

SECTION 2.6 - WATER MAINS AND APPURTENANCES

2.06.01 GENERAL

The Contractor shall furnish and install all water mains, valves, hydrants, fittings, corporation stops, house service piping and appurtenances as specified herein and as defined in the standard details or as directed by the Town Engineer or Easton Utilities. Provide all necessary adaptors for connection to existing mains.

2.06.02 DUCTILE IRON PIPE AND FITTINGS

- A. Ductile iron pipe shall be manufactured in accordance with ANSI/AWWA C-151/A21.51, latest edition, and shall be thickness Class 50 in streets and inside highway sleeves and Class 56 under railroads unless otherwise noted. The Contractor shall furnish mechanical or push-on joints conforming to latest edition of ANSI/AWWA C-111/A21.11.
- B. Pipe and fittings shall have an external standard coating of approximately 1 mil thick.
- C. Pipe and fittings shall have an internal cement lining in accordance with latest revision of ANSI/AWWA C-104/A21.4. No bituminous coating shall be used on the inside of pipe and fittings unless prior written approval is obtained from the Delaware Division of Public Health.
- D. All fittings and specials shall be ductile iron with mechanical joint having a 350 psi pressure rating. They shall be marked and manufactured in conformance with ANSI/AWWA C-110/A21.10-87, latest edition. Compact ductile iron fittings will be an acceptable alternate. They shall be mechanical joint with a 350 psi pressure rating conforming to ANSI/AWWA C-153/A21.53 and C-111/A21.11.

2.06.03 POLYVINYL CHLORIDE (PVC) PLASTIC PIPE AND FITTINGS

- A. Polyvinyl chloride pipe shall meet the requirements of AWWA C-900 and C-909. It shall be manufactured in standard length not exceeding 20 feet and have an outside diameter equal to cast iron pipe. The pipe shall C-900 DR-18 PVC or C-909, DR-21 PVC.
- B. PVC pipe shall be manufactured with an elastomeric-gasket joint conforming to ASTM-D 3139. Pipe ends shall be beveled.
- C. Fittings for PVC water mains shall be ductile iron as specified above.
- D. The Contractor shall provide all necessary adaptors for connecting PVC pipe to ductile iron fittings and valves or other pipelines. Adaptors shall be as recommended by the pipe manufacturer.
- E. PVC pipe shall be delivered and stockpiled in unit pallets. Store pipe on flat surface. No

stacking of pallets of random lengths above five (5') feet in height will be allowed. If pipe is stockpiled for more than 30 days prior to installation in the trench, it must be suitably covered with reflective materials to protect the pipe from ultraviolet rays emanating from sunlight. Do not use plastic sheets. Allow for air circulation under covering.

- F. Bowed section of pipe will not be acceptable and will not be allowed to be installed on this project.

2.06.04 BORING AND JACKING OF WATER MAINS

- A. Where possible, an approach trench shall be excavated far enough to provide a jacking face of at least three (3') feet from a pavement surface. This open face shall be stored securely to prevent slipping or raveling of the face.
- B. Boring pits shall be large enough to contain all necessary equipment and tools. Adequate provision shall be made for the removal of excavated material.
- C. A substantial backstop of heavy timber or steel beams shall be provided to take the thrust of the jack or boring equipment.
- D. As material is excavated or bored ahead of the pipe, the pipe shall be jacked in to follow this excavation. The distance dug ahead of the pipe shall not exceed six (6") inches.
- E. The installation of casing pipe and the boring or excavation shall be done simultaneously.
- F. Voids between the sleeve and excavation shall be filled by pressure grouting.
- G. Cement grout shall be used to seal the pipe ends between the carrier pipe and sleeve.
- H. A one (1") inch PVC pipe shall be installed in the downgrade seal to permit drainage.
- I. Steel pipe sleeve shall be furnished in random lengths of the diameter shown on the plans and noted in the proposal and shall conform to the requirements of AWWA C-200; Grade B pipe shall be used. Pipe thickness for 18-inch dia. sleeve shall be 0.313 inches. 12-inch dia. sleeves shall be 0.250 inches thick. All joints for casing pipe shall be made by continuous weld completely around the perimeter of the pipe in accordance with AWWA C-206.
- J. Carrier pipe shall be Class 50 ductile iron at each location as required by the plans except at railroad crossing use Class 56.

2.06.05 DIRECTIONAL BORE AND SLEEVE

- A. PE carrier/casing pipe roadway crossings are allowed with the concurrence of the permitting agency having road jurisdiction. The design engineer shall submit connection details for approval.

- B. PE pipe shall be plain end for fusion welding conforming to ASTM F 714 and ASTM D 3035. Minimum pressure rating shall be 160 psi. Minimum SDR shall be 11.0 for carrier pipe and SDR 17.0 for casing pipe.
- C. Molded fittings will conform to ASTM F 714. End sections of PE piping in direction bore shall have a mechanical joint adaptor with end butt fusion welded to PE main.

2.06.06 GATE VALVES AND BOXES

- A. Gate valves shall be resilient seat type, in accordance with AWWA C-509 or C-515. Valve bodies and bonnets shall be cast iron epoxy coated on the inside per AWWA C-550.
- B. Stem and wedge nuts shall be bronze. Stems shall be sealed by at least two O-rings. Seals shall be replaceable with the valve fully open and while subject to the rated pressure. Valves shall open clockwise (open right).
- C. Wedge shall be constructed of ductile iron fully encapsulated in synthetic rubber except for guide and wedge nut areas or it shall have a replaceable internally reinforced, contoured molded rubber disc seat ring attached to the face of the wedge with self-locking stainless steel screws. Wedge rubber shall be molded in place and bonded to the ductile iron portion. Wedge shall seat against accurately formed seating surfaces in the valve body.
- D. Waterway shall be smooth and shall be no depressions or cavities in seat area where foreign material can lodge and prevent closure or seating.
- E. Gate valves shall be manufactured by Kennedy or American Flow Control.
- F. Provide each gate valve with a 5-1/4 inch diameter valve box with "Water" cast in the lids. All boxes for 4, 6, and 8 inch valves shall be equipped with #6 round bases. 10 inch valves shall be used with #8 valve box base. Valve boxes shall be adjustable between 2'-4" and 3'-4" except when deeper settings are required. Lids shall be extra deep and have tow holes for removal of lid. Valve boxes shall be as manufactured by Bingham and Taylor. Each valve box shall incorporate a rubber compound valve box adaptor to be placed between the valve and the valve box base. Adaptor shall be Valve Box Adaptor II by Adaptor, Inc. or approved equal.
- G. Provide heavy duty socket valve operating wrenches as indicated by Easton Utilities.

2.06.07 TAPPING SLEEVE AND VALVE

- A. Tapping sleeves shall be of all stainless steel construction including sleeve, bolts and nuts. Sleeves shall wrap 360° around the pipe with gridded full circumference gasket. Units shall be by Ford Meter Box Co. or Powerseal.

- B. Tapping valves shall be cast iron Fig. 950X, by Kennedy or American Flow Control.
- C. Install tapping sleeve and valve per manufacturer's recommendations.

2.06.08 FIRE HYDRANTS

- A. Fire hydrants shall be provided per the Easton Utilities standards. Hydrants shall be compression type with a 5-1/4 inch main valve opening, two 2-1/2 inch hose nozzles, one 4 inch steamer nozzle and a 6 inch mechanical joint hub base. Hydrant seats shall be provided with bronze to bronze threaded connections.
- B. Steamer nozzle threads shall be 6 threads per inch style 60V. 2 1/2 inch hose nozzle threads shall be hose thread 3-1/32 inch diameter, 8 threads per inch. Hydrants shall be of proper length for a 4 foot trench depth or as required by field conditions and be American Darling B-62-B or Kennedy K-81D Guardian with Stainless Steel hardware. They shall meet the requirements of AWWA C-502.
- C. A sworn certificate of inspection and testing shall be furnished by the manufacturer. Install hydrants with restraint system as detailed on the drawings.
- D. All hydrants to be furnished with non-kinking chains on the 2-1/2 inch nozzles.
- E. Hydrants shall open by turning the operating nut counter-clockwise. Nozzle caps shall open counter-clockwise
- F. Fire hydrants to receive one (1) coat of primer and two (2) coats of green paint in accordance with Federal and Easton Utilities Standards. The final coat shall be applied after the hydrant has been installed.
- G. Provide hydrant operating wrenched and repair kits as required by Easton Utilities.

2.06.09 FIRE MAINS

- A. Fire mains requested for building insurance purposes shall be of ductile iron or PVC construction. Each fire main shall be equipped with a backflow preventer with detector check valve.
- B. Backflow preventers shall be Febco or approved equal. Provide one OS&Y gate valve on each side of the backflow preventer.
- C. Backflow preventer shall be in a below ground vault or within a mechanical room accessible from the exterior door to said room. Internal systems shall be accessible to the Town of Easton and Easton Utilities.

2.06.10 LAYING WATER MAINS, FITTINGS AND APPURTENANCES

- A. Water main pipe, fittings and valves shall be installed per manufacturer's printed instructions. Care shall be taken to insure that no joints are made with unevenness or rough edges. Pipeline deflection must be kept below the manufacturer's limitations.
- B. All pipes shall be bedded on a solid foundation prior to backfilling. Defects due to settlement shall be corrected by the Contractor at his own expense. Bell holes shall be dug sufficiently large to receive same.
- C. Pipe and fittings shall be kept clean until final acceptance of the work. All open pipe ends shall be provided with plugs to keep dirt, water and other materials from entering. This plug shall be kept in place when actual pipe laying is not in progress.
- D. Excavation and backfill for water mains and appurtenances shall be per Section 2A of these standards.
- E. PVC pipe shall be beveled before making pipe joint.
- F. Install no pipe on frozen or frost penetrated subgrade. When directed, the Contractor shall install pipe on artificial foundations. Such foundation may consist of gravel or concrete and shall be to the dimensions and in the manner directed by the Engineer.
- G. Pipeline detectable tape shall be installed continuously along all water mains. The tape shall be installed 12 inches directly above the water main and 12 inches from the ground surface. The tape shall be Lineguard Type II Detectable Tape as manufactured by Lineguard, Inc. of Wheaton, Illinois or equal. The tape shall be a minimum of 6 inches wide, blue in color, imprinted with the words "CAUTION - WATER LINE BELOW" and be capable of being detected with inductive methods.
- H. Pipeline tracer wire shall be installed as shown in the details. Wire shall be a reinforced coated 8 gauge tracer wire as manufactured by Copperhead Industries or approved equal.
- I. All concrete required to construct buttresses behind plugs, tees, bends and other fittings and anchorages beneath vertical bends shall be placed as directed and/or as shown on the details.

2.06.11 INSTALLING FITTINGS, HYDRANTS, GATE VALVES AND VALVE BOXES

- A. Fittings, hydrants, gate valves and valve boxes shall be placed along the water mains at the locations indicated on the drawings or where otherwise designated by the Engineer.
- B. A valve box shall be carefully placed over the bonnet of each gate valve with the top at the finished surface of the street, sidewalk or at such other elevations as the Engineer shall direct. It shall be set exactly plumb. In tamping the backfill around the box special care shall be

taken to keep the box plumb and to have it firmly supported on valve box adaptor. Any box which is found out of plumb or which is not firmly supported, shall be excavated and made to rest in a satisfactory manner, at the Contractor's expense. Place gravel in and around valve box bases to provide for drainage.

- C. Ductile iron pipe with cast iron or ductile iron Mega-lug fittings shall be used exclusively throughout the hydrant assembly. Sakrete is not permitted for hydrant tee buttress construction.

2.06.12 INSTALLATION OF WATER MAINS BY THE DIRECTIONAL BORING METHOD

- A. General: Installation of the PE water main shall be by the directional boring method to the limits indicated on the drawings and as specified herein.

- B. Operating Expertise:

- 1. The Contractor must demonstrate expertise in trenchless methods by providing a list of ten utility references for whom similar work has been performed in the last two years. The references shall include a name and telephone number where contact can be made to verify the Contractor's capability. The Contractor must provide documentation showing successful completion of water main projects used for reference. Conventional trenching experience will not be considered applicable.
- 2. The directional boring equipment shall be the GuideDril system manufactured by UTILX Corporation's Flow Mole service or approved equal.

- C. Drilling Equipment

- 1. The system must be remotely steerable and permit electronic monitoring of tunnel depth and location. The system must be able to control the depth and directional of the pipe and must be accurate to a window of ± 2 inches.
- 2. The system must be capable of turning 90 degrees in a 35 foot radius.
- 3. The system shall utilize a fluid-cutting process, using a liquid clay such as bentonite. This clay must be totally inert and pose no risk to the environment or water main.
- 4. Liquid clay shall remain in the tunnel to increase stability of the tunnel and provide a lubricant to reduce frictional drag when the pipe is installed.
- 5. Spoils shall be recovered by use of a vacuum system mounted on a vehicle for removal of the spoil to an approved spoils site. Spoils shall not be discharged into sewers or storm drains.

6. The equipment must be capable of completing the boring in a single bore.
7. Equipment must be fitted with a permanent alarm system capable of detecting an electrical current. The system will have an audible alarm to warn the operator when the drill head nears electrified cables.

D. Safety:

1. All crews are to be provided with grounded safety mats, heavy gauge ground cables with connectors, hot boots and gloves to minimize the risk of electrocution.
2. Upon completion of boring and pipe installation, the Contractor will remove all spoils from the starting and termination pits. The pits are to be restored to the original condition.

2.06.13 DISINFECTION OF WATER MAINS

- A. Upon completion of water main construction, disinfect main and appurtenances. Disinfection shall be done in accordance with ANSI/AWWA C-651, latest edition. Contractor shall submit a plan of disinfection for approval by the Engineer.
- B. After the applicable retention period, the heavily chlorinated water shall be flushed from the main. This water shall be discharged to the sanitary sewer system or in accordance with the Maryland Department of the Environment regulations. Prior to discharge, heavily chlorinated water shall be dechlorinated using sodium metabisulfite or other acceptable methods to prevent excess strain on the wastewater treatment facility. Only after water leaving the main is no higher in chlorine concentration than normal drinking water, will a discharge to storm drains be allowed. Convey flushed water discharge point in a closed system.
- C. Affidavits of compliance, certifying the water sampled from the water mains to be free of coliform bacteria shall be submitted to the Engineer. The Contractor is responsible for coordinating and paying for testing by a private lab which is certified and approved in the State having jurisdiction. The Contractor shall provide written documentation when a section of mains can be placed in service.
- D. The Contractor shall place in each length of pipe, hydrants, hydrant branches and other appurtenances, a sufficient amount of chlorine tablets to insure adequate disinfection treatment of the main after its completion. Use only NSF approved chlorine tablets. Tablets shall be fastened to the inside top of every length of pipe as laid, using gasket cement known as "Permatex No. 2".
- E. The Contractor shall be held entirely responsible for securing a minimum residual chlorine content of 5 ppm at the extremities of the mains after twenty-four (24) hours or more contact with the full water pressure on the main.

- F. Water for filling the mains shall be introduced at a velocity of less than one (1') foot per second in order to permit the chlorine tablets to completely dissolve and have a reasonable uniform distribution throughout the mains. It is the intent of this Specification to require a sufficient amount of chemical to be equivalent to a dosage of 50 ppm of chlorine.
- G. After the chlorine has been in contact with the mains or storage units for twenty-four (24) hours or longer, samples collected from the extremities of the mains shall indicate a residual chlorine content of 5 ppm or more.
- H. If less than 5 ppm residual chlorine is indicated, the system shall be drained and the disinfection treatment repeated.
- I. If samples collected at the extremities indicate chlorine of 5 ppm or more, the system shall be flushed until there is only a normal chlorine residual (1.0 ppm or less) present, as determined by the DPD Method Test. Samples of water shall be collected from various points along the lines by an independent laboratory for bacteriological analysis as previously stated in paragraph C, in this section. If satisfactory bacteriological results are obtained, the lines may then be allowed to be placed in service. A copy of all test results shall be submitted to the Engineer.
- J. Dechlorinate and safely dispose of all testing water. Disposal rate and location shall be approved by Easton Utilities. Submit for approval a description of dechlorination method and equipment to be utilized.

2.06.14 WATER MAIN TESTING

- A. The Contractor shall furnish all equipment, labor and materials, including water, pumps, compressors, stopwatch, gauges and meters as approved by the Engineer for testing. The Engineer shall determine the amount of main to be tested at any one time and reserves the right to separate the installation into several test sections. All tests must be witnessed by Easton Utilities.
- B. **PRESSURE TEST**

After the pipe has been laid, all newly laid pipe or any valved section thereof, shall be subjected to a hydrostatic pressure of 120 psi.

- 1. Test Pressure shall:
 - a. Be of at least two hour duration.
 - b. Not vary by more than ± 5 psi.
- 2. Pressurization. Each valved section of pipe shall be filled with water slowly and to the specified test pressure, based on the elevation of the lowest point of the line or section under the test; corrected to the elevation of the test gage and shall be applied

by means of a pump connected to the pipe in a manner satisfactory to Easton Utilities.

3. Air Removal. Before applying the specified test pressure, air shall be expelled completely from the pipe, valves and hydrants. If permanent air vents are not located at all high points, the Contractor shall install corporation cocks at such points, so that the air can be expelled as the line is filled with water. After all the air is expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, all corporation cocks shall be removed and plugged or left in place at the discretion of Easton Utilities.
4. Examination. All exposed pipe, fittings, valves, hydrants and joints shall be examined carefully during the test. Any damage or defective pipe, fittings, valves or hydrants that are discovered following the pressure test shall be repaired or replaced with same material and the test shall be repeated until it is satisfactory to Easton Utilities.

C. LEAKAGE TEST

A leakage test shall be conducted concurrently with the pressure test.

1. Leakage Defined. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or at any valved section thereof, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.
2. Allowable Leakage. No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{SD\sqrt{P}}{266,400}$$

in which L is the allowable leakage, in gallons per hour; S is the length of pipeline tested in feet; D is the nominal diameter of the pipe in inches; and P is the average test pressure during the leakage test in pounds per square inch gage.

- D. Should the test show the main to be defective, the Contractor shall remedy such defects and retest the main as specified above. This procedure shall be repeated until the test requirements are met.

E. HYDRANT FLOW TESTING

The contractor shall have a certified fire hydrant flow test performed and report flow data to the Town and Easton Utilities. The fire flow test is required for all hydrants on all new developments, adjacent hydrants on water main replacements and street reconstructions or

upgrades.

Coordinate all fire flow tests with Easton Utilities

2.06.15 SERVICE PIPE AND APPURTENANCES

A. GENERAL

1. For all new residential or commercial developments currently not served by the Easton Utilities, the Contractor is responsible for furnishing and installing all corporation stops, house service pipe, meter setters or prefabrication meter setters, covers, valves and appurtenances as indicated on the drawings and specified herein.
2. The Easton Utilities will provide at the contractor's expense, a main tap complete with corp stop for all new residential or commercial developments in areas already served by Easton Utilities. The service will be stubbed out to the right-of-way line from where it becomes the Contractor's responsibility.
3. The meter setters installed by the Contractor shall accommodate Easton Utilities standard meters.
4. The Contractor shall provide all tools, equipment and accessories required for tapping ductile iron and polyvinyl chloride water mains and installing water services. All underground service lines, valves and fittings shall conform to ANSI/AWWA C800-84.
5. Trench tape approved by the Engineer shall be placed directly over all water services during backfilling operation. Tracer wire shall be installed as shown in the Standard details.

B. HOUSE SERVICES

1. Standard water service lines shall be as shown on the standard details. Service lines shall conform to ASTM D-2239, 200 PSI rating.
2. Corporation stops shall be 1 inch, Ford Model FB1000-4. Install stainless steel liners at connection to service lines. The Contractor shall furnish and install liners wherever a compression connection is used on plastic service lines.
3. Cutting tools shall be of the hollow, shell bit type for removal of pipe plug. On closely spaced taps for townhouse developments, place corporation stops as recommended by pipe manufacturer. Furnish saddles with standard AWWA corporation stop inlet thread, double strapped for tapping all mains. Saddles shall be Ford stainless steel double strapped type F202 for ductile or cast iron mains and FS 202 for PVC mains.

4. Meter box shall be as shown in the standard details. Cover frames shall incorporate anchor spikes where installed in concrete sidewalks. Lids shall have the word "WATER" cast into the cover and include lifter worm locks.
5. Meter setter with ball valve inlet and dual check valve outlet for 3/4" meters shall be installed in the meter pit. Ball valves, couplings and check valves shall be as required by Easton Utilities. Meter support shall be by a lateral PVC brace.

C. COMMERCIAL SERVICE

1. For tapping ductile iron pipe use Ford FS202, double strap, iron service clamp with 2 inch AWWA threads and FB1001-7-IDR 7 corporation stop. For tapping PVC pipe use Ford FS202, stainless steel tapping saddle with 2 inch AWWA threads and FB1001-7-IDR 7 corporation stop. Use Teflon tape for threaded service connections. Do not torque saddles or sleeves without water pressure in main.
2. Curb valves shall be 2 inch Ford B66-777-IDR7 ball valve. Curb valve boxes shall be B&T 92D screw extension type with arch base.
3. Meter pits shall be Sono-Loc box. Meter pit covers shall be No. 30 by Ford. Provide double extra heavy covers for traffic areas. Setters shall be Ford VH77-15B-11-77 with 2 inch flange angle check valve, 2 inch flange angle ball valve plus a bypass ball valve with padlock wings.

D. LAYING SERVICE PIPE AND APPURTENANCES

1. All service pipe shall be carefully inspected for damaged areas. All damaged pipe shall be cut out and recoupled. Pipe installed during hot weather shall be allowed to contract to normal length before backfilling. Pipes and fittings shall be bedded on a solid foundation.
2. Fittings and valves shall be kept clean, handled carefully and installed according to the manufacturer's recommendations.
3. All new service lines shall be installed in the center of vacant lots with meter in the sidewalk and not driveways, unless otherwise directed by the Engineer.
4. Service lines in streets shall be installed by open cutting or with an underground piercing tool such as an ACCU-punch or equal. Maximum diameter of piercing tool to be 2-1/2 inches.
5. Installation of services by piercing tool shall be performed with all necessary devices to assure alignment accuracy. Such devices shall include a magnetic level, launcher and aiming frame. The Contractor shall demonstrate installation procedures to the Engineer for approval prior to use.

6. Service connections and meter boxes shall be installed immediately after the construction of the adjacent main. Postponement of construction of service lines will not be allowed.
7. Requirements for sterilization and pressure testing of service connections shall be the same as specified for mains in this specification.
8. The Contractor is responsible for locating existing services, cutting and reconnecting with all necessary adaptors or sleeves. The Contractor shall obtain the services of a licensed plumber if required by code.

END OF SECTION