, the Contractor shall perform an initial sewer cleaning and closed circuit TV (CCTV) inspection according to Section 02732 of this Specification to determine the general condition of the sewer, to remove any obstruction and debris, to determine defective pipe sections for point repairs, to log the location of all house laterals and to verify location of active house laterals.

D. Excavation

1. Existing utilities shall be located and protected as required by utility owners.
2. Excavation, dewatering, sheeting, shoring, and bracing shall be in accordance with FED-OSHA 29 C.F.R., Part 1926 Sub-Part P. Sewer house connections shall be exposed prior to pipe installation operation.

3. Access excavations shall be provided as required to facilitate the pipe bursting insertion. When practicable, they shall be located where interference to vehicular traffic and inconvenience to the public is minimized. Access excavations shall coincide with sewer house connections, changes in the sewer line and grade and to provide access to the sewer in both directions. Excavations that have pull or push equipment installed shall have adequate support provided to prevent damage to adjacent areas.

E. Locating Existing Sewer Lateral Connection

1. Upon completion by the Contractor of CCTV inspection, the Contractor shall mark in the field the location of the existing sewer lateral connection.
2. The Contractor shall expose the existing sewer lateral connection and make arrangements with the resident to access all the plumbing fixtures in each house and perform dye tests when necessary or other means to determine if the exposed sewer lateral connection is active. If access to the house fixtures is denied by the resident, the exposed sewer lateral connection shall be assumed active unless otherwise directed by the Engineer and shall be reconnected in accordance with these specifications.
3. All inactive sewer laterals shall be plugged at the sewer main.

3.04 PIPE BURSTING AND PIPE INSTALLATION

A. Site Organization

1. Excavation of launch pits shall be situated to provide minimum inconvenience to residents, businesses or traffic. Launch excavation will be situated to give maximum possible advantage to the insertion operation but more importantly to give minimum inconvenience to traffic and pedestrian users. Launch pits shall not be located in the easement areas and private property without permission of the homeowner and the Engineer.
2. Dimensions will vary with depth of cover and size of pipe and also pipe wall thickness. These latter parameters, together with ambient temperature, control the pipe bend radius and the pipe manufacturer's recommendations must be used to obtain the slit trench length.
3. A sump hole in the base of the excavations should be provided to allow pumping of water from the excavation.
4. Layout of a temporary by-pass pumping system to isolate the working area should take into account the location of pumps and pipes, possible pump failure contingency and avoidance of blocking entrances to homes, drives, bus stops, etc. Equipment used should be selected to give minimum noise levels and emission of fumes. All costs for this time are included in the bid price per linear foot of replacement.

5. Where buried utilities are known to exist, surface marking should be carried out and where necessary local excavations made to relieve the possibility or transferred loading. This is especially important in the case of gas mains which should be at least one foot away from the line of work. If nearer than this, special arrangements must be made with the local gas utility to comply with codes of practice.
6. Existing manholes shall be utilized where-ever practical. Remove manhole inverts and bottoms to permit access for installation equipment.
7. Support equipment used to perform the work shall be located away from buildings so as not to create a noise impact. Provide silencers or other devices to reduce machine noise as required to meet local requirements.

B. Pipe Installation

1. The Contractor shall remove internal bead.
2. Contact by radio shall be maintained between key positions at all times so that slowing down, stopping and starting can be effected when necessary.
3. The Contractor shall record the general progress, i.e. insertion rates in feet per minute, reasons for stoppages, signs of failure of equipment and road or other surface damage.
4. Particular care shall be exercised when passing buried utilities or when near building foundations.
5. At manholes or lateral excavations, the Contractor shall slow the rate of progress to examine the winch rope attachments on the head and the pipe retaining assembly at the rear of the head. Repairs and replacements in these positions are much easier than having to excavate to repair between positions.
6. Thread winch and associated lines through sewer section to be rehabilitated. Keep lines away from pedestrian and vehicular traffic.
7. For the method using sectional pipe, only existing manholes in the street may be used for launch and receiving access. Manholes in the easement area may be used only with the permission of the homeowner and the Engineer. Remove manhole invert and bottom as required.

3.05 ANCHORING PIPE AND SEALING MANHOLES

- A.** After the pipe has been installed in the entire length of the sewer section, anchor the pipe at manholes. The pipe shall protrude in the manholes for enough distance to allow sealing and trimming.

- B. Sealing the pipe at manholes providing a flexible gasket connector in the manhole wall at the end of the pipe, centered in the existing manhole wall. Grout the flexible connector in the manhole wall filling all voids the full thickness of the manhole wall.
- C. Restore manhole bottom and invert.

3.06 CLEANING SANITARY SEWERS

- A. Contractor shall flush and clean all sewer mains by means of pneumatic, sewer cleaning balls. The balls shall be of the appropriate size to fit the sewer pipe being cleaned. "Sewer Balling" operations shall be conducted by experienced personnel under the observation of the Engineer. The ball shall be introduced at the uppermost manhole and passed from manhole to manhole by means of a line with sufficient head of water to carry the ball along. The movement of the ball shall be controlled by a rope; care shall be exercised not to feed the ball too rapidly in order that all debris can be removed at each manhole.
- B. Each section of the sewer line shall be thoroughly cleaned before proceeding to the next section. Where sewer balls will not pass, flexible sewer rods with approved spears or cutters may be used to clear the obstruction. Where obstructions cannot be cleared by sewer rodding, the obstructions shall be removed by excavation at the Contractor's expense. The Contractor shall remove all debris from sewer lines using approved methods.
- C. Installation cost shall include cost for water for sanitary sewer flushing and cleaning operations.

3.07 TESTING SANITARY SEWERS

- A. Sanitary sewer systems including laterals, and sanitary sewer mains shall be tested for tightness after completion of all backfilling and prior to request for final inspection. Contractor shall notify the Engineer at least two (2) working days in advance of proposed testing dates. Tests of gravity sewers shall be made from end or manhole to manhole unless grades are flat enough to permit testing two or more sections at one time. Sections which fail to pass the tests shall be repaired or replaced, and the section retested until it falls within specified allowances.
- B. All water for sanitary sewer testing shall be provided and the tests performed by the Contractor in conformance with the following requirements:
 - 1. Mandrell Test
 - a. Pipes shall be tested for deflection by passing a mandrel through the pipe without obstruction.
 - b. The size of the mandrel shall be set at 92.5% of the base inside diameter of the pipe, as defined in ASTM 3034.
- C. Leakage Tests shall be performed per City Standard Specification Section 02730, "Sanitary Sewer" - Subsection 3.07, "Testing Sanitary Sewer".

3.08 MANHOLE INSPECTION

- A. Manholes will be inspected after completion and within the guarantee period. Leakage and other defects that were a result of the Contractor's work shall be eliminated and repaired by the Contractor as required by the Engineer, at the Contractor's expense.

3.08 FINAL CLEANING AND CLOSE CIRCUIT TELEVISION INSPECTION (CCTV) REQUIREMENTS

- A. Prior to final acceptance and final inspection of the pipe, the contractor shall flush and clean all parts of the newly installed HDPE pipes by removing all accumulated construction debris, rocks, gravel, sand and other foreign material from the pipe.

- B. Perform final CCTV inspection per specification Section 02732 and Section 02737 after existing sewer mains and laterals are completely replaced/rehabilitated.

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