

SECTION 600 - WATER

ITEM 601. DUCTILE IRON PIPE AND FITTINGS

601.1 **SCOPE OF WORK**

- A. This specification covers the requirements to furnish and install ductile iron pipe and ductile iron pipe fittings including bracing, pipe laying, jointing, testing, blocking, and any other work that is required or necessary to complete the installation as shown on the Plans and as specified herein.

601.2 **SUBMITTALS**

- A. Within 30 days of the Notice to Proceed, the Contractor shall provide a list of materials to be used from the Approved Materials List (AML) or submit to the Engineer or City Staff for approval, technical product literature including the name of the pipe and fitting suppliers and a list of materials to be furnished, completely detailed working drawings and schedules of all ductile-iron pipe and fittings required, prior to each shipment of pipe, submit certified test reports that the pipe for this Contract was manufactured and tested in accordance with the ASTM and ANSI/AWWA Standards specified herein.

601.3 **REFERENCE STANDARDS**

- A. **American Society for Testing and Materials (ASTM)**
1. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs 60,000 PSI Tensile Strength.
- B. **American Water Works Association (AWWA)**
1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pressure Pipe and Fittings.
 2. AWWA C105 - Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids.
 3. AWWA C110 - Ductile-Iron and Gray-Iron Fittings, 3-inch Through 48-in for Water and Other Liquids.
 4. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 5. AWWA C115 - Standard for Flanged Ductile-Iron Pipe with Threaded Flanges.
 6. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds for Water or Other Liquids.
 7. AWWA C153 - Ductile-Iron Compact Fittings, 3-inch Through 16-inch for Water and Other Liquids.
 8. AWWA C600 - Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances.
 9. AWWA C651 - Disinfection Water Mains
- C. **American National Standards Institute (ANSI)**
1. ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.



- D. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

601.4

QUALITY ASSURANCE

- A. All ductile-iron pipe and fittings of a given size range shall be from a single Manufacturer. All ductile-iron pipe to be installed under this Contract may be inspected at the foundry for compliance with these Specifications by an independent testing laboratory provided by the City. The Contractor shall require the Manufacturer's cooperation in these inspections. The cost of foundry inspection of disapproved pipe will be borne by the Contractor.
- B. Inspection of the pipe will be made by the Engineer or other representatives of the City after delivery. The pipe shall be subject to rejection at any time on account of failure to meet any of the Specification requirements, even though pipes may have been accepted as satisfactory at the place of manufacture. Pipe rejected after delivery shall be marked for identification and shall immediately be removed from the job.

601.5

MATERIALS

- A. Ductile iron pipe shall conform to AWWA C151, be manufactured from metal having a minimum tensile strength of 60,000 psi, a minimum yield strength of 42,000 psi, and a minimum elongation of 10 percent (60-42-10), and be provided in the following minimum pressure classes:
1. 12-inch and smaller, Class 350.
 2. 14-inch through 20-inch, Class 250.
 3. 24-inch, Class 200.
 4. 30-inch and larger, Class 150.
- B. Ductile iron fittings shall conform to AWWA C110 or C153.
- C. All pipe and fittings shall have a bituminous outside coating in accordance with AWWA C151 and C110, respectively. All pipe and fittings shall be cement-mortar lined and seal coated in accordance with AWWA C104. Cement mortar lining shall be double thickness.
- D. Ductile iron pipe with push-on or mechanical joints shall be centrifugally cast pipe in accordance with AWWA C150 and C151.
- E. Restrained joints shall be restrained push-on joints, TR Flex by U.S. Pipe and Foundry; Lok-Fast by American Cast Iron Pipe Company, or equal. Joints shall be suitable for 250 psi working pressure and be fabricated of heavy section ductile iron casting. Bolts and nuts shall be low carbon steel conforming to ASTM A307, Grade B.
- F. Sleeve type couplings shall be of steel and shall be Style 38 by Dresser Manufacturing Division, Smith-Blair or equal. Couplings shall be furnished with black steel bolts and nuts and with pipe stop removed. Gaskets shall be of a material suitable for exposure to liquid within the pipe.



601.6

POLYETHYLENE ENCASEMENT

- A. All buried ductile iron pipe and metallic fittings shall be encased with 8 mil, Type I, Grade E-1, polyethylene film conforming to AWWA C105. Class usage shall be:
 - 1. Class A - Natural Color where exposure to weather (including sunlight) is less than 48 hours total before burial.
 - 2. Class C - Black where exposure to weather (including sunlight) may be more than 48 hours.
- B. Exposure to weather shall be kept to a minimum, and in no case shall it exceed 10 days. The Class of polyethylene used shall be approved by the Engineer.
- C. Polyethylene encasement shall not be paid for separately, but the cost there of shall be included in the appropriate item of the Proposal and Bid Schedule.

601.7

LAYING DUCTILE IRON PIPE AND FITTINGS

- A. Unless otherwise specified on the Plans, pipe shall be installed to clear all utility lines and shall have 42" minimum cover. For water lines to be constructed under a future roadway, the cover may be increased to allow for future paving grades. The depth of cover, where shown on the Plans, is that distance from the top of the pipe to the approximate proposed grade line.
- B. Care shall be taken in loading, transporting and unloading to prevent injury to the pipe, lining or coatings. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before laying and no piece shall be installed which is found to be defective. Any damage to the pipe linings or coatings shall be repaired as directed by the Engineer. Handling and laying of pipe and fittings shall be in accordance with the Manufacturer's instruction and as specified herein.
- C. All pipe and fittings shall be thoroughly cleaned before laying, shall be kept clean until they are used in the work, and when laid, shall conform to the lines and grades required. Pipe shall not be laid unless the subgrade is free of water and in a satisfactory condition. Ductile iron pipe and fittings shall be installed in accordance with the requirements of AWWA C600 except as otherwise provided herein. All piping on this project regardless of size or class shall be placed in the embedment as shown on the detail sheets in the Plans. If any defective pipe is discovered after it has been laid, it shall be removed and replaced with a sound pipe in a satisfactory manner by the Contractor, at his own expense.
- C. All pipe shall be sound and clean before laying. When laying is not in progress, including lunchtime, the open ends of the pipe shall be closed by watertight plugs or other approved means. Good alignment shall be preserved in laying. The deflection at joints shall not exceed that recommended by the Manufacturer. Fittings, in addition to those shown on the Plans, shall be provided, if required, for crossing utilities which may be encountered upon opening the trench. Solid sleeves shall be used only where approved by the Engineer and the City.
- E. When cutting pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of pipe to be joined with a bell shall be beveled to conform to the manufactured spigot end. Cement lining shall be undamaged.
- F. Joints shall be protected by eight (8) mil. Polyethylene film prior to placing concrete. Concrete shall be placed against undisturbed material, and shall not cover joints, bolts or nuts, or interfere with the removal of any joint.

601.8

PUSH-ON JOINTS

- A. Push-on joints shall be made in accordance with AWWA C111 and the Manufacturer's instructions. Pipe shall be laid with bell ends in the direction of trenching. A rubber gasket shall be inserted in the



groove of the bell end of the pipe, and the joint surfaces cleaned and lubricated. The plain end of the pipe to be laid shall then be aligned and inserted in the bell of the pipe to which it is to be joined and pushed home with a jack or by other means. After joining the pipe, a metal feeler shall be used to make certain that the rubber gasket is correctly located.

601.9 MECHANICAL JOINTS

- A. Mechanical joints shall be made in accordance with Appendix "A" of AWWA C111 and the Manufacturer's instructions. Thoroughly clean and lubricate the joint surfaces and rubber gasket with soapy water before assembly. Bolts shall be tightened to the specified torque.

601.10 RESTRAINED JOINTS

- A. Restrained joints shall be installed where shown on the Plans. The joint assemblies shall be made in accordance with the Manufacturer's recommendations.

601.11 SLEEVE TYPE COUPLINGS

- A. Couplings shall be installed where shown on the Plans. Couplings shall not be assembled until adjoining push-on joints have been assembled. After installation, apply a heavy bitumastic coating to bolts and nuts.

601.12 POLYETHYLENE ENCASEMENT

- A. The polyethylene encasement shall be installed in accordance with either method specified in AWWA C105.

601.13 CONCRETE AND BLOCKING

- A. 2,500 psi concrete shall be placed for blocking at each change in direction in the pipeline, in such manner as will substantially brace the pipe against undisturbed trench walls. Concrete blocking, made from Type I cement, shall have been in place four (4) days prior to testing the pipeline as hereinafter specified. Test may be made in two (2) days after completion of blocking if Type III cement is used.
- B. At all points where wet connections are made to existing lines, the existing lines shall be adequately blocked and the tapping connection fittings shall be supported by blocking up to the spring line with 2,500 psi concrete.
- C. Concrete blocking will not be measured or paid for as a separate item but the cost thereof shall be included in the proper items listed in the Proposal and Bid Schedule.

601.14 CLEANING

- A. At the conclusion of the work thoroughly clean all of the new pipelines by flushing with water or other means to remove all dirt, stones, pieces of wood or other material which may have entered during the construction period. If obstructions remain after this cleaning, the obstructions shall be removed.

601.15 CONNECTIONS AND APPURTENANCES

- A. The Contractor shall make the alterations and the necessary connections to existing water mains as shown on the Plans. Such connection shall be made at such time and in a manner approved by the City; in each case, when the work is started, it shall be prosecuted expeditiously and continuously until completed.
- B. Fittings, bends, plugs and valves shall be of standard manufacture and mechanical joint type to fit AWWA pipe specifications in Classes A, B, C and D, unless otherwise shown on the Plans.



- C. Payment for fittings and gate valves will be made separately under the appropriate bid items listed in the Proposal and Bid Schedule.

601.16

LEAKAGE TESTING AND STERILIZATION

- A. All Ductile Iron Pipe shall be leak tested and sterilized according to Section 213 – TESTING OF PIPELINES AND MANHOLES.

601.17

PAYMENT

- A. The pipeline, complete in place, including cleanup, will be measured for payment in linear feet along the centerline of the pipe actually installed. Measurement shall be through all fittings, specials, valves, etc., and no deduction in length shall be made for such appurtenances. Installation of the pipeline will be paid for at the unit contract price per linear foot as provided in the Proposal and Bid Schedule.
- B. Payment of the unit contract price for the items of work performed shall be the total compensation for furnishing all labor, materials, tools, equipment and incidentals and performing all work that is necessary for the installation, testing, and sterilization of the pipe, fittings, connections, blocking, embedment or placing in encasement pipe and all other appurtenances in accordance with the Plans and the provisions of the Specifications.

END OF SECTION



SECTION 600 – WATER SPECIFICATIONS

ITEM 602. POLYVINYL CHLORIDE (PVC) PIPE-WATER

602.1 SCOPE OF WORK

- A. This specification covers the requirements to install polyvinyl chloride (PVC) water pipe and ductile iron fittings for the water line, including excavation, sheeting, shoring, dewatering, pipe laying, jointing, testing, backfilling and any other work that is required or necessary to complete the installation as shown on the Plans and as specified herein.

602.2 SUBMITTALS

- A. Within 30 days of the Notice to Proceed, the Contractor shall provide a list of materials to be used from the Approved Materials List (AML) or submit to the Engineer or City Staff for approval, technical product literature including the name of the pipe and fittings suppliers, a list of materials to be furnished, shop drawings and schedules of all PVC pipe and fittings required, prior to each shipment of pipe, submit certified test reports that the pipe for this Contract was Manufactured and tested in accordance with the ASTM Standards specified herein.

602.3 QUALITY ASSURANCE

- A. All PVC pipe and fittings of a given size range shall be from a single Manufacturer. The supplier shall be responsible for the provisions of all test requirements specified in ASTM D3034 or ASTM F789 and/or ASTM F758 as applicable. In addition, all PVC pipe to be installed under this Contract may be inspected at the plant for compliance with these specifications by an independent testing laboratory provided by the City. The Contractor shall require the Manufacturer's cooperation in these inspections. The cost of plant inspection of disapproved pipe, will be borne by the Contractor.
- B. Inspections of the pipe may also be made by the Engineer or other representatives of the City after delivery. The pipe shall be subject to rejection at any time on account of failure to meet any of the Specification requirements, even though sample pipes may have been accepted as satisfactory at the place of manufacture. Pipe rejected after delivery shall be marked for identification and shall be removed from the job at once.

602.4 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

- A. Polyvinyl chloride pipe for water lines, unless otherwise specifically shown on the Plans, or approved in writing, shall be AWWA C900, C905, or C909 with a dimension ratio of 18 (DR-18), for water lines and shall be extruded, be of rubber gasket type, and be furnished in 20-foot nominal laying lengths. All such pipe shall bear a mark denoting approval by the Underwriters' Laboratories of Chicago, Illinois, so that it will be acceptable to the Texas State Fire Insurance Commission for use in fire protection lines without penalty. All joints shall be of the type which provides a recession in the bell for the employment of a single rubber gasket to be placed before the insertion of the succeeding spigot. Each size of polyvinyl chloride pipe shall have the same outside diameter as the corresponding size of cast iron pipe.
- B. Fittings shall be ductile iron, mega-lugged or flanged type and shall be Class 250 in accordance with AWWA Specifications C110-77, C-111-80, C115-75 and C153. Flanges shall be faced and drilled in accordance with ASA Standard B16.1, Class 125 unless otherwise shown on the Plans or in the Special Conditions. All fittings shall be tar coated on the outside surface and shall have an interior cement lining with seal coat per AWWA Specifications C104-80 unless otherwise shown or specified.
- C. The Contractor shall obtain installation instructions, including support spacing and solvent welding, from the supplying Manufacturer, shall comply with the instructions, and shall meet the requirements of ASTM D-2855, Standard Recommended Practice for making Solvent Cemented Joints with PVC



Pipe and Fittings. The PVC solvent cement shall comply with ASTM D-2564 and shall be furnished by the pipe and fitting Manufacturer for the class and type of pipe supplied to the project.

602.5

HANDLING AND CUTTING PIPE

- A. Pipe and fittings are slightly brittle. Care shall be taken in shipping, handling and laying to avoid damaging the pipe and fittings. Extra care will be necessary during cold weather construction.
- B. Any pipe or fitting showing a crack or which has received a blow that may have caused an incipient fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work.
- C. All pipe ends shall be square after cutting.
- D. While stored, pipe shall be adequately supported from below at not more than three (3) foot intervals to prevent deformation. Pipe shall not be stacked higher than six (6) feet. Pipe and fittings shall be stored in a manner which will keep them at ambient outdoor temperatures and out of direct sunlight. Temporary shading as required to meet this requirement shall be provided. Simple covering of the pipe and fittings which allows temperature buildup when exposed to direct sunlight will not be permitted.

602.6

JOINTING POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

- A. PVC pipe and fittings shall be jointed in accordance with the recommendations of the latest ASTM Standards and detailed instructions of the Manufacturer.

602.7

INSTALLING POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

- A. Unless otherwise specified on the Plans, polyvinyl chloride pipe shall be installed to clear all utility lines and shall have 42" minimum cover. For water lines to be constructed under a future roadway, the cover may be increased to allow for future paving grades. The depth of cover, where shown on the Plans, is that distance from the top of the pipe to the approximate proposed grade line.
- B. Care shall be taken in loading, transporting and unloading to prevent injury to the pipe, lining or coatings. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before laying and no piece shall be installed which is found to be defective. Any damage to the pipe linings or coatings shall be repaired as directed by the Engineer. Handling and laying of pipe and fittings shall be in accordance with the Manufacturer's instruction and as specified herein.
- C. No single piece of pipe shall be laid unless it is generally straight. The centerline of the pipe shall not deviate from a straight line drawn between the centers of the openings at the ends of the pipe by more than $\frac{1}{16}$ -inch per foot of length. If a piece of pipe fails to meet this requirement check for straightness, it shall be rejected and removed from the site. Laying instructions of the Manufacturer shall be explicitly followed.
- D. Any pipe or fittings discovered to be defective after laying shall be removed and replaced with a sound piece.
- E. The Engineer or the City may examine each bell and spigot end to determine whether any preformed joint has been damaged prior to installation. Any pipe having defective joint surfaces shall be rejected, marked as such, and immediately removed from the job site.
- F. All pipe shall be sound and clean before laying. When laying is not in progress, including lunch time, the open ends of the pipe shall be closed by watertight plugs or other approved means. Good alignment shall be preserved in laying.



- G. Pipe and fittings shall be installed in accordance with the instructions of the Manufacturer, ASTM D2321 and as specified herein. As soon as the excavation is complete to normal grade of the bottom of the trench, embedment material shall be placed, compacted and graded to provide firm, uniform and continuous support for the pipe. Bell holes shall be excavated so that only the barrel of the pipe bears upon the bedding. The pipe shall be laid accurately to the lines and grades indicated on the Plans. The specified embedment shall be accurately shaped and trimmed to receive the pipe barrel and each pipe section, when in place, shall have a uniform bearing on the subgrade for the full length of the pipe barrel. Pipe shall not be laid unless the subgrade is free of water and in a satisfactory condition. Embedment material shall be placed evenly on each side of the pipe to mid-diameter and hand tools shall be used to force the embedment material under the haunches of the pipe and into the bell holes to give firm continuous support for the pipe. Embedment material shall then be placed to 12-inches above the top of the pipe. Next, the varying depths of select material backfill above the embedment material backfill shall be placed according to the Plan Details and carefully compacted. Generally, the compaction shall be done evenly on each side of the pipe and compaction equipment shall not be operated directly over the pipe until sufficient select material backfill has been placed to ensure that such compaction equipment will not have a damaging effect on the pipe. Equipment used in compacting the varying depths of select material backfill shall be approved by the pipe Manufacturer's representative prior to use. Adjustments of the pipe to line and grade shall be made by scraping away or filling in with granular material, and not by wedging or blocking up the bell.
- H. Perforated PVC Pipe and fittings shall be installed in accordance with the instructions of the Manufacturer, ASTM F758 and as specified herein. As soon as the excavation for the trench is complete to normal grade of the bottom of the trench, geotextile fabric shall be laid and then the pea gravel bedding shall be carefully placed (so not to damage the geotextile fabric) and graded to provide uniform and continuous support for the pipe. Bell holes shall be excavated so that only the barrel of the pipe bears upon the bedding. Before the perforated pipe is laid on the trench, the perforated pipe shall be wrapped around and closed according to the Manufacturer's closure recommendations with the geotextile fabric. The pipe shall be laid accurately to the lines and grades indicated on the Plans. Blocking under the perforated PVC pipe will not be permitted. Pea gravel shall be placed evenly on each side of the pipe to mid-diameter and hand tools shall be used to gently place the pea gravel under the haunches of the pipe and into the bell holes to give firm continuous support for the pipe. Making sure not to damage the geotextile fabric, pea gravel shall then be carefully placed above the top of the perforated pipe varying from two to three (2-3) feet depending on the Plans. Once the remaining pea gravel has been placed, overlap or close the geotextile fabric according to the Manufacturer's recommendations or six (6) inches minimum overlap. Then one (1) foot of topsoil shall be placed over the pea gravel to the ground level with proper grass sodding on top.
- I. Joints shall not be "pulled" or "cramped". Each joint of pipe shall be completed in compliance with Manufacturer's recommendations.
- J. Before any joint is made, the pipe shall be checked to assure that a close joint with the next adjoining pipe has been maintained and that the inverts are matched and conform to the required grade. The pipe shall not be driven down to grade by striking it.
- K. Precautions shall be taken to prevent flotation of the pipe in the trench.
- L. When moveable trench bracing such as trench boxes, moveable sheeting, shoring or plates are used to support the sides of the trench, care shall be taken in placing and moving the boxes or supporting bracing to prevent movement of the pipe, or disturbance of the pipe bedding and backfill or embedment material. Trench boxes, moveable sheeting, shoring or plates shall not be allowed to extend below mid-diameter of the pipe. As trench boxes, moveable sheeting, shoring or plates are moved, embedment material shall be placed to fill any voids created and the embedment material and backfill shall be recomacted to provide uniform side support for the pipe.



602.8

CONCRETE AND BLOCKING

- A. 2,500 psi concrete shall be placed for blocking at each change in direction in the pipeline, as shown in the Standard Details and in such manner as will substantially brace the pipe against undisturbed trench walls. In no event shall this quantity of concrete blocking be less than those shown in the Plans. Concrete blocking, made from Type I cement, shall have been in place four (4) days prior to testing the pipeline as hereinafter specified. Tests may be made in two (2) days after completion of blocking if Type III cement is used.
- B. At all points where wet connections are made to existing lines, the existing lines shall be adequately blocked and the tapping connection fittings shall be supported by blocking up to the spring line with 2,500 psi concrete.
- C. Concrete blocking will not be measured or paid for as a separate item but the cost thereof shall be included in the various items listed in the Proposal and Bid Schedule.

602.9

TESTING AND ALLOWABLE LEAKAGE

- A. All PVC pipe and fittings shall be leak tested and sterilized according to Section 213- TESTING OF PIPELINES AND MANHOLES.

602.10

PAYMENT

- A. The pipeline, complete in place, including cleanup, will be measured for payment in linear feet along the centerline of the pipe actually installed. Measurement shall be through all fittings, specials, valves, etc., and no deduction in length shall be made for such appurtenances. Installation of the pipeline will be paid for at the unit contract price per linear foot as provided in the Proposal and Bid Schedule.
- B. Payment of the unit contract price for the items of work performed shall be the total compensation for furnishing all labor, materials, tools, equipment and incidentals and performing all work that is necessary for the installation, testing, and sterilization of the pipe, fittings, connections, blocking, embedment or placing in encasement pipe and all other appurtenances in accordance with the Plans and the provisions of the Specifications.

END OF SECTION



SECTION 600 – WATER SPECIFICATIONS

ITEM 603. VALVES, HYDRANTS AND APPURTENANCES

603.1 SCOPE OF WORK

- A. This specification covers the requirements to provide all buried valves, valves in manholes and underground vaults, hydrants and appurtenances complete with actuators and all accessories as shown on the Plans and as specified herein.

603.2 SUBMITTALS

- A. Within 30 days of the Notice to Proceed, the Contractor shall provide a list of materials to be used from the Approved Materials List (AML) or submit to the Engineer or City Staff for approval, technical product literature including Manufacturer's literature, illustrations, specifications and engineering data which includes dimensions, size, materials of construction, weight, protection coating, and all other pertinent data to illustrate conformance to the specification found within. The Contractor shall also submit four (4) copies of all certified shop test results specified herein, complete operation and maintenance manuals including all copies of all approved shop drawings, and certificates of compliance where required by referenced standards: For each valve specified to be manufactured and/or installed in accordance with AWWA and other standards, submit an affidavit of compliance with the appropriate standards, including certified results of required tests, and certification of proper installation.

603.3 REFERENCE STANDARDS

- A. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. American Water Works Association (AWWA)
1. AWWA C500 - Gate Valves, three (3)-inch through 48-inch NPS, for Water and Sewage Systems.
 2. AWWA C502 - Dry-Barrel Fire Hydrants.
 3. AWWA C509 - Resilient-Seated Gate Valves, three (3) inch through 12-inch NPS, for Water and Sewage Systems.
- C. American National Standards Institute (ANSI)
1. ANSI B16.1 - Cast-Iron Pipe Flanges and Flanged Fittings.
 2. ANSI C111 - Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.
- D. American Society for Testing and Materials (ASTM)
1. ASTM A48 - Gray Iron Castings.
 2. ASTM A126 - Gray Iron Castings for Valves, Flanges and Pipe Fittings
 3. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 4. ASTM A276 - Standard Specification for Stainless and Heat Resisting Steel Bars and Shapes.



5. ASTM A536 - Ductile Iron Castings.

E. Steel Structures Painting Council (SSPC)

1. SSPC SP-6 - Commercial Blast Cleaning

F. Where reference is made to one (1) of the above standards, the revision in effect at the time of bid opening shall apply.

603.4

DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the site to ensure uninterrupted progress of the work.

B. Protect threads and seats from corrosion and damage. Rising stems and exposed stem valves shall be coated with a protective oil film which shall be maintained until time of use.

C. Provide covers for all openings.

1. All valves three (3) inches and larger shall be shipped and stored on site until time of use with wood or plywood covers on each valve end.

2. All valves smaller than three (3) inches shall be shipped and stored as above except that heavy card board covers may be furnished instead of wood.

D. Store equipment to permit easy access for inspection and identification. Any corrosion in evidence at the time of City acceptance shall be removed, or the valve shall be removed from the job.

E. Store all equipment in covered storage off the ground.

603.5

COORDINATION

A. Review installation procedures under other Sections and coordinate with the work which is related to this Section including buried piping installation and site utilities.

B. Contractor shall coordinate the location and placement of concrete thrust blocks when required.

603.6

GENERAL

A. All valves shall open counter-clockwise.

B. The use of a Manufacturer's name and/or model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

C. Valves shall be of the size shown on the Plans or as noted, and as far as possible equipment of the same type shall be identical and from one Manufacturer.

D. Valves shall have the name of the maker, nominal size, flow directional arrows, working pressure for which they are designed and standard to which they are manufactured cast in raised letters on some appropriate part of the body.

E. Unless otherwise noted, valves shall have a minimum working pressure of 200 psi or be of the same working pressure as the pipe they connect to, whichever is higher, and suitable for the pressures noted where they are installed.



- F. Valves shall be of the same nominal diameter as the pipe or fittings they are connected to. Except as otherwise noted, joints shall be mechanical joints, with joint restraint where the adjacent piping is required to be restrained.
- G. Valves shall be constructed for buried service.

603.7

VALVE BOXES

- A. All gate valves shall be provided with extension shafts (where the operating nut is greater than five (5) feet below grade), operating nuts and valve boxes as follows:
 - 1. Extension shafts shall be steel and the operating nut shall be two (2) inches square. Shafts shall be designed to provide a factor of safety of not less than four (4). Operating nuts shall be pinned to the shafts.
 - 2. Valve boxes shall be selected from the AML and suitable for installation on the buried valves. Covers shall be cast iron with integrally-cast direction-to-open arrow and "WATER" shall be cast in the cover when used on a water line or "SEWER" when used on a wastewater force main. Aluminum or plastic are not acceptable. A means of lateral support for the valve extension shafts shall be provided in the top portion of the valve box. The valve box lid shall be furnished with a pentagon-head bolt for locking.
 - 3. The upper section of each box shall have a bottom flange of sufficient bearing area to prevent settling. The bottom of the lower section shall enclose the stuffing box and operating nut of the valve and shall be oval.
 - 4. An approved operating key or wrench shall be provided.
 - 5. All fasteners shall be Type 304 stainless steel.

603.8

RESILIENT SEATED GATE VALVES

- A. Valves shall be manufactured in accordance with AWWA C509.

Acceptable Gate Valves are listed in the AML.
- B. Valves shall be provided with a minimum of two (2) O-ring stem seals.
- C. Bonnet and gland bolts and nuts shall be either fabricated from a low alloy-steel for corrosion resistance or electroplated with zinc or cadmium. The hot-dip process in accordance with ASTM A153 is not acceptable.
- D. Wedges shall be totally encapsulated with rubber.
- E. Units shall be, in addition, UL and FM approved.
- F. Resilient wedge gate valves shall be furnished and installed in sizes and shall be manufactured in accordance with the latest AWWA C-509 and cast iron shall conform to the latest ASTM A-126 standards. Gate valves furnished under these specifications shall be of the solid wedge, resilient seat type with cast iron/ductile iron body and bronze stem designed for 250 pounds per square inch minimum working pressure. All gate valves shall be tested hydrostatically to 400 pounds per square inch. Gate valves shall meet the latest AWWA standard specifications (C-509).
- G. The seat shall be made of Styrene Butadiene rubber and provide a positive water tight seal. The seat shall be permanently bonded or mechanically attached to the wedge with stainless steel screws. If



bonded, ASTM P-429 requirements shall be followed. Non-rising stem gate valves shall be equipped with "O" ring type packing gland consisting of at least two (2) "O" rings. The thrust collar shall work in an "O" ring seal lubricant reservoir or against bearings or washers, above and below constructed of Delrin or approved equal material. Gate valve stems, shall be fabricated from solid bronze rod having a tensile strength of not less than 60,000 pounds per square inch, and a minimum yield strength of 30,000 pounds per square inch.

- H. Cast iron body shall be of iron with an even grain and shall possess a tensile strength of not less than 32,000 pounds per square inch. All bronze castings, except the stem, shall have a tensile strength of not less than 30,000 pounds per square inch. The entire internal valve body surfaces shall be coated with a factory applied two (2) component epoxy system or approved equal. The seating surface shall be machined or otherwise constructed to provide a smooth, even surface for the resilient seat. All valves shall open left (counter clockwise) and have a two (2) inch square wrench nut unless specified otherwise.

603.9 TAPPING SLEEVES AND TAPPING VALVES

- A. Tapping sleeves shall be stainless steel, designated for working pressure not less than 200 psi. Armored end gaskets shall be provided for the full area of the sleeve flanges. Sleeves shall be as manufactured by A.P. Smith Division of U.S. Pipe, Mueller, Clow, or equal. Nuts and bolts shall be Type 304 stainless steel.
- B. Size-on-Size tapping sleeve shall be ductile iron or cast iron.
- C. Tapping valves shall conform to the requirements specified above for gate valves except that one (1) end shall be flanged and one (1) mechanical. Tapping valves shall be provided with an oversized opening to permit the use of full size cutters. Tapping valves shall be Ford B81-777 or equal.

603.10 CHECK VALVES

- A. Controlled Closing Swing Check Valves (lever & weight)
 - 1. Check valves shall be of the controlled closing swing type. The controlled closing swing check valves shall be guaranteed to operate under severe conditions as check valves. The valve shall be designed to open smoothly, provide full pipe line flow, permit minimum head loss and close at a controlled rate of speed for the final predetermined portion of its stroke. All bolts and nuts used in the assembly shall be steel, commercial.
 - 2. The valve body shall be Cast Iron ASTM A126-B/ductile iron ASTM A536. The disc arm and chamber level shall be of heavy steel construction and keyed to the hinge shaft. The hinge shaft shall be of 18-8 stainless steel and of adequate diameter to withstand a complete hydraulic unbalance pressure of 125 psi on the valve disc. A single cushioning device mounted on the external side of the valve shall control the valve closure by way of the interchange of oil to and from an oil reservoir. The use of air or gas pressurized oil reservoir shall not be permitted. The oil plunger assembly shall be rigidly attached to the valve body by shoulder bolts or dowel pins to prevent fretting.
 - 3. The Manufacturer, if required by the Engineer or the City, shall submit design calculations of principle component stresses to substantiate the integrity of the valve for the working pressure involved.
 - 4. The valve when closed shall be tight seating by way of a resilient replaceable seat against a bronze seat ring in the body.
 - 5. Valves shall be as listed in the AML.. The City reserves the right to inspect all valves before shipment is made. Any failure of valves to operate satisfactorily during the first year of installation due to faulty workmanship or defective material shall be replaced and made good by



the Manufacturer. Under these specifications, any valve stuffing box that leaks for any reason or because of excessive wear or deterioration of packing, shall be reason for classification as defective material.

B. Slanted / Tilted Check Valves

1. Slanted or tilted check valves shall be furnished and installed where shown on the Plans.
2. The body of the valve shall be ductile iron or cast iron with access ports to the disc. The disc shall be cast iron. The seat and disc rings shall be bronze. Pivot pins and bushings shall be bronze or stainless steel. The valve shall include a localized indicator of the position of the valve.
3. The valves shall include a top mounted oil dash pot to prevent slamming of the disc. The dash pot shall control the last 10% of closure of the disc. The speed of closure within this 10% shall be adjustable.
4. Valves shall be as listed in the AML.

603.11 FLANGES

- A. Flanges shall be cast solid and faced accurately at right angles to the axis of the casting. Dimensions and drilling of flanges shall be in accordance with the American Standard Association for a working pressure of 125 pounds per square inch. Special drilling shall be provided where necessary.

603.12 FIRE HYDRANTS

- A. Fire hydrants shall be dry-barrel type conforming to the requirements of the latest revision of AWWA C502. Hydrants shall be designed such that the hydrant valve closes with line pressure preventing loss of water and consequent flooding in the event of traffic damage.
- B. Hydrants shall have six (6)-inch mechanical joint inlet connections, two 2½-inch hose connections and one 5¼-inch pumper connection. Threads for the hose and pumper connections shall be in accordance with National Standard Thread. Hydrants shall be according to Manufacturer's standard pattern. Hydrants shall be equipped with "O" ring packing. Each nozzle cap shall be provided with a Buna-N rubber washer.
- C. Hydrants shall be so arranged that the direction of outlets may be turned 90 degrees without interference with the drip mechanism or obstructing the discharge from any outlet. The body of the hydrant shall be equipped with a breakable flange, or breakable cast iron flange bolts, just above the grade line.
- D. A bronze or rustproof steel nut and check nut shall be provided to hold the main hydrant valve on its stem.
- E. Hydrant valve opening shall have an area at least equal to that area of a 5¼-inch minimum diameter circle and be obstructed only by the valve rod. Each hydrant shall be able to deliver 500 gallons per minute minimum through its two 2½-inch hose nozzles when opened together with a loss of not more than two (2) psi in the hydrant.
- F. Hydrants shall be designed for installation in a trench that will provide minimum cover as noted on Plans and for the flange to be 3 ½-inches above ground surface. Hydrant extensions shall be as manufactured by the company furnishing the hydrants and of a style appropriate for the hydrants as furnished.
- G. Hydrants shall be provided with an automatic and positively operating, non-corrodible drain or drip valve so as to drain the hydrant completely when the main valve is shut. A drain valve operating by springs or



gravity is not acceptable.

- H. Operating stems whose threads are located in the barrel or waterway shall be of manganese bronze, everdur, or other high-quality non-corrodible metal, and all working parts in the waterway shall be bronze to bronze.
- I. Hydrants shall open by turning operating nut to left (counter-clockwise) and shall be marked with a raised arrow and the word "open" to indicate the direction to turn stem to open hydrant.
- J. Hydrants shall be furnished with caps, double galvanized steel hose cap chain, galvanized steel pumper hose cap chain, a galvanized steel chain holder and any other hooks and/or appurtenances required for proper use.
- K. Hydrant operating nut shall be AWWA Standard pentagonal type measuring 1½-inch point to flat.
- L. Hydrants shall be hydrostatically tested as specified in AWWA C502.
- M. Hydrants shall beas listed in the AML.:

- N. All iron work to be set below ground, after being thoroughly cleaned, shall be painted with two (2) coats of asphalt varnish specified in AWWA C502. Iron work to be left above ground shall be factory primed and, with exception of the bonnet, painted flynt aluminum using a high grade enamel paint of quality and color to correspond to the present standard of the City. The bonnet shall be primed only.
- O. Fire hydrants shall be installed on the same side of the street or roadway as the water main and shall be installed plumb and true.
- P. Heel and thrust blocks shall be placed in undisturbed soil as shown in the details of the Plans.

603.13 CORPORATION STOPS

- A. Corporation stops shall be brass, not less than 3/4-inch in diameter and shall be installed where shown, specified or required.
- B. Provide corporation stops from manufacturers listed in the AML.

603.15 SURFACE PREPARATION AND SHOP COATINGS

- A. The interior ferrous metal surfaces, except finished or bearing surfaces, shall be blast cleaned in accordance with SSPC SP-6 and painted with two (2) coats of an approved two (2) component coal tar epoxy coating specifically formulated for potable water use. The coating used must appear on the current edition of the United States Environmental Protection Agency's list entitled "Accepted Categories and Subcategories of Coatings, Liners and Paints for Potable Water Usage."
- B. Exterior ferrous metal surfaces of all buried valves and hydrants shall be blast cleaned in accordance with SSPC SP-6 and given two (2) shop coats of a heavy coat tar enamel or an approved two (2) component coat tar epoxy paint.

603.16 INSPECTION AND PREPARATION

- A. During installation of all valves and appurtenances, the Contractor shall verify that all items are clean, free of defects in material and workmanship and function properly.



- B. All valves shall be closed and kept closed until otherwise directed by the Engineer or the City.

603.17

INSTALLATION OF BURIED VALVES AND VALVE BOXES

- A. Buried valves shall be cleaned and manually operated before installation. Buried valves and valve boxes shall be set with the stem vertically aligned in the center of the valve box. Valves shall be set on a firm foundation and supported by tamping pipe bedding material under the sides of the valve. The valve box shall be supported during backfilling and maintained in vertical alignment with the top flush with finish grade. The valve box shall be set so as not to transmit traffic loads to the valve.
- B. Before backfilling, all exposed portions of any bolts shall be coated with two (2) coats of bituminous paint.

603.18

INSTALLATION OF TAPPING SLEEVES AND VALVES

- A. The City shall be contacted and their permission granted prior to tapping a line. The required procedures and time table shall be followed exactly.
- B. Installation shall be made under pressure and flow shall be maintained. The diameters of the tap shall be a minimum of $\frac{1}{4}$ -inch less than the inside diameter of the branch line.
- C. The entire operation shall be conducted by workers experienced in the installation of tapping sleeves and valves. The tapping machine shall be furnished by the Contractor.
- D. Determine the location of the line to be tapped to confirm that the proposed location will be satisfactory and that no interference will be encountered such as joints or fittings. No tap or sleeve will be made closer than three (3) feet from a pipe joint.
- E. A tapping sleeve and valve with boxes shall be set squarely centered on the line to be tapped. Adequate support shall be provided under the sleeve and valve during the tapping operation. Thrust blocks or other permanent restraint acceptable to the Engineer and the City shall be provided behind all tapping sleeves. Proper tamping of supporting pipe bedding material around and under the valve and sleeve is mandatory for buried installations.
- F. After completing the tap, the valve shall be flushed to ensure that the valve seat is clean. All proper regulatory procedures (including disinfection) shall be followed exactly.

603.19

INSTALLATION OF FIRE HYDRANTS

- A. Fire hydrants shall be set at the locations as shown on the Plans and bedded on a firm foundation. Hydrants and connecting pipe shall have at least the same depth of cover as the distributing pipe. A drainage pit as detailed on the Plans shall be filled with $\frac{3}{4}$ -inch washed rock gravel and compacted. The hydrants shall be set upon a slab of concrete not less than six (6)-inches thick and 24-inches square. During backfilling, additional screened gravel shall be brought up around and six (6) inches over the drain port. Each hydrant shall be set in true vertical alignment and properly braced.
- B. 2,500 psi concrete thrust blocks shall be placed between the back of the hydrant inlet and undisturbed soil at the end of the trench. Minimum bearing area shall be as shown on the Plans. Eight (8) mil. Polyethylene film shall be placed around the hydrant elbow before placing concrete. CARE SHALL BE TAKEN TO ENSURE THAT CONCRETE DOES NOT PLUG THE DRAIN PORTS.
- C. All connections from the main to the fire hydrants shall be anchoring mechanical joints designed to prevent movement due to thrust or pressure.



- D. The hydrant shall be tied to the pipe with suitable rods or clamps, and shall be coated with Koppers 300 or approved equal at a minimum of 8 mil. thick. Bolts shall have a zinc bolt cover per AWWA. Hydrant paint shall be touched up as required after installation.
- E. Fire hydrants shall be factory primed and, with exception of the bonnet, painted flynt aluminum using a high grade enamel. The bonnet shall be primed only.

603.20

FIELD TESTS AND ADJUSTMENTS

- A. Conduct a functional field test of each valve, including actuators and valve control equipment, in presence of Engineer or the Representative of the City to demonstrate that each part and all components together function correctly. All testing equipment required shall be provided by the Contractor at his/her sole expense.

603.21

PAYMENT

- A. Gate valves, tapping sleeves and tapping valves, and fire hydrants complete in place as shown on the Plans and as specified, will be paid for at the unit contract price per each as provided in the Proposal and Bid Schedule.
- B. The unit price per each installation shall be the total compensation for furnishing all labor, materials, tools, equipment and incidentals necessary to complete the work including excavation, base blocking, disposal of surplus materials and backfill in conformance with the Plans and these specifications. The six (6) inch connection pipe, six (6) inch gate valve, concrete collar, thrust block, drain pit, concrete pad, rods, bolts, paint, protective coatings, and fittings for fire hydrants shall not be paid for separately.
- C. Fire hydrants shall be furnished with the proper length of barrel to comply with these specifications. Barrel extensions will not be measured and paid for separately.
- D. No separate payment shall be made for work performed in accordance with this specification, other than that listed in Parts A-C of this subsection, and the cost thereof shall be included in the proper items of the Proposal and Bid Schedule.

END OF SECTION



SECTION 600 – WATER SPECIFICATIONS

ITEM 604. ENCASEMENT PIPE

604.1 SCOPE OF WORK

- A. This specification covers the requirements for furnishing and installing encasement pipe complete in place including any required spacers and end plugs as shown on the plans and specified herein.

604.2 SUBMITTALS

- A. Within 30 days after the Notice to Proceed, the Contractor shall provide a list of materials to be used from the Approved Materials List (AML) or submit to the Engineer or City Staff for approval, technical product literature including type and Manufacturer of pipe, spacers, and end plugs, and all other pertinent data to illustrate conformance to the specification found within.

604.3 GENERAL

- A. Where pipe is required to be installed under highways, streets, or other facilities, construction shall be made in such a manner that will not interfere with the operation of the street, highway, or other facility, and shall not weaken or damage any embankment or structure.
- B. All carrier pipe shall be laid to the required line and grade within the specified limits through the encasement pipe. Carrier pipe shall be handled and placed in the encasement pipe by use of proper skids, wedges, guide rails or other approved means. Care shall be taken that once the pipe is in place to line and grade, it shall not be disturbed or become displaced.

604.4 MATERIALS

- A. Encasement pipe shall be smooth steel 35,000 psi yield strength, ¼” minimum wall thickness; 3/8” minimum wall thickness when crossing TxDOT facility; ½” minimum wall thickness when crossing railroad and sizing according to the following table:

Carrier Size (Inner Diameter)	Minimum Encasement Steel Casing Size (Inner Diameter)
4"	10"
6"	12"
8"	16"
10"	18"
12"	20"
14"	24"
16"	24"
18"	28"
20"	36"
24"	36"
30"	42"



- B. Casing spacers shall be polyethylene (RACI or equivalent). Connecting flanges shall be ribbed for extra strength. Casing spacers shall have runners made of ultra high molecular weight polymer, with a minimum height of two (2) inches. Wedges shall not be used between the top of the carrier pipe and the inside of the easement pipe. Casings spacers shall have a minimum of one (1) inch clear distance between the runners on top of the casing spacers and the inside of the encasement pipe. Prior to inserting the carrier pipe, all water shall be pumped out of the encasement pipe to at least a point where no more than two (2) inches of water remains. Spacers shall be required within at least three (3) feet from both openings of the encasement pipe and spaced no greater than six (6) feet through out the encasement pipe. Casing spacers will not be paid for directly but shall be considered subsidiary to the bid item of encasement pipe. Casing spacers shall be made by Cascade Waterworks MFG Company or approve equal.
- C. End Plugs shall be provided as required and as specified by the pipe manufacturer.
- D. Spiral weld encasement pipe shall not be used.

604.5

PAYMENT

- A. Separate payment will be made for Steel Encasement Pipe per linear foot as called for on the Plans and set forth in the Proposal and Bid Schedule.
- B. All costs incurred for furnishing and installing encasement pipe shall include all labor, materials, tools, equipment and incidentals necessary to perform all work or whatever nature required to complete the specific operation.

END OF SECTION

