

SPECIFICATIONS - DETAILED PROVISIONS
Section 02768 - Furnish and Install PVC Force Main

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SECTION 02768
FURNISH AND INSTALL PVC FORCE MAIN

PART 1 - GENERAL

1.01 DESCRIPTION

Under these specifications, the Contractor shall furnish all labor, material, equipment and tools required for the complete installation and testing of force main and appurtenances and allied structures as stated on the Bidding Sheets, shown on the contract drawings or specified herein, and all within the contract time. The Contractor shall be responsible for all work specified herein and the orderly progress and completion of the work in accordance with an approved schedule of construction.

The work includes, but is not limited to, all excavation, backfill, disposal, resurfacing of roads and driveways, verification of utilities, installation of all pipe and specials such as elbows, bends and tapers. All restraint for pipe, such as at the elbows, bends, etc., shall be sufficient to withstand all unbalanced forces. Unless otherwise approved by the Engineer, restraint shall be provided by means of restraint fittings as required by the Contract Drawings and these specifications. The use of concrete anchorage in lieu of restrained joints will be considered on a case by case basis. All restraint shall be included in the bid price for the installation of pipe.

It shall be the responsibility of the Contractor to furnish the District with accurate tie dimensions to all valves installed in the course of constructing this project.

Refer to Section 02201 of the District's standard specifications for requirements relating to Construction Methods and Earthwork and Section 02221 for requirements relating to Trenching, Backfilling and Compacting.

1.02 QUALITY ASSURANCE

Unless otherwise specified, all work specified herein and as shown on the drawings shall conform to the applicable requirements of the latest revision of the following standards. Unless specifically stated otherwise, the most stringent requirement will govern when there is a conflict.

- A. AWWA C-900. American Water Works Association (AWWA) C-900 standard for polyvinyl chloride (PVC) pressure pipe 4 inches through 12 inches.
- B. AWWA C-905. American Water Works Association (AWWA) C-905 standard for polyvinyl chloride (PVC) transmission pipe 14 inches through 36 inches.

1.03 SUBMITTALS

Shop drawings for all pipe and appurtenances shall be submitted pursuant to the requirements of the Contract Documents for Submittals, and shall show the materials, dimensions, stations and all relevant details of all specials.

1.04 PRODUCT DELIVERY

- A. Materials Furnished by the Contractor. Except as otherwise stated on the Bidding Sheet, all materials, including pipe and appurtenances, shall be furnished in place by the Contractor. Materials to be furnished by the Contractor shall include that necessary for replacement of all obstructions, road surfacing, etc. The Contractor shall furnish the Engineer, as soon as issued, duplicate copies of all orders placed outside the Contractor's plant for articles or materials to be furnished by the Contractor for incorporation in the work. The Contractor shall also furnish the Engineer with such additional information as reasonably may be required respecting the character of the material and progress of their procurement.
- B. Materials Furnished by the District. ONLY AS SHOWN ON THE CONTRACT DRAWINGS OR ON THE BIDDING SHEETS, OR ORDERED BY THE ENGINEER, will the District furnish any or all of the following materials necessary for the completion of the work under these specifications.
1. PVC pipe with rubber gaskets joints and gasket rings. Pipe will be delivered, unloaded and strung along trench site by the Pipe Supplier. Approximately 5% of each size of pipe will be furnished in the standard short lengths manufactured by the pipe supplier, except as otherwise requested by the Contractor.
 2. Valves, Gaskets, bends, elbows, tapers, and air valve assemblies complete with piping and valves, etc.
 3. Joint materials.
 4. Locating wire required for PVC pipe systems.
 5. Telemetry wire where noted on the construction drawings.

The Contractor shall, within seven (7) days after execution of the contract, meet with the Engineer for approval of his proposed schedule of construction and shall furnish the Engineer a written statement of the Contractor's requirements for delivery of materials and equipment to be furnished by the District with the dates upon which delivery of each class of said materials and equipment will be necessary in order to conform to the Contractor's program of construction.

Materials to be furnished by the District, except for pipe, will be delivered to the Contractor f.o.b. the Contractor's trucks at the District yard or warehouse, and the Contractor will sign for these materials received. No direct payment will be made to the Contractor for hauling or handling materials or equipment furnished by the District, but payment for such handling and hauling will be included in the prices

named for the contract items wherein the materials and equipment are used. The Contractor shall be responsible for coordinating the delivery and the actual placement of all pipe in accordance with his requirements and construction schedule, shall properly barricade the pipe and other materials, and shall be responsible for any damage to property as a result of the unloading or placement of the pipe or other materials.

If the delivery of any materials or equipment specified herein to be furnished by the District shall be delayed by strikes, acts of God, or other causes beyond the control or without the fault or negligence of the District, the Contractor shall have no claim against the District for such delay in delivery, but shall be entitled to so much additional time wherein to perform and complete the contract on his part as the Engineer shall certify in writing to be just.

- C. Hauling and Handling Pipe. The Contractor shall protect all pipes from damage during hauling and handling. Dropping or dumping of pipe will not be permitted. Pipe shall not be strung prior to blasting in those areas where blasting is required. Damaged pipe shall be replaced or repaired by the Contractor at his expense, and be subject to approval by the Engineer.

1.05 JOB CONDITIONS.

Water Furnished by District. The District will make water available for construction at the locations stated in the Special Provisions.

1.06 PAYMENT

- A. Measurement for Payment. Quantities for installation of pipelines and appurtenances on District-administered projects shall be measured for payment as specified herein and described on the Bidding Sheet:
1. Pipelines. Will be measured in place along the horizontal axis of the pipe by the linear foot, on the basis of pipeline completely installed and tested including earthwork, special bedding included in the work, pipe, gaskets, fittings, polyethylene encasement, specials, concrete and miscellaneous materials. The measurement will be continuous through all valves and fittings.
 2. Valves will be measured on the basis of each valve completely installed and tested including valve, valve riser and cap, earthwork and miscellaneous materials.
 3. Sewage Air Valves. Will be measured on the basis of each air valve assembly completely installed and tested including tap-to-main, piping, all valves, fittings, valve vault, earthwork, and miscellaneous materials.

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4. Special Bedding. Will be measured on the basis of the cubic yards of special bedding required to bring the bedding up to grade for the trench size excavated up to the maximum size of trench allowable under these specifications. Only that special bedding for which there are stipulated costs, or for which special bid items are listed in the bid sheet will be measured for payment. No allowance will be made for over-excavation except as directed by the Engineer, or for special bedding required in the contract work under other bid items.
 5. Bore Casing. Will be measured on the basis of horizontal centerline distance and shall include all excavation, furnishing and placement of casing, furnishing and placement of all required back-packing and grouting around casing, backfilling within casing, pipe bracing, restoration of surfaces, and all labor and material for a finished job. Furnishing and installation of pipe within casing shall be included in pipeline measurement.
 6. Paving. Will be measured as a part of project causing removal and/or replacement of paving, except as otherwise specified on the Bidding Sheet.
- B. Payment. Payment for quantities for installation of pipeline and appurtenances on District-administered contracts will be paid for in the following manner. Quantities of items listed herein, measured as stated above and accepted, will be paid for at the unit bid prices as stated herein, which prices and payments shall constitute full compensation for furnishing all labor, equipment and tools necessary to complete the described work in place. No additional compensation will be paid above the unit bid prices for changes in quantities.
1. Pipelines. Quantities of pipelines will be paid for at the respective unit bid prices per horizontal linear foot for the kinds and sizes of pipe stated in the bidding sheet. Work includes all earthwork, installation and testing of pipe, specials, fittings, anchors, removal and restoration of pavement, curbs, gutters and sidewalks, and clean-up.

Payment for pipe in place shall be further broken down based upon the Contractor's submittal under Section F-10 of the General Conditions, as concurred by the Engineer, but not to exceed in the ordinary project the following percentages of the linear foot price stated on the Bidding Sheet:

Trench excavation	10%
Pipe laid in place and shaded	65%
Trench backfilled and backfill compacted.....	20%
Testing and clean-up, exclusive of pavement replacement	5%

2. Fittings and Specials. Payments for quantities of fittings and specials shall be included in the payment for installation of pipelines. Work includes installation of bends, tapers, and all earthwork, and no additional compensation will be made therefore.
3. Valves. Quantities of valves will be paid for at the respective unit bid prices for the size and type of valves stated in the bidding sheet. Work includes installation of valves, flanges, gaskets, bolts, and all earthwork.
4. Sewage Air Valves. Quantities of air valve assemblies will be paid for at the respective unit bid prices for the size of air valves stated in the bidding sheet. Work includes installation of tap-to-main, valves, service stops, elbows, bends, valve vaults, and all piping.
5. Special Bedding. Quantities of special bedding measured as stated above and accepted, will be paid for at the stipulated cost price, or the respective unit bid price for the quantities as stated in the bidding sheet, which price shall constitute full compensation for all labor, materials, and equipment necessary to complete the work in place, including the special bedding material.
6. Bore Casing. Payment for bore casing in place measured as stated above shall be made as specified on the bidding sheet.
7. Paving. Payment for quantities of paving measured as stated above and accepted shall be included in the unit bid for pipeline. Work includes removal and/or restoration of paving and all earthwork, and no additional compensation will be made therefore, except as otherwise provided on the bidding sheet.

1.07 GUARANTEE

All work, materials, and equipment shall be guaranteed for one year after the filing of the notice of completion except where the periods of time are set forth elsewhere in the contract documents for General Guaranty or Warranty.

PART 2 - PRODUCTS & MATERIALS

2.01 MATERIALS

Contractor to furnish PVC pipe as hereinafter described.

- A. Type of PVC Pipe. PVC pipe shall be extruded from 12454 A or B compound providing a hydrostatic design basis (HDB) of 4000 p.s.i. in accordance with AWWA C-900 and C-905. Pipe shall have cast iron outside diameters.

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- B. Pipe Class or Working Pressure. AWWA C-900 PVC pipe shall be Class 150 and AWWA C-905 pipe shall be rated at 165 p.s.i. (DR-25) or as specified on approved drawings.

2.02 VALVES ENDS

Where valves do not connect to fittings, the fitting may be hub-end, or flange x hub-end. However, where valves connect to cast iron or welded steel fittings, fittings shall be flanged. Where flange x hub-end valves are not available for use with PVC pipe, flanged valves shall be used with flange x hub-end adaptors.

All valves shall be hung plumb, with the stems vertical.

2.03 RESTRAINED JOINTS

Restrained joints shall be provided by a clamping ring and an additional ring designed to seat on the bell end of the pipe. The rings shall be connected with T-Head bolts or rods. Restraining devices shall provide full (360°) support around the circumference of the pipe. No point loading shall be permitted. Restraint of mechanical joint fittings shall be provided by a clamping ring installed on the PVC pipe and connected to the mechanical joint fitting with T-Head bolts or rods.

Restraining devices shall meet or exceed the requirements of UNI-Bell B-13 "Recommended Standard Performance Specification for Joint Restrainers for Use with PVC Pipe." Restraining devices shall be Uni-Flange Series 1300 or 1350 or approved equal.

All buried steel parts shall be sand blasted in accordance with the coating manufacturer's technical data sheet for "submerged" service and coated with a two coat epoxy. Epoxy shall be Tnemac Series 66 or equal. All bolts and tie rod materials shall be either high strength cast iron containing a minimum of 0.5% copper or high-strength, low alloy steel, as specified in AWWA C-111 for buried mechanical joints.

2.04 PORTLAND CEMENT CONCRETE

Cast-in-place structures of plain and reinforced concrete shall conform to the requirements of Chapter 26 of the Uniform Building Code and ACI 318, unless otherwise approved by the Engineer.

Classes of concrete used in the construction of cast-in-place structures shall be proportioned as specified in Section 03300 of the District standard specifications.

2.05 LOCATOR WIRE

Locator wire shall be installed over all waterlines, reclaimed waterlines and forcemains whether or not telemetry wire is buried with pipe. Locator wire per Standard Drawing B-656 shall be 14-1 solid insulated copper wire (UF), in a continuous strand, placed on top of pipe and secured with tape. Locator wire shall be brought to the surface at the edge of the right of way at 660 feet maximum on centers in Brooks No. 1-SP, or equal, valve boxes. The valve boxes shall be placed within two feet of fire hydrants when fire hydrants are available at 660' or less on center. Where no fire hydrants are available EMWD marker posts shall be installed within two feet of the valve boxes. For subdivision construction, instead of the marker post, mark the face of the curb in front of the box with the letters "LW". Loop 2 feet of wire in valve box. Provide the inspector survey stations at each valve box for as-built drawings.

2.06 TELEMETRY CABLE

On District-administered contracts, the District will supply the telemetry cable for installation in accordance with these specifications and contract drawings. The telemetry cable will be delivered to the Contractor at the District's warehouse. Prior to acceptance and delivery of the cable, a continuity test will be performed by District personnel or the Contractor's representative. Certification of the test results will be acknowledged by the Contractor or his representative in writing. The Contractor will be responsible for the safe handling, installation and retesting for total continuity of the cable installation prior to acceptance by the District.

2.07 POLYETHYLENE ENCASEMENT

All ductile iron fittings shall be polyethylene encased at the time of installation. Polyethylene encasement and installation shall be in accordance with ANSI/AWWA C105/A21.5.

PART 3 - EXECUTION

3.01 GENERAL

It shall be the responsibility of the Contractor, prior to start of construction, to meet with the Engineer:

- A. For approval of schedule of construction for work and completion of pipelines or sections thereof;
- B. To submit the required forms listed in the General Conditions.
- C. To coordinate delivery of District-furnished materials.
 1. Determine location and placing of the pipe to be unloaded and direction of placing bells;
 2. Determine the quantity of pipe to be placed in a particular location;

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3. Coordinate delivery of pipe and other materials to meet his construction schedule.
- D. To furnish such additional information as may be required from time to time as construction progresses, regarding the progress of the procurement and delivery of the required equipment and materials, and/or the scheduling of the work.

Any subsequent shuttling of pipe, turning of bells, etc., will be at the Contractor's expense and no additional compensation will be allowed above the unit bid price, unless authorized by the Engineer in writing. All quantities shown on the Bidding Sheet and the contract drawings indicate the estimated quantities of materials for the completed pipelines in place.

3.02 BEDDING PIPE

- A. General. Each section of pipe shall be lowered into the trench in a manner that will prevent injury to the pipe, or joints and shall be carefully bedded to provide continuous bearing and prevent uneven settlement. The inside of the pipe shall be clean and free from foreign material of any kind before being installed.
- B. Tolerance. The pipe shall be accurately laid to alignment and grade shown on the drawings or established by the Engineer. Where grade stakes are provided with which to establish the proper pipeline grade, pipe shall be laid to grade within a tolerance of 0.1', or 0.2' cumulative deviation from elevations set by adjacent grade stakes. As ordered by the Engineer, the allowed tolerance may be greater than herein indicated for lines on steep grades, or less than herein indicated for the larger lines or lines on flat grades, where necessary to avoid air pockets.
- C. Pipe Zone Bedding. The pipe zone bedding material shall conform to the requirements for solid wall PVC pipe on Standard Drawing SB-157, SB-158, and SB-159.

3.03 RUBBER GASKET PIPE JOINTS

After the subgrade has been prepared as specified, the rubber gasket shall be placed in the groove on the spigot ring, and the spigot end of the pipe then entered into the bell of the adjoining pipe and forced into position. Care shall be taken to avoid twisting or cutting the gasket when jointing the pipe. The inside surface of the bell shall be lubricated with a compound recommended by Manufacture which will facilitate the telescoping of the joint.

3.04 CURVES, ANGLES, CLOSURES AND SHORT SECTIONS

The laying of pipe on curved alignment by means of unsymmetrical closure of spigot into bell rings will be permitted. The amount of pull permitted from normal closure on one side of the joint shall not exceed the manufacturer's recommendation. For the purpose of reducing the angular deflections at pipe joints and for closure sections, the Contractor shall be permitted to install pipe sections of less than standard length. Where such installations are allowed, Contractor shall be responsible for anchorage of the necessary joints, as directed by the Engineer.

3.05 FLANGE, FITTING AND BOLT PROTECTION

All appurtenances and fittings at the pipeline shall be primed, and wrapped with Protecto-Wrap No. 200 with No. 1170 Primer, or approved equal.

3.06 VALVE CAP AND RISER INSTALLATION

In new subdivision developments Contractor shall leave valve cans 3" minimum below rough-graded subgrade street surface, properly covered, and shall return after paving of the street is completed by others, to raise the valve slip can and cap to grade. Contractor shall coordinate his work with that of the paving contractor to place the slip can during placement of the road sub-base, if desirable.

3.07 TEMPORARY BULKHEADS

The Contractor shall furnish and install complete, all the necessary temporary bulkheads or skillets and appurtenances thereto in the pipeline used for backfilling or testing purposes and shall remove such bulkheads upon completion of the line.

The Contractor shall furnish, at his own expense, any openings in the pipeline or bulkhead and any valves or by-pass arrangements which are for his convenience in filling, testing and/or emptying the pipeline.

At all times when the work of installing pipe is not in progress, all openings into the pipe and the ends of the pipe in the trench shall be tightly closed to prevent entrance of animals and foreign materials.

The Contractor shall take all necessary precautions to prevent the pipe from floating due to water entering the trench from any source, shall assume full responsibility for any damage due to this cause and shall at his own expense restore and replace the pipe to its specified condition and grade if it is displaced due to floating. If the Contractor, upon approval by the Engineer, elects to test a system utilizing valves and connecting pipe installed by the District, the District will assume responsibility for any leaks occurring in any pipeline or valve furnished and installed by the District. In the event Contractor is unable to satisfactorily test his system because of leaks in the District-installed system, Contractor shall install temporary bulkheads in his construction to perform tests, as determined necessary by the Engineer.

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Full compensation for furnishing all labor, tools, materials, and equipment (except water when provided by the District), and for doing all work involved in testing, and for repairing any leaks shall be included in the price paid for installation of the pipe, and no additional compensation by the District will be allowed therefore.

3.08 FIELD HYDROSTATIC TEST

Upon completion of the laying, jointing, backfilling, and proper curing of the joints, and compaction of backfill, the pipeline or portions thereof shall be hydrostatically tested.

For convenience of testing, the pipeline may be divided into sections and each section tested separately. Main line valves may be used in lieu of special bulkheads, or if valves are not conveniently located, temporary bulkheads shall be constructed. Bulkheads shall be constructed to safely withstand the hydraulic pressures imposed upon them. No payment will be made expressly for the work and materials required for the bulkheads and any compensation desired by the Contractor for this work shall be included in the price quoted for the installation of pipe. The Contractor shall have no claim against the District by reason of required construction of bulkheads due to the omission of the installation of any or all main line valves.

After the section of pipeline has been bulkheaded and completely filled with water, it shall be allowed to stand under pressure a sufficient time to allow the escape of air from any air pockets. The pressure shall then be increased to the specified test pressure as hereinafter described, and shall be maintained at this pressure for not less than four (4) hours.

All pipe shall be tested under a pressure $1\frac{1}{2}$ times the design operating pressure of the pipe. Maximum test pressure shall not exceed that determined by the Engineer.

If any leakage is evidenced in the testing of the pipeline, the various sections of the pipeline shall be isolated for testing between available valves, or between bulkheads located as directed by the Engineer. The maximum allowable leakage for pipe shall be two (2) gallons per day per mile of pipe per inch of pipe inside diameter. If the leakage exceeds this amount, the section being tested will be considered defective. The Contractor shall determine the points of leakage, make the necessary repairs and perform another test. This procedure shall be continued until the leakage in each section falls below the allowable maximum for that section of pipeline.

Leakage shall be determined by metering the water injected into the pipeline while under the required pressure. The Contractor shall submit to the District before and after the test the gage and meter used so that these devices may be tested by this District.

The Contractor shall provide all calibrated meters for measurement of leakage, all bulkheads or skillets, piping, calibrated gages, pumps and other equipment, all water not furnished by the District, and all power and labor necessary for the performance of pressure tests satisfactory to the Engineer. The Contractor shall furnish all necessary equipment and labor to fill each section of pipeline tested and for pumping the water from one test section to another as may be necessary for obtaining and maintaining the required water pressure and for filling the entire pipeline with water after the conclusion of the testing, as hereinafter provided.

The Contractor, at his own expense, shall do any excavation necessary to locate and repair leaks or other defects which may develop under test, including removal of backfill already placed, shall replace such excavated material, and shall make all repairs necessary to meet the required water tightness after which the test shall be repeated until the pipe meets the test requirements. All tests shall be made in the presence of the Engineer. After the pipe has met successfully all test requirements specified herein, the entire pipeline shall be filled with water and so maintained until the completion of the contract unless otherwise ordered by the Engineer.

END OF SECTION 02768

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