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## **SECTION 02400 WATER LINES**

### **PART I: GENERAL**

#### **1.1 GENERAL REQUIREMENTS**

- A. Installation of water lines.
- B. Technical Specifications identify requirements for both small diameter water lines and large diameter water lines. When Technical Specifications for large diameter water lines differ from those for small diameter water lines, large diameter Technical Specifications shall govern for large diameter pipe.

#### **1.2 MEASUREMENT AND PAYMENT**

- A. Unit Prices:
  - 1. Payment for water lines installed by open-cut, augered with or without casing, aerial crossing and pipe offset section or within limits of Potentially Petroleum Contaminated Area (PPCA) is on linear foot basis for each size of pipe installed. Separate pay items are used for each type of installation.
    - a. Mains: Measure along axis of pipe and include fittings and valves.
    - b. Branch Pipe: Measure from axis of water line to end of branch.
  - 2. Payment for interconnection is on lump sum basis for each interconnection identified on the Drawings. Payment shall include tapping sleeve and valves piping, connections and other related work necessary for construction as shown on the Drawings or specified herein.
  - 3. Payment for removal of existing internal elliptical or dished head plug is on unit price basis for each internal elliptical or dished head plug removed. Payment shall include deletion of plug, drainage or dewatering of water lines, repair of damaged linings, rechlorination and items incidental to operation.
  - 4. Payment for plug and clamp is on a unit price basis for each size of pipe.
  - 5. Payment for drainline connection with service manhole is on unit price basis for each drainline shown on drawings. Payment includes valve, access manhole and connection.
  - 6. Payment for cylindrical corrosion barriers is on a unit price basis for each pipe fitting installed with one or more barriers.
  - 7. When directed by the Project Manager to install extra fittings as required to avoid unforeseen obstacles, payment shall be based on the following:
    - a. Each extra fitting requested by the Project Manager and

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delivered to jobsite shall be paid according to unit price bid for "Extra Fittings in Place."

- b. Payment shall include and be full compensation for items necessary for installation and operation of water line.
8. Refer to Section 01270 – Measurement and Payment for unit price procedures.
- B. Stipulated Price (Lump Sum):
  1. If Contract is Stipulated Price Contract, payment for work in this Section is included in Total Stipulated Price.

### 1.3 REFERENCES

- A. ANSI – American National Standards Institute.
  1. ANSI A21.11/AWWA C111 – Standard for Rubber-Gasket Joints for Ductile – Iron Pressure Pipe and Fittings.
  2. ANSI/NSF Standard 61 – Drinking Water System -Health Components.
- B. ASTM – American Society for Testing and Materials.
  1. ASTM A36 – Standard Specification for Carbon Structural Steel.
  2. ASTM A126 – Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
  3. ASTM A536 – Standard Specification for Ductile Iron Castings.
  4. ASTM B21 – Standard Specification for Naval Brass Rod, Bar and Shapes.
  5. ASTM B98 – Standard Specification for Copper-Silicon Alloy Rod, Bar and Shapes.
  6. ASTM B301 – Standard Specification for Free-Cutting Copper Rod and Bar.
  7. ASTM B584 – Standard Specification for Copper Alloy Sand Casting for General Application.
  8. ASTM E165 – Standard Test Method for Liquid Penetrant Examination.
  9. ASTM E709 – Standard Guide for Magnetic Particle Examination.
  10. ASTM F1674 – Standard Test Method for Joint Restraint Products for Use with PVC Pipe.
- C. AWWA – American Water Works Association.
  1. AWWA C206 – Standard for Field Welding of Steel Water Pipe.
  2. AWWA C207 – Standard for Steel Pipe Flanges for Waterworks Service – Sizes 4 Inches through 144 Inches.
  3. AWWA C508 – Standard for Swing-Check Valves for Waterworks Service, 2 IN. through 24 IN. NPS.
- D. CFTS – City of Friendswood Technical Specifications.

### 1.4 SUBMITTALS

- A. Conform to requirements of Section 01330 – Submittal Procedures.

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- B. Conform to submittal requirements of applicable Section for type of pipe used.
- C. Photographs: Submit photographs conforming to requirements of Section 01320 – Construction Photographs prior to commencement of construction.
- D. Submit One Call notification transmittal number(s) prior to beginning excavation.
- E. Submit, a minimum of fifteen days (15 D) before beginning pipe laying operations, layout drawing(s) identifying proposed sections for hydrostatic testing (not to exceed four thousand linear feet (4000 LF) per section), disinfecting, and site restoration for entire project for review and approval.

## **PART II: PRODUCTS**

### **2.1 PIPE MATERIALS**

- A. Install pipe materials which conform to following:
  - 1. Section 02215 – Ductile Iron Pipe (DIP) and Fittings.
  - 2. Section 02250 – Steel Pipe and Fittings. Water line piping within plant site and aerial crossings to be welded joint steel pipe with flange or approved restraint joint connections, unless otherwise shown on the Drawings.
  - 3. Section 02235 – Polyvinyl Chloride Pipe (PVC).
  - 4. Section 02225 – Prestressed Concrete Cylinder Pipe (PCCP).
  - 5. Section 02255 – Steel Pipe and Fittings for Large Diameter Water Lines.
  - 6. Section 02200 – Bar Wrapped Steel Cylinder Pipe.
- B. Conform to American National Standards Institute/National Sanitation Foundation (ANSI/NSF) Standard 61 and have certified by an organization accredited by ANSI.
- C. Type of pipe materials used is Contractor's option unless specifically identified on the Drawings.
- D. Provide minimum of three-eighths inch (3/8 In) inside joint recess between ends of pipe in straight pipe sections.

### **2.2 WELDED JOINT PROTECTION FITTING FOR SMALL DIAMETER STEEL PIPE**

- A. Cylindrical Corrosion Barrier: Provide approved cylindrical corrosion barrier.
- B. O-rings: Conform to National Sanitary Foundation requirements.

### **2.3 RESTRAINED JOINTS**

- A. Ductile Iron Pipe (DIP): See Section 02215 – Ductile Iron Pipe (DIP) and Fittings.
- B. PVC Pipe: See Section 02235 – Polyvinyl Chloride Pipe (PVC). Perform hydrostatic testing in accordance with ASTM F1674.

- C. Prestressed Concrete Cylinder Pipe (PCCP), Bar-Wrapped Pipe and Steel Pipe: Welded joints (see Paragraph 3.6 D).
- D. Restrained Joints where required on DIP and PVC pipe:
  - 1. Restraint devices: Manufacture of high strength ductile iron, ASTM A536 up to twenty-four inches (24 In) and ASTM A36 for sizes greater than thirty inches (30 In). Working pressure rating twice that of design test pressure.
  - 2. Bolts and connecting hardware: High strength low alloy material in accordance with ANSI A21.11/AWWA C111.

#### 2.4 COUPLINGS AND APPURTENANCES FOR LARGE DIAMETER WATERLINE

- A. Flexible (Dresser-type) Couplings.
  - 1. Install where shown on the Drawings or where allowed by the Project Manager for the Contractor's convenience. Use galvanized flexible couplings when installed on galvanized pipe which is cement lined or when underground. Provide gaskets manufactured from Neoprene or Buna-N.
  - 2. For steel pipe; provide approved sleeve-type flexible couplings. Thickness of middle ring equal to or greater than thickness of pipe wall.
  - 3. Provide approved flanged adapter couplings for steel pipe.
  - 4. Use Type 316 stainless steel bolts, nuts and washers where flexible couplings are installed underground. Coat entire coupling with twenty (20) mil of approved coal tar coating.
- B. Flap Valves: Provide approved flap valves on discharge of manhole drainline as shown on the Drawings.
  - 1. Body and Flap: ASTM A126-B cast iron.
  - 2. Seats: ASTM B21-CA482 or ASTM B301-CA145 bronze.
  - 3. Resilient Seat: AWWA C508.
  - 4. Hinge Arms: ASTM B584-CA865 high tensile bronze.
  - 5. Hinge pins: ASTM B98-CA655 silicon bronze.

### PART III: EXECUTION

#### 3.1 PREPARATION

- A. Conform to applicable installation Technical Specifications for types of pipe used.
- B. Employ workmen who are skilled and experienced in laying pipe of type and joint configuration being furnished. Provide watertight pipe and pipe joints.
- C. Lay pipe to lines and grades shown on the Drawings.

- D. Confirm that nine feet (9 Ft) minimum separation from gravity sanitary sewers and manholes or separation of four feet (4 Ft) minimum from force mains as specified in this Section in all directions unless a special design is provided on the Drawings.
- E. Where above clearances cannot be attained and a special design has not been provided on the Drawings, obtain direction from the Project Manager before proceeding with construction.
- F. Inform the Project Manager if unmetered sprinkler or fire line connections exist which are not shown on the Drawings. Make transfer to new lines only after approval by the Project Manager.
- G. For projects involving multiple subdivisions or locations, limit water line installation to maximum of two (2) project site locations. Maximizing two (2) pipe installation crews shall be permitted, unless otherwise approved by the Project Manager.
- H. The City of Friendswood Public Works Department shall handle, at no cost to the Contractor, operations involving opening and closing valves for wet connections and for chlorination. The Contractor is responsible for handling necessary installations and removal of chlorination and testing taps and risers.
- I. If asbestos-cement (A.C.) pipe is encountered, follow safety practices outlined in American Water Works Association's publication, "Work Practices for A/C Pipe". Strictly adhere to "recommended practices" contained in this publication and make them "mandatory practices" for this Project.
- J. For pipe diameters thirty-six inches (36 In) and greater, clearly mark each section of pipe and fitting with unique designation on inside of pipe along with pressure class. Locate unique identifying mark minimum of five feet (5 Ft) away from either end of each section of pipe. Provide one (1) unique identifying mark in middle of each fitting. Place markings at consistent locations. Use permanent black paint and minimum letter height of four inches (4 In) to mark designations.
- K. The Contractor is responsible for assuring chosen manufacturer fulfills requirements for extra fittings and, therefore, is responsible for costs due to downtime if requirements are not met by the manufacturer.
- L. Do not remove plugs or clamps during months of peak water demands; June, July and August, unless otherwise approved by the Project Manager.

### 3.2 HANDLING, CLEANING AND INSPECTION

- A. Handling:
  - 1. Place pipe along project site where storm water or other water shall not enter or pass through pipe.
  - 2. Load, transport, unload and otherwise handle pipe and fittings to prevent damage of any kind. Handle and transport pipe with equipment designed, constructed and arranged to prevent damage to pipe, lining and coating. Do not permit bare chains,

- hooks, metal bars or narrow skids or cradles to come in contact with coatings. Where required, provide pipe fittings with sufficient interior strutting or cross bracing to prevent deflection under their own weight.
3. Hoist pipe from trench side into trench by means of sling of smooth steel cable, canvas, leather, nylon or similar material.
  4. For large diameter water lines, handle pipe only by means of sling of canvas, leather, nylon or similar material. Sling shall be minimum thirty-six inches (36 In) in width. Do not tear or wrinkle tape layers.
  5. Use precautions to prevent injury to pipe, protective linings and coatings.
    - a. Package stacked pipe on timbers. Place protective pads under banding straps at time of packaging.
    - b. Pad fork trucks with carpet or other suitable material. Use nylon straps around pipe for lift when relocating pipe with crane or backhoe.
    - c. Do not lift pipe using hooks at each end of pipe.
    - d. Do not place debris, tools, clothing or other materials in pipe.
    - e. Do not drop pipe into trench deeper than two feet (2 Ft). Any pipe that has been dropped shall be marked with an "X" and shall not be used.
  6. Repair damage to pipe or protective lining and coating before final acceptance.
  7. For cement mortar line and coated steel pipe and PCCP, permit no visible cracks longer than six inches (6 In), measured within fifteen degrees (15°) of line parallel to pipe longitudinal axis of finished pipe, except:
    - a. In surface laitance of centrifugally cast concrete.
    - b. In sections of pipe with steel reinforcing collars or wrappers.
    - c. Within twelve inches (12 In) of pipe ends.
  8. Reject pipe with visible cracks (not meeting exceptions) and remove from project site.
- B. Cleaning: Thoroughly clean and dry interior of pipe and fittings of foreign matter before installation and keep interior clean until the Work has been accepted. Keep joint contact surfaces clean until jointing is completed. Do not place debris, tools, clothing or other materials in pipe. After pipe laying and joining operations are completed, clean inside of pipe and remove any debris.
- C. Inspection: Before installation, inspect each pipe and fitting for defects. Reject defective, damaged or unsound pipe and fittings and remove them from site.

**3.3 EARTHWORK**

- A. Conform to applicable provisions of Section 02125 – Excavation and Backfilling for Utilities and Section 02270 – Augering for Water Pipe and Conduit.
- B. Bedding: Use bedding materials in conformance with Section 02140 – Utility Backfill Materials.
- C. Backfill: Use bank run sand or earth or native soil as specified in Section 02140 – Utility Backfill Materials. Backfill excavated areas in same day excavated. When not possible, cover excavated areas using steel plates on paved areas and other protective measures elsewhere.
- D. Place material in uniform layers of prescribed maximum loose thickness and wet or dry material to approximately optimum moisture content. Compact to prescribed density. Water tamping or jetting is not allowed.
- E. Pipe Embedment: Including six (6) inch pipe bedding and backfill to twelve inches (12 In) above top of pipe.

**3.4 PIPE CUTTING**

- A. Cut pipe twelve inches (12 In) and smaller with standard wheel pipe cutters. Cut pipe larger than twelve inches (12 In) in manner approved by the Project Manager. Make cuts smooth and at right angles to axis of pipe. Bevel plain end with heavy file or grinder to remove sharp edges.

**3.5 PIPING INSTALLATION**

- A. General Requirements:
  - 1. Lay pipe in subgrade free of water.
  - 2. Make adjustments of pipe to line and grade by scraping away subgrade or filling in with granular material.
  - 3. Properly form bedding to fully support bell without wedging or blocking up bell.
  - 4. Open Cut Construction: Keep pipe trenches free of water which might impair pipe laying operations. Grade pipe to provide uniform support along bottom of pipe. Excavate for bell holes after bottom has been graded and in advance of placing pipe. Lay not more than nominal city block length of not more than three hundred feet (300 Ft) of pipe in trench ahead of backfilling operations. Cover or backfill laid pipe if pipe laying operations are interrupted and during non-working hours. Place backfill carefully and simultaneously on each side of pipe to avoid lateral displacement of pipe and damage to joints. If adjustment of pipe is required after it has been laid, remove and re-lay as new pipe.
- B. Install pipe continuously and uninterrupted along each street on which the Work is to be performed. Obtain approval of the Project Manager prior to skipping any portion of the Work.
- C. Protection of Pipeline: Securely place stoppers or bulkheads in openings and in end of line when construction is stopped temporarily and at end of each day's work.

- D. Perform Critical Location as shown on the Drawings. Refer to Section 02125 – Excavation and Backfill for Utilities for additional requirements at critical locations.
- E. Laying Large Diameter Water Line:
  - 1. Lay not more than fifty feet (50 Ft) of pipe in trench ahead of backfilling operations.
  - 2. Dig trench to proper width as shown on the Drawings. When trench width below top of pipe becomes four feet (4 Ft) wider than specified, install higher class of pipe or improved bedding, as determined by the Project Manager. No additional payment shall be made for higher class of pipe or improved bedding.
  - 3. Use adequate surveying methods and equipment; employ personnel competent in use of this equipment. Horizontal and vertical deviations from alignment as indicated on the Drawings shall not exceed one-tenth foot (0.10 Ft). Measure and record "as-built" horizontal alignment and vertical grade at maximum of every one hundred feet (100 Ft) on record drawings.
  - 4. Prevent damage to coating when placing backfill. Use backfill material free of large rocks or stones or other material which could damage coatings.
  - 5. Before assembling couplings, lightly coat pipe ends and outside of gaskets with cup grease or liquid vegetable soap to facilitate installation.
  - 6. Prior to proceeding with critical tie-ins submit sequence of work based on findings from "critical location" effort.
- F. Perform following additional procedures when working on plant sites.
  - 1. Seventy-two hours (72 Hrs) prior to each plant shut down or connection, schedule coordination meeting with the Project Manager and Water Production personnel. At this meeting, present proposed sequencing of the Work and verification of readiness to complete the Work as required and within time permitted. Do not proceed with the Work until the Project Manager agrees key personnel, equipment and materials are on hand to complete the Work.
  - 2. Prior to fully excavating around existing piping, excavate as minimal as possible to confirm type and condition of existing joints. Verify size, type and condition of pipe prior to ordering materials or fully mobilizing for the Work.
  - 3. Do not proceed with connections to existing piping and identified critical stages of work unless approved by the Project Manager and the City's Utilities Superintendent is present to observe.
  - 4. Coordinate with the City's Utilities Superintendent to obtain reduction in operating pressures prior to performing connections to existing piping.
  - 5. Make connections to existing piping only when two (2) valves are closed off between connection and source of water pressure. Do

- not make connection relying solely on one (1) valve being closed, unless otherwise approved by the Project Manager.
6. Perform critical stages of the Work identified on the Drawings at night or during low water demand months as specified in Section 01110 – Summary of Work.
  7. Excavation equipment used on plant sites to have smooth bucket; no teeth or side cutters.
  8. Submit to the Project Manager One Call Notification transmittal number prior to beginning excavation.
  9. Before each "dig" with mechanical excavator, probe ground to determine potential obstructions. Repeat procedure until existing pipe is located or excavation reaches desired elevation. Perform excavations within one foot (1 Ft) of existing piping by hand methods.
  10. Provide adequate notice to pipe manufacture's representative when connecting or modifying existing Prestressed Concrete Cylinder Pipe (PCCP).
  11. Provide field surveyed (horizontal and vertical elevations) "as-builts" of new construction and existing underground utilities encountered. Submit in accordance with Section 01330 – Submittal Procedures.
  12. Prior to performing plant work to be done on weekend, provide list of sites and contact person with phone numbers to the Project Manager by noon on each Thursday of week when such work is contemplated. Contact person must be accessible during weekend, have local Metro Area phone number and be authorized to make emergency decisions.
  13. No night work or plant shut down shall be scheduled to begin two (2) working days before or after designated City holidays.
- G. For tie-ins to existing water lines, provide necessary material on hand to facilitate connection prior to shutting down existing water line. Provide the City a minimum of seventy-two hours (72 Hrs) notice prior to shutting down existing water line.
1. Any work that has not been scheduled seventy-two hours (72 Hrs) before work is to commence, with the exception of emergency operations, shall not be allowed to start.

### 3.6 JOINTS AND JOINTING

- A. Rubber Gasketed Bell-and-Spigot Joints for Prestressed Concrete Cylinder Pipe (PCCP), Bar Wrapped Pipe PVC, Steel and DIP:
1. After rubber gasket is placed in spigot groove of pipe, equalize rubber gasket cross section by inserting tool or bar recommended by manufacturer under rubber gasket and moving it around periphery of pipe spigot.
  2. Lubricate gaskets with nontoxic water-soluble lubricant before pipe units are joined.

3. Fit pipe units together in manner to avoid twisting or otherwise displacing or damaging rubber gasket.
  4. After pipe sections are joined, check gaskets to ensure that no displacement of gasket has occurred. If displacement has occurred, remove pipe section and remake joint as for new pipe. Remove old gasket, inspect for damage and replace if necessary before remaking joint.
  5. Where preventing movement of sixteen inch (16 In) diameter or greater pipe is necessary due to thrust, use restrained joints as shown on the Drawings.
    - a. Include buoyancy conditions for soil unit weight when computing thrust restraint calculations.
    - b. Do not include passive resistance of soil in thrust restraint calculations.
  6. Except for PVC pipe, provide means to prevent full engagement of spigot into bell as shown on the Drawings. Means may consist of wedges or other types of stops as approved by the Project Manager.
- B. Flanged Joints where required on Prestressed Concrete Cylinder Pipe (PCCP), Bar Wrapped Pipe, Ductile Iron Pipe (DIP) or Steel Pipe:
1. AWWA C207. Prior to installation of bolts, accurately center and align flanged joints to prevent mechanical prestressing of flanges, pipe and equipment. Align bolt holes to straddle vertical, horizontal or north-south center line. Do not exceed three sixty-fourths inch per foot (3/64 In/Ft) inclination of flange face from true alignment.
  2. Use full-face gaskets for flanged joints. Provide one-eighth inch (1/8 In) thick cloth inserted rubber gasket material. Cut gaskets at factory to proper dimensions.
  3. Use galvanized or black nuts and bolts to match flange material. Use cadmium plated steel nuts and bolts underground. Tighten bolts progressively to prevent unbalanced stress. Maintain at all times approximately same distance between two (2) flanges at points around flanges. Tighten bolts alternately one hundred eighty degrees (180°) apart until all are evenly tight. Draw bolts tight to ensure proper seating of gaskets. Provide Densco petroleum based tape or approved equal for all exposed portions of nuts, bolts and pipe.
  4. Full length bolt isolating sleeves and washers shall be used with flanged connections.
  5. For in-line flange joints thirty inches (30 In) in diameter and greater and at butterfly valve flanges, provide Pyrox G-10 with nitrite seal, conforming to ANSI A 21.11 mechanical joint gaskets. For in-line flange joints sized between twelve inches (12 In) in diameter and greater and twenty-four inches (24 In) in diameter and smaller, provide Phenolic PSI with nitrite seal

- gasket conforming to ANSI A 21.11 mechanical joint gaskets.
- C. Welded Joints (Prestressed Concrete Cylinder Pipe (PCCP), Bar Wrapped Pipe, Steel Pipe):
1. Prior to starting work, provide certification of qualification for welders employed on project for type of work procedures and positions involved.
  2. Joints: AWWA C206. Full-fillet, single lap-welded slip-type either inside or outside or double butt-welded type; use automatic or hand welders; completely penetrate deposited metal with base metal; use filler metal compatible with base metal; keep inside of fittings and joints free from globules of weld metal which would restrict flow or become loose. Do not use mitered joints. For interior welded joints, complete backfilling before welding. For exterior field-welded joints, provide adequate working room under and beside pipe. Use exterior welds for thirty inch (30 In) and smaller.
  3. Furnish welded joints with trimmed spigots and interior welds for thirty-six inch (36 In) and larger pipe.
  4. Bell-and-spigot, lap-welded slip joints: Deflection may be taken at joint by pulling joint up to three-quarters inch (3/4 In) as long as one and one-half inch (1-1/2 In) minimum lap is maintained. Spigot end may be miter cut to take deflections up to five degrees (5°) as long as joint tolerances are maintained. Miter end cuts of both ends of butt-welded joints may be used for joint deflections of up to five degrees (5°).
  5. Align piping and equipment so that no part is offset more than one-eighth inch (1/8 In). Set fittings and joints square and true and preserve alignment during welding operation. For butt welded joints, align abutting ends to minimize offset between surfaces. For pipe of same nominal wall thickness, do not exceed one-sixteenth inch (1/16 In) offset. Use line-up clamps for this purpose; however, take care to avoid damage to linings and coatings.
  6. Protect coal-tar-epoxy lining during welding by draping an eighteen inch (18 In) wide strip of heat resistant material over top half of pipe on each side of lining holdback to avoid damage to lining by hot splatter. Protect tape coating similarly if external welding is required.
  7. Welding rods: Compatible with metal to be welded to obtain strongest bond, E-70XX.
  8. Deposit metal in successive layers to provide at least two (2) passes or beads for automatic welding and three (3) passes or beads for manual welding in completed weld.
  9. Deposit no more than one-quarter inch (1/4 In) of metal on each pass. Thoroughly clean each individual pass with wire brush or hammer to remove dirt, slag or flux.

10. Do not weld under weather condition that would impair strength of weld, such as wet surface, rain or snow, dust or high winds, unless work is properly protected.
11. Make tack weld of same material and by same procedure as completed weld. Otherwise, remove tack welds during welding operation.
12. Remove dirt, scale and other foreign matter from inside piping before tying in sections, fittings or valves.
13. Welded Joints for Large Diameter Water Lines:
  - a. Furnish pipe with trimmed spigots and interior welds for thirty-six inch (36 In) and larger pipe.
  - b. Use exterior welds for thirty inch (30 In) and smaller.
  - c. Only one (1) end may be miter cut. Miter end cuts of both ends of butt-welded joints may be used for joint deflections of up to two and one-half degrees (2-1/2°).
  - d. For large diameter water lines, employ an independent certified testing laboratory, approved by the Project Manager, to perform weld acceptance tests on welded joints. Include cost of such testing and associated work to accommodate testing in contract unit price bid for water line. Furnish copies of test reports to the Project Manager for review. The Project Manager has the final decision as to suitability of welds tested.
    - 1) Weld acceptance criteria:
      - a) Conduct in accordance with ASTM E165-Standard Test Method for Liquid Penetrant Examination and ASTM E709 Standard Guide for Magnetic Particle Examination. Use X-ray methods for butt welds, for one hundred percent (100%) of joint welds.
      - b) Examine welded surfaces for the following defects:
        - i) Cracking.
        - ii) Lack of fusion/penetration.
        - iii) Slag which exceeds one-third (1/3) of (t) where (t) equals material thickness.
        - iv) Porosity/Relevant rounded indications greater than three-sixteenths inch (3/16 In); rounded indication is one (1) of circular or elliptical shape with length equal to or less than three (3) times its width.
        - v) Relevant linear indications in which length of linear indication exceeds three (3) times its width.

- vi) Four (4) or more relevant one-sixteenth inch (1/16 In) rounded indications in line separated by one-sixteenth inch (1/16 In) or less edge to edge.
- 14. After pipe is joined and prior to start of welding procedure, make spigot and bell essentially concentric by jacking, shimming or tacking to obtain clearance tolerance around periphery of joint except for deflected joints.
- 15. Furnish each welder employed steel stencil for marking welds, so work of each welder can be identified. Mark pipe with assigned stencil adjacent to weld. When welder leaves job, stencil must be voided and not duplicated. Welder making defective welds must discontinue work and leave project site. Welder may return to project site only after recertification.
- 16. Provide cylindrical corrosion barriers for epoxy lined steel pipe twenty-four inch (24 In) diameter and smaller, unless minimum wall thickness is one-half inch (1/2 In) or greater.
  - a. In addition to welding requirements contained here in Paragraph 3.6, conform to protection fitting manufacturer's installation recommendations.
  - b. Provide services of technical representative of manufacturer available on site at beginning of pipe laying operations. Representative to train welders and advise regarding installation and general construction methods. Welders must have twelve months (12 Mos) prior experience installing protection fittings.
  - c. All steel pipe is to have cutback three-quarters inch (3/4 In) to not greater than one inch (1 In) of internal diameter coating from weld bevel.
  - d. Furnish steel fittings with cylindrical corrosion barriers with shop welded extensions to end of fittings. Extension length to measure no less than diameter of pipe. Shop apply lining in accordance with AWWA C210 or AWWA C213.
  - e. All steel pipe receiving field adjustments are to be cold cut using standard practices and equipment. No cutting using torch is to be allowed.
- D. Harnessed Joints (Prestressed Concrete Cylinder Pipe (PCCP), Bar Wrapped Pipe):
  - 1. Use of snap-ring type restrained joints on pipe is limited to twenty inch (20 In) through forty-eight inch (48 In) diameters.
  - 2. Position snap-ring joint bolt on top [twelve (12) o'clock position]. Provide minimum one-half inch (1/2 In) joint recess. Use joint "diapers" minimum of twelve inches (12 In) wide.
  - 3. For field adjustments with deflections beyond manufacturer's

recommendations:

- a. Field trim spigot.
  - b. Do not engage ring.
  4. Harnessed joints shall not be permitted in areas defined on the Drawings as potentially petroleum contaminated material, in tunnels or at bend greater than five degrees (5°).
  5. Install harness type joints including snap rings at straight sections of pipe.
- E. Restrained Joints
1. For existing water lines and water lines less than sixteen inches (16 In) in diameter, restrain pipe joints with concrete thrust blocks.
  2. Thrust restraint lengths shown on the Drawings are minimum anticipated lengths. These lengths are based on deflections indicated and on use of Prestressed Concrete Cylinder Pipe (PCCP) for large diameter lines and ductile Iron Pipe (DIP) for small diameter lines. Adjustments in deflections or use of other pipe material may result in reduction or increase of thrust lengths. Perform calculations by pipe manufacturer to verify proposed thrust restraint lengths. Submit calculations for all pipe materials sealed by a Professional Engineer licensed by the State of Texas for review by the Project Manager. Make adjustments in thrust restraint lengths at no additional cost to the City.
  3. Passive resistance of soil shall not be permitted in calculation of thrust restraint.
  4. For sixteen inch (16 In) lines and larger use minimum sixteen foot (16 Ft) length of pipe in and out of joints made up of beveled pipe where restraint joint lengths are not identified on the Drawings. Otherwise, provide restraint joints for a minimum length of sixteen feet (16 Ft) on each side of beveled joints.
  5. Restraint Devices:
    - a. Prestressed Concrete Cylinder Pipe (PCCP), bar wrapped pipe and steel pipe, that has either welded or flanged fittings or valves, shall not need to be further restrained.
    - b. Mega-lug fittings are the acceptable and preferred method of restraint for all other piping with the exception of those listed in paragraph 3.7.E.5.d of this Section.
    - c. Use of Ellison clamps and all-threaded rod is allowed with the approval of the Project Manager. Ellison clamps, all-threaded rod and other hardware shall be 316 stainless steel. Ellison clamp shall be a minimum of two feet (2 Ft) from edge of fitting.
    - d. All offsets, even if Mega-lugs are used on the fittings, shall have Ellison clamps on the end and/or sides of the

- offset and shall have stainless steel all-threaded rod connections in between fittings to prevent movement.
5. Installation:
    - a. Install restrained joints mechanism in accordance with manufacturer's recommendations.
    - b. Examine and clean mechanism; remove dirt, debris and other foreign material.
    - c. Apply gasket and joint NSF 61 FDA food grade approved lubricant.
    - d. Verify gasket is evenly seated.
    - e. Do not over stab pipe into mechanism.
  6. Prevent any lateral movement of thrust restraints throughout pressure testing and operation.
  7. Place Class C, two thousand five hundred pounds per square inch (2500 psi) concrete conforming to Section 03300 – Structural Concrete, for blocking at each change in direction of existing water lines, to brace pipe against undisturbed trench walls. Finish placement of concrete blocking, made from Type I cement, four days (4 D) prior to hydrostatic testing of pipeline. Test may be made two days (2 D) after completion of blocking if Type II cement is used.
- F. Joint Grout (Prestressed Concrete Cylinder Pipe (PCCP), Bar Wrapped Pipe, Steel Pipe):
1. Mix cement grout mixture by machine except when less than one-half cubic yard (1/2 Cy) is required. When less than one-half cubic yard (1/2 Cy) is required, grout may be hand mixed. Mix grout only in quantities for immediate use. Place grout within twenty minutes (20 Min) after mixing. Discard grout that has set. Retempering of grout by any means is not permitted.
  2. Prepare grout in small batches to prevent stiffening before it is used. Do not use grout which has become so stiff that proper placement cannot be assured without retempering. Use grout for filling grooves of such consistency that it shall adhere to ends of pipe.
  3. Surface Preparation: Remove defective concrete, laitance, dirt, oil, grease and other foreign material from concrete surfaces with wire brush or hammer to sound, clean surface. Remove rust and foreign materials from metal surfaces in contact with grout.
  4. Follow established procedures for hot and cold weather concrete placement.
  5. Complete joint grout operations and backfilling of pipe trenches as closely as practical to pipe laying operations. Allow grouted exterior joints to cure at least one hour (1 Hr) before compacting backfill.
  6. Grouting exterior joint space: Hold wrapper in place on both sides of joint with minimum five-eighths inch (5/8 In) wide steel

straps or bands. Place no additional bedding or backfill material on either side of pipe until after grout band is filled and grout has mechanically stiffened. Pull ends of wrapper together at top of pipe to form access hole. Pour grout down one side of pipe until it rises on other side. Rod or puddle grout to ensure complete filling of joint recess. Agitate for fifteen minutes (15 Min) to allow excess water to seep through joint band. When necessary, add more grout to fill joint completely. Protect gap at top of joint band from backfill by allowing grout to stiffen or by covering with structurally protective material. Do not remove band from joint. Proceed with placement of additional bedding and backfill material.

7. Interior Joints for Pipe twenty-four inches (24 In) and smaller: Circumferentially butter bell with grout prior to insertion of spigot, strike off flush surplus grout inside pipe by pulling filled burlap bag or inflated ball through pipe with rope. After joint is engaged, finish off joint grout smooth and clean. Use swab approved by the Project Manager for twenty inch (20 In) pipe and smaller.
8. Protect exposed interior surfaces of steel joint bands by metallizing, by other approved coatings or by pointing with grout. Joint pointing may be omitted on potable water pipelines if joint bands are protected by zinc metallizing or other approved protective coatings.
9. Remove and replace improperly cured or otherwise defective grout.
10. Strike off grout on interior joints and make smooth with inside diameter of pipe.
11. When installed in tunnel or encasement pipe and clearance within casing does not permit outside grout to be placed in normal manner, apply approved flexible sealer, such as Flex Protex or equal, to outside joint prior to joint engagement. Clean and prime surfaces receiving sealer in accordance with manufacturer's recommendations. Apply sufficient quantities of sealer to assure complete protection of steel in joint area. Fill interior of joint with grout in normal manner after joint closure.
12. Interior Joints for Water Lines thirty inches (30 In) and larger: Clean joint space, wet joint surfaces, fill with stiff grout and trowel smooth and flush with inside surfaces of pipe using steel trowel so that surface is smooth. Accomplish grouting at end of each work day. Obtain written acceptance from the Project Manager of inside joints before proceeding with next day's pipe laying operation. During inspection, insure no delamination of joint mortar has occurred by striking joint mortar lining with rubber mallet. Remove and replace delaminated mortar lining.
13. Work which requires heavy equipment to be over water line must be completed before mortar is applied to interior joints.

- G. Large Diameter Water Main Joint Testing: In addition to testing individual joints with feeler gauge approximately one-half inch (1/2 In) wide and fifteen thousandths inch (0.015 In) thick, use other joint testing procedure approved or recommended by pipe manufacturer which shall help ensure watertight installation prior to backfilling. Perform tests at no additional cost to the City.
- H. Make curves and bends by deflecting joints or other method as recommended by manufacturer and approved by the Project Manager. Submit details of other methods of providing curves and bends which exceed manufacturer's recommended deflection prior to installation.
  - 1. Deflection of pipe joints shall not exceed maximum deflection recommended by pipe manufacturer, unless otherwise indicated on the Drawings.
  - 2. If deflection exceeds that specified but is less than five percent (5%), repair entire deflected pipe section such that maximum deflection allowed is not exceeded.
  - 3. If deflection is equal to or exceeds five percent (5%) from that specified, remove entire portion of deflected pipe section and install new pipe.
  - 4. Replace, repair or reapply coatings and linings as required.
  - 5. Assessment of deflection may be measured by the Project Manager at location along pipe. Arithmetical averages of deflection or similar average measurement methods shall not be deemed as meeting the intent of this standard.
  - 6. When rubber gasketed pipe is laid on curve, join pipe in straight alignment and then deflect to curved alignment.
- I. Closures Sections and Approved Field Modifications to Steel, Prestressed Concrete Cylinder Pipe (PCCP), Bar Wrapped Pipe and Fittings:
  - 1. Apply welded-wire fabric reinforcement to interior and exterior of exposed interior and exterior surfaces greater than six inches (6 In) in diameter. Welded-wire fabric: minimum W1; maximum spacing two inches by four inches (2 In x 4 In); three-eighths inch (3/8 In) from surface of steel plate or middle third (3rd) of lining or coating thickness for mortar thickness less than three-quarters inch (3/4 In).
  - 2. Fill exposed interior and exterior surfaces with nonshrink grout.
  - 3. For pipe diameters thirty-six inches (36 In) and greater, perform field welds on interior and exterior of pipe.
  - 4. For large diameter water lines, provide minimum overlap of four inches (4 In) of butt strap over adjacent piece on butt-strap closures.

### **3.7 CATHODIC PROTECTION APPURTENANCES**

- A. Conform to requirements of Section 02285 – Cathodic Protection.
- B. Where identified on the Drawings, modify pipe for cathodic protection as

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detailed on the Drawings and specified. Unless otherwise noted, provide insulation kits including test stations at connections to existing water system or at locations to isolate one (1) type of cathodic system from another type, between water line, access manhole piping and other major openings in water line or as shown on the Drawings.

- C. Bond joints for pipe installed in tunnel or open cut, except where insulating flanges are provided. Weld strap or clip between bell and spigot of each joint or as shown on the Drawings. No additional bonding required where joints are welded for thrust restraint. Repair coatings as specified by appropriate AWWA standard, as recommended by manufacturer and as approved by the Project Manager.
- D. Bonding Strap or Clip: Free of foreign material that may increase contact resistance between wire and strap or clip.

### 3.8 SECURING, SUPPORTING AND ANCHORING

- A. Support piping as shown on the Drawings and as specified in this Section, to maintain line and grade and prevent transfer of stress to adjacent structures.
- B. Where shown on the Drawings, anchor pipe fittings and bends installed on water line by welding consecutive joints of pipe together to distance each side of fitting. Restrained length, as shown on the Drawings, assumes that installation of pipe and subsequent hydrostatic testing begins upstream and proceed downstream, with respect to normal flow of water in pipe. If installation and testing differs from this assumption, submit for approval revised method of restraining pipe joints upstream and downstream of device used to test against (block valve, blind flange or dished head plug).
- C. Use adequate temporary blocking of fittings when making connections to distribution system and during hydrostatic tests. Use sufficient anchorage and blocking to resist stresses and forces encountered while tapping existing water line.

### 3.9 POLYETHYLENE WRAP FOR DUCTILE IRON PIPE (DIP)

- A. Double wrap pipe and appurtenances (except fire hydrants and fusion bond or polyurethane coated fittings) with eight (8) mil polyethylene film.
- B. Do not use polyethylene wrap if pipe is cathodically protected.
- C. Conform to requirements of Section 02260 – Polyethylene Wrap.

### 3.10 CLEANUP AND RESTORATION

- A. Provide cleanup and restoration crews to work closely behind pipe laying crews and where necessary, during disinfection and hydrostatic testing, service transfers, abandonment of old water lines, backfill and surface restoration.
- B. Unless otherwise approved by the Project Manager, comply with the following;
  - 1. Once water line is installed to limits approved in layout

- submitted, immediately begin preparatory work for disinfection effort.
  2. Immediately after transfer of services, begin abandonment of old water lines and site restoration.
  3. Do not exceed a total of fifty percent (50%) of total project linear feet of disturbed right-of-way and easement until site is restored in accordance with Section 01745 – Site Restoration.
  4. Exceeding any of the above footage limitations shall be considered a material breach of the Contract and subject to termination in accordance with the General Conditions.
- C. For large diameter water lines, do not install more than two thousand linear feet (2000 Lf) of water line, without previous two thousand linear feet (2000 Lf) being restored in accordance with Section 01745 – Site Restoration. Schedule paving crews so repaving work shall not lag behind pipe laying work by more than one thousand linear feet (1000 Lf). Failure to comply with this requirement shall be considered a material breach of the Contract and subject to termination in accordance with the General Conditions.

### 3.11 CLEANLINESS OF PIPING SYSTEMS

- A. End Caps shall be used throughout storage of material and during installation as needed to assure dirt and debris does not enter the piping system. If there is Remove construction debris or foreign material and thoroughly broom clean and flush piping systems. Provide temporary connections, equipment and labor for cleaning.

### 3.12 DISINFECTION OF WATER LINES

- A. Conform to requirements of Section 02455 – Disinfection of Waterlines.
1. No later than three (3) days after completing disinfection preparatory work, submit to the City appropriate request for disinfection.
  2. Schedule City' Utilities Superintendent at least seventy-two hours (72 Hrs) before disinfection or blowing off of lines. The City Water personnel shall turn all valves on and off for the duration.
  3. Water Lines shall not be placed into service until all Bac-T testing has passed.

### 3.13 FIELD HYDROSTATIC TESTS

- A. Conform to requirements of Section 02450 – Hydrostatic Testing of Waterlines.

**END OF SECTION**

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**SECTION 02405  
BUTTERFLY VALVES**

**PART I: GENERAL**

**1.1 GENERAL REQUIREMENTS**

- A. Butterfly valves.

**1.2 MEASUREMENT AND PAYMENT**

- A. Unit Prices:

1. Payment for butterfly valves twenty inches (20 In) in diameter and smaller shall be on the unit price basis for each.
2. Payment for butterfly valves twenty-four inches (24 In) in diameter and greater is on a unit price basis.
3. Refer to Section 01270 – Measurement and Payment for unit price procedures.

- B. Stipulated Price (Lump Sum):

1. If Contract is Stipulated Price Contract, payment for work in this Section is included in Total Stipulated Price.

**1.3 REFERENCES**

- A. ASME – American Society of Mechanical Engineers.

1. ASME B16.1 – Cast Iron Pipe Flanges and Flanged Fittings.

- B. ASTM – American Society for Testing and Materials.

1. ASTM A126 – Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.

- C. AWWA – American Water Works Association.

1. AWWA C504 – Standard for Rubber-Seated Butterfly Valves.
2. AWWA C550 – Standard for Protective Interior Coatings for Valves and Hydrants.

- D. CFTS – City of Friendswood Technical Specifications.

**1.4 SUBMITTALS**

- A. Conform to requirements of Section 01330 – Submittal Procedures.

- B. Submit manufacturer's product data for proposed valves and actuators for approval.

- C. Submit manufacturer's affidavit for proposed valves and actuators certifying compliance with the Technical Specifications.

- D. Submit manufacturer's affidavit that butterfly valves were manufactured in the United States and conform to applicable requirements of AWWA C504 and that they have been satisfactorily tested in the United States in accordance with AWWA C504 using test pressure of one hundred fifty pounds per square inch (one hundred fifty pounds per square inch (150 psi)) in both directions. Submit Proof-of-Design and hydrostatic testing procedure in accordance with AWWA C504.

- E. Submit manufacturer's affidavit that coating for interior surfaces of valves conform to applicable requirements of AWWA C550. Submit results of holiday test and thickness measurements of coatings.
- F. Furnish, at time of delivery, affidavit of compliance, as specified in Section 6.3 of AWWA C504 certifying compliance with applicable portion of AWWA C504 and modification or supplements herein. Furnish certified drawings and material test records by manufacturer covering items included in Section 4.3 of AWWA C504, for review. Furnish certified copies of test reports covering items in Sections 4.5.8.5.5, 4.5.8.5.8 and 5.2.1 through 5.2.4.3 of AWWA C504 for review.
- G. Submit data indicating maximum torque required to open valve, maximum torsional strength of shaft and torque output of actuator.
- H. Provide submittal information on CD-ROM in Adobe portable document format (\*.PDF).
- I. Include number of turns to operate valves to fully open/closed.

#### 1.5 QUALITY CONTROL

- A. Perform valve leakage tests in both directions at one hundred fifty pounds per square inch (150 psi) in factory and field. Hydrostatic field tests of one hundred fifty pounds per square inch (150 psi) shall be made against dished head plug or similar arrangement.
- B. For purposes of interpreting referenced AWWA tests, the following shall apply: Shutoff pressure is one hundred fifty pounds per square inch (150 psi); cycle consists of rotating disc from fully opened to fully closed position, for valves larger than seventy-two inches (72 In), proof of design shall require one thousand (1000) cycles and shall be performed on valve greater than seventy-two inches (72 In) of like design and construction. When proof of design tests are performed on valve delivered to job site, replace disc, bushing, shaft and seals with new and unused items and test and certify as described above.
- C. Hydrostatic Testing by Manufacturer:
  - 1. Hydrostatic testing to be witnessed by the Project Manager prior to shipment of valves. Provide minimum four weeks (4 Wks) notice to the Project Manager to schedule witness testing. When possible, maximize number of valves to be tested during a plant visit, no more than two (2) visits shall be allowed per project to witness test valves, unless otherwise approved by the Project Manager. The City shall pay expenses for each visit up to total of two (2) visits incurred by the Project Manager to witness testing of each grouping of valve(s) per project. Expenses for subsequent or extended visits by the Project Manager for defective valves, improper scheduling or valve failures are to be paid by the Contractor. Witness of hydrostatic testing by the Project Manager shall only be in regards to compliance with this Technical Specification and shall not constitute approval by the Project Manager nor relieve the Contractor of obligations to

- comply with the Contract Documents.
2. Document serial number on valve at time of testing and reflect in certified test records furnished to the Project Manager. Identification plate shall be permanently affixed to valve and actuator prior to hydrostatic testing.
  3. Hydrostatic testing to conform to AWWA C504 except as modified below:
    - a. Install actuator prior to hydrostatic testing. Test actuator to verify actual number of turns match manufacturer's published number of turns. Verify valve stops are in correct positions.
    - b. Fully open and close valve prior to performing shell test and prior to each leakage test.
    - c. Perform shell test first (1st).
    - d. When tested with water, adequately dry seat and disc.
    - e. When tested with air, fill top of valve with water to aid in viewing possible leakage.
    - f. Pressure Gauges: Calibrated within past twelve months (12 Mos); zero pounds per square inch (0 psi) to five hundred pounds per square inch (500 psi) range in increments of five pounds per square inch (5 psi), present calibration certificates prior to hydrostatic testing.
    - g. If seat adjustment is required during hydrostatic testing, perform valve leakage test again in both directions. Once seat adjustment is made, fully open and fully close valve three (3) times and repeat leakage test.
  4. Field Testing
    - a. When valve arrives at the job site, the Contractor shall operate valve fully open and closed twice in presence of the Project Manager. Document number of turns to open and close each time.
    - b. Install operator nut plum.
    - c. After valve is installed, repeat the operation test and document number of turns in presence of the Project Manager.
    - d. Manufacturer's representative must be present to witness the operation test again at the substantial completion walk-through. Verify valve operate fully open/closed twice at the appropriate number of turns.

## **PART II: PRODUCTS**

### **2.1 VALVES AND ACTUATORS**

- A. Butterfly Valves and Actuators: Provide approved butterfly valves and

actuators. Conform to AWWA C504, except as modified or supplemented herein.

- B. If type of valve is not indicated on the Drawings, use butterfly valves for line valve sizes twenty-four inch (24 In) and larger. When type of valve is specified on the Drawings, no substitute shall be allowed, unless otherwise approved by the Project Manager.
- C. Butterfly valves shall be short-body, flanged design and installed at locations as shown on the Drawings.
- D. Direct-bury valves and valves in subsurface vaults shall open left (counterclockwise). Above-ground and plant valves shall open left (counterclockwise).
- E. Provide flanged joints when valve is connected to steel or PCCP.
- F. Butterfly Valves and Actuators (Additional Requirements for Large Diameter Water Lines):
  - 1. Provide valves from approved manufacturer. Provide all valves for single project, from same manufacturer.
  - 2. Valves larger than seventy-two inches (72 In) in diameter design: allowable stresses at rated pressure not to exceed one-third (1/3) of yield strength or one-fifth (1/5) of ultimate strength of material used.
  - 3. Provide manual actuators for single project from same manufacturer.
  - 4. Shaft connecting actuator to valve body must be fully enclosed. Valve bonnet and shaft extension to be fully enclosed and watertight.

## 2.2 VALVE CONSTRUCTION

- A. Valves: AWWA C504, Class 150B. Body: Cast iron, ASTM A126, Class B. Flanges: ASME B16.1, Class 125 lb.
- B. Discs for Butterfly Valves: Either cast iron or ductile iron. Valves greater than fifty-four inches (54 In) in diameter must utilize flow through disc.
- C. Seats: Buna-N or neoprene and may be applied to disc or body. Seats shall be mechanically secured and shall not rely solely on adhesive properties of epoxy or similar bonding agent to attach seat to body. Seats on disc shall be mechanically retained by stainless steel (18-8) retaining ring held in place by stainless steel (18-8) cap screws that pass through rubber seat for added retention. When seat is on disc, seat shall be retained in position by shoulders located on both disc and stainless-steel retaining ring. Mating surfaces for seats: Type 304 or 316, stainless steel and secured to disc by mechanical means. Sprayed-on or plated mating surfaces shall not be allowed. Seat shall be replaceable in field for valves greater than thirty inches (30 In) in diameter. Valves with segmented retaining rings shall not be accepted.
- D. Coat interior wetted ferrous surfaces of valve, including disc, with epoxy suitable for potable water conditions. Epoxy, surface preparation and epoxy application in accordance with AWWA C550 and coating

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manufacturer's recommendations. Provide three (3) coats of two (2) component, high-build epoxy with minimum dry film thickness of twelve (12) mils. Provide approved epoxy coating. Coatings shall be holiday-tested and measured for thickness.

- E. Valve shaft and keys: twenty-four inches (24 In) in diameter and greater valves require a minimum of two (2) taper pins used for attaching valve shaft to valve disc, use of torque plug for purposes of attaching valve shaft to valve disc is not permitted: Type 316 stainless steel. Shaft Bearings: Stainless steel, bronze, nylon or Teflon (supported by fiberglass mat or backing material with proven record of preventing Teflon flow under load) in accordance with AWWA C504. Sinter stainless steel bearing material. Design valve shaft to withstand three (3) times amount of torque necessary to open valve.
- F. Packing: Self adjusting and wear compensating, full or split ring V-type and replaceable without removing actuator assembly.
- G. Retaining Hardware for Seats: Type 304 or 316 stainless steel. Nuts and screws used with clamps and discs for rubber seats shall be held securely with locktight, or other approved method, to prevent loosening by vibration or cavitational effects.
- H. Valve disc shall seat in position at ninety degrees (90°) to pipe axis and shall rotate ninety degrees (90°) between full-open and tight-closed position. Install valves with valve shafts horizontal and convex side of disc facing anticipated direction of flow, except where shown otherwise on the Drawings.
- I. For valves utilizing retaining rings, tighten bolts to a uniform torque. Measure torque prior to testing valve.

### 2.3 VALVE ACTUATOR CONSTRUCTION

- A. Provide actuators for valves with size based on line velocity of twelve feet per second (12 Ft/Sec) and unidirectional service and, unless otherwise shown on the Drawings, equip with geared manual actuators. Provide fully enclosed and traveling-nut type, rack-and-pinion type or worm-gear type for valves twenty inches (20 In) and smaller. Provide worm-gear type for valves twenty-four inches (24 In) and larger.
- B. Provide actuator designed for installation with valve shaft horizontal unless otherwise indicated on the Drawings.
- C. Provide bonnet extensions, as required, between valve body and actuator. Space between actuator housing and valve body shall be completely enclosed so that no moving parts are exposed to soil or elements.
- D. Provide oil-tight and watertight actuator housings for valves, specifically designed for buried service or submerged service when located in valve vaults and factory packed with suitable grease.
- E. Install valve position indicator on each actuator housing located above ground or in valve vaults. Valves shall be equipped with two inch (2 In) actuator nut only.

- F. Indicate direction of opening of valve on exposed visible part of assembly and cast direction of open on two inch (2 In) nut on top of valve operator extension. Paint two inch (2 In) actuator nut and extension shaft black when counter-clockwise open.
- G. Design worm-gear or traveling-nut actuators to be self-locking and designed to transmit twice the required actuator torque without damage to faces of gear teeth or contact faces of screw or nut.

#### 2.4 VALVE BOXES

- A. Provide Standard Type "A" valve boxes conforming to requirements of Section 02440 – Valve Boxes, Meter Boxes and Meter Vaults.

#### 2.5 VALVE SERVICE MANHOLES

- A. For large diameter water lines, provide manholes to dimensions shown on the Drawings conforming to requirements of Section 02305 – Precast Concrete Manholes.

### PART III: EXECUTION

#### 3.1 EARTHWORK

- A. Conform to applicable provisions of Section 02125 – Excavation and Backfill for Utilities.

#### 3.2 SETTING VALVES AND VALVE BOXES

- A. Prior to Hydrostatic testing of water line and valve:
  - 1. Test valve by opening and closing valve at a minimum of two (2) times to verify valve seats properly.
  - 2. Verify number of turns from fully open to fully closed position is same as identified in manufacturer's submittal.
  - 3. Adjust valve as required if number of turns do not match.
  - 4. Remove foreign matter from within valves.
- B. Install valves where shown on the Drawings or as located by the Project Manager. Use valve boxes for sixteen inch (16 In) and twenty-four inch (24 In) valves. Set valves plumb and as detailed. Center valve boxes on valves. Carefully tamp earth around each valve box for minimum radius of four feet (4 Ft) or to undisturbed trench face when less than four feet (4 Ft).
- C. Avoid disturbing or overstressing valve body when installing valves. Perform field adjustment of valves under pressure to ensure shutoff occurs in number of rotations as described in valves operation and maintenance manual.
- D. Attach two (2) – four feet (4 Ft) lengths of pipe to each side of valve prior to installation in line.
- E. Submit certification that large diameter valve was installed, adjusted and exercised in accordance with manufacturer's instructions. Manufacturer's certification shall state that all performance

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characteristics of large diameter valves, as installed, have been met. Adjustments made to valve, for any reason, must be made by manufacturer's representative.

**3.3 DISINFECTION AND TESTING**

- A. The Contractor shall disinfect valves and appurtenances as required by Section 02455 – Disinfection of Waterlines and test as required by Section 02450 – Hydrostatic Testing of Waterlines. Do not use valves for throttling without prior approval of manufacturer.

**3.4 COATING OF PIPING**

- A. Coat valves located in vaults, stations and above ground using approved paint. Minimum of two (2) coats shall be applied with minimum of three (3) mil thickness. Apply coating in accordance with manufacturer's recommendations.

**END OF SECTION**

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**SECTION 02410  
GATE VALVES**

**PART I: GENERAL**

**1.1 GENERAL REQUIREMENTS**

- A. Gate valves.

**1.2 MEASUREMENT AND PAYMENT**

A. Unit Prices:

1. Payment for gate valves is on a unit price basis. The unit price includes cost of required box for gate valves and extensions.
2. Payment for two inch (2 In) blow-off valve with box is on a unit price basis for each installation.
3. Refer to Section 01270 – Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum):

1. If Contract is Stipulated Price Contract, payment for work in this Section is included in Total Stipulated Price.

**1.3 REFERENCES**

A. ASTM – American Society for Testing and Materials.

1. ASTM A307 – Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.
2. ASTM B62 – Standard Specification for Composition Bronze or Ounce Metal Casting.
3. ASTM B763 – Standard Specification for Copper Alloy Sand Casting for Valve Application.
4. ASTM D429 – Standard Test Methods for Rubber Property-Adhesion to Rigid Substrates.

B. AWWA – American Water Works Association.

1. AWWA C500 – Standard for Metal-Seated Gate Valves for Water Supply Service.
2. AWWA C509 – Standard for Resilient-Seated Gate Valves for Water Supply Service.
3. AWWA C515- Standard for Reduced Wall, Resilient- Seated Gate Valves for Water Supply Service.
4. AWWA C550 – Standard for Protective Epoxy Interior Coatings for Valves and Hydrants.

C. CFTS – City of Friendswood Technical Specifications.

**1.4 SUBMITTALS**

- A. Conform to requirements of Section 01330 – Submittal Procedures.
- B. Submit manufacturer's product data for proposed valves for approval.
- C. Provide detailed drawings of gearing mechanism for twenty inch (20 In)

and larger gate valves.

1.5 QUALITY CONTROL

- A. Submit manufacturer's affidavit that gate valves are manufactured in the United States and conform to stated requirements of AWWA C500, AWWA C509, AWWA C515 and this Section and that they have been satisfactorily tested in the United States in accordance with AWWA C500, AWWA C509 and AWWA C515.

**PART II: PRODUCTS**

2.1 MATERIALS

- A. Gate Valves: AWWA C500, AWWA C509, AWWA C515 and additional requirements of this Section. Direct bury valves and those in subsurface vaults shall open counterclockwise (left hand).
- B. If type of valve is not indicated on the Drawings, use gate valves as line valves for sizes twenty inches (20 In) and smaller. When type of valve is indicated, no substitute is allowed.
- C. Gate Valves one and one-half inches (1-1/2 In) in diameter and smaller: one hundred twenty-five pounds per square inch (125 psi) pressure rating; bronze; rising-stem; singlewedge; disc type; screwed ends
- D. Coatings for Gate Valves two inches (2 In) and larger: AWWA C550 non-toxic, imparts no taste to water, functions as physical, chemical and electrical barrier between base metal and surroundings, minimum eight (8) mil-thick, fusion-bonded epoxy. Prior to assembly of valve, apply protective coating to interior and exterior surfaces of body.
- E. Gate Valves two inches (2 In) in diameter: Iron body, double disc or resilient-seated, non-rising stem, one hundred fifty pounds per square inch (150 psi) pressure rating, two inch (2 In) square nut operating to open counterclockwise (left hand).
- F. Gate Valves three inches (3 In) to twelve inches (12 In) in diameter: Non-directional, standard-wall resilient seated (AWWA C509), parallel seat double disc (AWWA C500) or reduced-wall resilient seated gate valves (AWWA C515), two hundred pounds per square inch (200 psi) pressure rating, bronze mounting, push-on bell ends with rubber joint rings and nut-operated unless otherwise specified. Provide approved standard-wall resilient seated valves. Provide approved reduced-wall resilient seated valves. Provide approved double disc valves. Comply with following requirements unless otherwise specified in the Drawings:
  - 1. Design: Fully encapsulated rubber wedge or rubber seat ring mechanically attached with minimum 304 stainless-steel fasteners or screws; threaded connection isolated from water by compressed rubber around opening.
  - 2. Body: Cast or ductile iron, flange bonnet and stuffing box together with ASTM A307 Grade B bolts. Manufacturer's initials, pressure rating and year manufactured shall be cast in body.

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3. Bronze: Valve components in waterway shall contain not more than fifteen percent (15%) zinc and not more than two percent (2%) aluminum.
  4. Stems: ASTM B763 bronze, alloy number-995 minimum yield strength of forty thousand pounds per square inch (40,000 psi); minimum elongation in two inches (2 In) of twelve percent (12%), non-rising.
  5. O-rings: For AWWA C500, Section 3.12.2. For AWWA C509, Sections 2.2.6 and 4.8.2. For AWWA C515, Section 4.2.2.5.
  6. Stem Seals: Consist of three (3) O-rings, two (2) above and one (1) below thrust collar with anti-friction washer located above thrust collar for operating torque.
  7. Stem Nut: Independent or integrally cast of ASTM B62 bronze.
  8. Resilient Wedge: Molded, synthetic rubber, vulcanized and bonded to cast or ductile iron wedge or attached with 304 stainless steel screws tested to meet or exceed ASTM D429 Method B; seat against epoxy-coated surface in valve body.
  9. Bolts: AWWA C500 Section 3.4, AWWA C509 Section 4.4 or AWWA C515 Section 4.4.4; stainless steel; cadmium plated or zinc coated.
- G. Gate valves fourteen inch (14 In) and larger in Diameter: AWWA C500; parallel seat double disc gate valves; push-on bell ends with rubber rings and nut-operated unless otherwise specified. Provide approved double disc valves with one hundred fifty pounds per square inch (150 psi) pressure rating. Comply with following requirements unless otherwise specified on the Drawings:
1. Body: Cast iron or ductile iron; flange together bonnet and stuffing box with ASTM A307 Grade B bolts. Cast following into valve body manufacturer's initials, pressure rating and year manufactured. When horizontally mounted, equip valves greater than twelve inches (12 In) in diameter with rollers, tracks and scrapers.
  2. O rings: For AWWA C500, Section 3.12.2. For AWWA C515, Section 4.2.2.5.
  3. Stems: ASTM B763 bronze, alloy number-995 minimum yield strength of forty thousand pounds per square inch (40,000 psi); minimum elongation in two inches (2 In) of twelve percent (12%), non-rising.
  4. Stem Nut: Machined from ASTM B62 bronze rod with integral forged thrust collar machined to size; non-rising.
  5. Stem Seals: Consist of three (3) O-rings, two (2) above and one (1) below thrust collar with antifriction washer located above thrust collar for operating torque.
  6. Bolts: AWWA C500 Section 3.4 or AWWA C515 Section 4.4.4; stainless steel; cadmium plated or zinc coated.
  7. Discs: Cast iron with bronze disc rings securely pinned into

- machined dovetailed grooves.
8. Wedging Device: Solid bronze or cast-iron, bronze-mounted wedges. Thin plates or shapes integrally cast into cast-iron surfaces are acceptable. Other moving surfaces integral to wedging action shall be bronze monel or nickel alloy-to-iron.
  9. Provide bypass for valves sixteen inches (16 In) and larger.
  10. Bronze Mounting: Built as integral unit mounted over or supported on, cast-iron base and of sufficient dimensions to be structurally sound and adequate for imposed forces.
  11. Gear Cases: Cast iron; furnished on eighteen (18) inch and larger valves and of extended type with steel side plates, lubricated, gear case enclosed with oil seal or O-rings at shaft openings.
  12. Stuffing Boxes: Located on top of bonnet and outside gear case.
- H. Gate valves fourteen inches (14 In) to twenty-four inches (24 In): Provide AWWA C515; reduced-wall, resilient seated gate valves with 250 psi pressure rating. Furnish with spur or bevel gearing.
1. Mount valves horizontally if proper ground clearance cannot be achieved by normal vertical installation. For horizontally mounted gate valves, provide bevel operation gear mounted vertically for above ground operation.
  2. Use valve body, bonnet, wedge and operator nut constructed of ductile iron. Fully encapsulate exterior of ductile iron wedge with rubber.
  3. Ensure wedge is symmetrical and seals equally well with flow in either direction.
  4. Provide ductile iron operator nut with four (4) flats at stem connection to apply even input torque to the stem.
  5. Bolts: AWWA C515, Section 4.4.4, Stainless Steel; cadmium plated or zinc coated.
  6. Provide high strength bronze stem and nut.
  7. O-rings: AWWA C515, Section 4.2.2.5, pressure O-rings as gaskets.
  8. Provide stem sealed by three (3) O-rings. Top two (2) O-rings are to be replaceable with valve fully open at full rated working pressure.
  9. Provide thrust washers to the thrust collar for easy valve operation.
- I. Gate Valves Extension Stem: When shown on the Drawings, provide non-rising, extension stem having coupling sufficient to attach securely to operating nut of valve. Upper end of extension stem shall terminate in square wrench nut no deeper than four feet (4 Ft) from finished grade or as shown on the Drawings. Support extension stem with an arm attached to wall of manhole or structure that loosely holds extension stem and allows rotation in the axial direction only.
- J. Gate Valves in Factory Mutual (Fire Service) Type Meter Installations:

Conform to provisions of this specification; outside screw and yoke valves; carry label of Underwriters' Laboratories, Inc.; flanged, Class 125; clockwise to close.

- K. Gate Valves for Tapping Steel Pipe: Provide double disc gate valve. Resilient wedge gate valve shall only be installed in a vertical position.
- L. Provide flanged joints when valve is connected to steel or PCCP.

## **PART III: EXECUTION**

### **3.1 INSTALLATION**

- A. Earthwork: Conform to applicable provisions of Section 02125 – Excavation and Backfill for Utilities.
- B. Operation: Do not use valves for throttling without prior approval of the manufacturer.

### **3.2 SETTING VALVES AND VALVE BOXES**

- A. Remove foreign matter from within valves prior to installation. Inspect valves in open and closed positions to verify that parts are in satisfactory working condition.
- B. Install valves and valve boxes where shown on the Drawings. Set valves plumb and as detailed. Center valve boxes on valves. Carefully tamp earth around each valve box for minimum radius of four feet (4 Ft) or to undisturbed trench face when less than four feet (4 Ft). Install valves completely closed when placed in water line.
- C. For pipe section of each riser, use only six inch (6 In), ductile iron Class 51 or DR18 PVC pipe cut to proper length. Riser must be installed to allow complete access for operation of valve. Assemble and brace box in vertical position as indicated on the Drawings.

### **3.3 DISINFECTION AND TESTING**

- A. Contractor shall disinfect valves and appurtenances as required by Section 02455 – Disinfection of Waterlines and test as required by Section 02450 – Hydrostatic Testing of Waterlines.
- B. Double-Disc Gate Valves: Apply hydrostatic test pressure equal to twice rated working pressure of valve between discs. Valve shall show no leakage through metal, flanged joints or stem seals. Test at rated working pressure, applied between discs. Valve shall show no leakage through metal, flanged joints or stem seals. Do not exceed leakage rate of one ounce per hour per inch (1 Oz/Hr/In) of nominal valve size.
- C. Solid-Wedge Gate Valves: Apply hydrostatic pressure equal to twice rated working pressure of valve with both ends bulkheaded and gate open. Valve shall show no leakage through metal, flanged joints or stem seals. Test at rated working pressure, applied through bulkheads alternately to each side of closed gate with opposite side open for inspection. Valve shall show no leakage through metal, flanged joints or stem-seals. Do not exceed leakage rate of one ounce per hour per inch

(1 Oz/Hr/In) of nominal valve size.

D. Repair or replace valves which exceed leakage rate.

**3.4 PAINTING OF VALVES**

A. Paint valves in vaults, stations and above ground with approved paint.

**END OF SECTION**

## **SECTION 02415 PRESSURE REDUCING VALVES**

### **PART I: GENERAL**

#### **1.1 GENERAL REQUIREMENTS**

- A. Pressure reducing valves (PRV).

#### **1.2 MEASUREMENT AND PAYMENT**

- A. A unit prices:
  - 1. Payment for pressure reducing valves is on a unit price basis for each valve installed.
  - 2. Payment includes vault, piping, manhole, fittings and appurtenances necessary for complete installation of valve.
  - 3. Refer to Section 01270 – Measurement and Payment for a unit price procedures.
- B. Stipulated Price (Lump Sum):
  - 1. If Contract is a Stipulated Price Contract, payment for work in this Section is included in Total Stipulated Price.

#### **1.3 REFERENCES**

- A. ASME – American Society of Mechanical Engineers.
  - 1. ASME B16.1 – Cast Iron Pipe Flanges and Flanged Fittings.
- B. ASTM – American Society for Testing and Materials.
  - 1. ASTM A48 – Standard Specification for Gray Iron Castings.
- C. CFTS –City of Friendswood Technical Specifications.

#### **1.4 SUBMITTALS**

- A. Conform to requirements of Section 01330 – Submittal Procedures.
- B. Submit manufacturer's product data for proposed valves for approval.
- C. Submit design calculations and shop drawings for valve vaults and manholes, sealed by a Professional Engineer licensed by the State of Texas.

#### **1.5 QUALITY CONTROL**

- A. Submit manufacturer's affidavit that pressure reducing valves purchased for the Work, were manufactured and tested in the United States and conform to requirements of this Section.

### **PART II: PRODUCTS**

#### **2.1 MATERIALS**

- A. Provide approved PRV with basket strainer in location and arrangement as shown on the Drawings.
  - 1. Valve body: Ductile iron with ASME B16.1, Class 125, flanges.

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2. Valve cover: ASTM A48 cast iron.
3. Valve internals:
  - a. Provide top and bottom single moving disc and diaphragm assembly.
  - b. Use flexible nylon fabric reinforced elastomer diaphragm integral with assembly.
  - c. Provide valve internal trim (seat ring, disc guide and cover bearing) made of stainless steel.
  - d. Provide heat-fusion bonded epoxy coating to internal and external surfaces of valve body including disc retainer and diaphragm washer. Holiday-test coating applied to valve body.
  - e. Treat stem and seat with penetrative salt nitride process.
  - f. Use Xylan coated seat.
  - g. Do not use leather parts.
- B. Control Tubing: Contain shutoff cocks with Y-strainer.
- C. PRV: Equip with visual valve position indicator. Fit valve position indicator with air-bleed petcock. Authorized manufacturer's representative to initially set pressure in field with sixty pounds per square inch (60 psi) downstream pressure.
- D. Provide basket strainer upstream of PRV as shown on the Drawings.
  1. Strainer body: Quick-opening type, fabricated-steel construction with ANSI B 16.1, Class 150, flanges.
  2. Basket: Type 304, stainless steel.
  3. Model: Provide basket compatible with the manufacturer of the pressure reducing valve. Hayward Model 90 or approved equal, for PRV four inches (4 In) through twenty-four inches (24 In). Provide Hayward Model 510 or approved equal, for PRV fourteen inches (14 In) or greater when space limitations dictate use of smaller strainer housing.
- E. Provide pressure reducing pilot that has adjustable range of twenty pounds per square inch (20 psi) to one hundred seventy-five pounds per square inch (175 psi). Provide and install pilot system components according to manufacturer's recommendations unless otherwise approved by the Project Manager.
- F. Valve Vaults: Provide as shown on the Drawings and conforming to requirements of Section 02440 – Valve Boxes, Meter Boxes and Meter Vaults.

## **PART III: EXECUTION**

### **3.1 EARTHWORK**

- A. Conform to applicable provisions of Section 02125 – Excavation and Backfill for Utilities.

**3.2 SETTING VALVES**

- A. Provide services of authorized representative of valve manufacturer on site during installation of valves and to serve as adviser on aspects of installation. Take necessary precautions to protect pilot system during PRV installation.
- B. Prior to installing valves, remove foreign matter from within valves. Inspect valves in open and closed position to verify that parts are in satisfactory working condition.

**3.3 DISINFECTION AND TESTING**

- A. Disinfect valves and appurtenances as required by Section 02455 – Disinfection of Waterlines and test as required by Section 02450 – Hydrostatic Testing of Waterlines.

**3.4 PAINTING OF PIPING AND VALVES**

- A. Paint piping and valves located in vaults, stations and above ground using ACRO Paint No. 2215 or approved equal.

**END OF SECTION**

**SECTION 02420  
TAPPING SLEEVES AND VALVES**

**PART I: GENERAL**

**1.1 GENERAL REQUIREMENTS**

- A. Tapping sleeves and valves for connections to existing water system.

**1.2 MEASUREMENT AND PAYMENT**

A. Unit Prices:

1. Payment is on a unit price basis for each tap installed.
2. Refer to Section 01270 – Measurement and Payment for unit price procedures.
3. For water lines four inches (4 In) and greater, no payment shall be made until coupon (cut out portion of pipe tapped) is delivered to the City.

B. Stipulated Price (Lump Sum):

1. If Contract is Stipulated Price Contract, payment for work in this Section is included in Total Stipulated Price.

**1.3 REFERENCES**

A. ASTM – American Society for Testing and Materials.

1. ASTM A240 – Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels.
2. ASTM A193 Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
3. ASTM A194 Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service.

B. AWWA – American Water Works Association.

1. AWWA C110 – Standard for Ductile-Iron and Gray-Iron Fittings, 3 in. through 48 in., for Water and other Liquids.
2. AWWA C200 – Standard for Steel Water Pipe – 6 in. and Larger.
3. AWWA C207 – Standard for Steel Pipe Flanges for Waterworks Service – Sizes 4 in. through 144 in.
4. AWWA C223 – Standard for Fabricated Steel and Stainless Steel Tapping Sleeves.
5. AWWA C500 – Standard for Metal Seated Gate Valves, for Water Supply Service.

C. CFTS – City of Friendswood Technical Specifications.

**1.4 SUBMITTALS**

- A. Conform to requirements of Section 01330 – Submittal Procedures.
- B. Submit results of tapping sleeves NPT test opening.

- C. Submit manufacturer's affidavit as required in Section 02410 – Gate Valves.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Ship steel sleeves in wooden crates that provide protection from damage to epoxy coating during transport and storage.

**PART II: PRODUCTS**

2.1 MATERIALS

A. Tapping Sleeves:

- 1. Tapping Sleeve Bodies: AWWA C223 stainless steel, full circumference to be bolted together with high-strength, corrosion-resistant, low-alloy steel bolts with mechanical joint ends.
- 2. Branch Outlet of Tapping Sleeve:
  - a. Flanged, machined recess, AWWA C207, Class D, ANSI 150 pound drilling.
  - b. Gasket: Affixed around recess of tap opening to prevent rolling or binding during installation.

B. Stainless Steel tapping-sleeve bodies and flange shall be used for following sizes and with following restrictions:

- 1. Flange: ASTM A240 Stainless Steel, Type 304, ANSI 150 pound drilling.
- 2. Gasket: Full circumferential, affixed around recess of tap opening to prevent rolling or binding during installation, compounded for water and sewer service.
- 3. Stainless Steel sleeves are restricted to use on pipe sizes four inches (4 In) and larger.
- 4. Body: ASTM A240 Stainless Steel, Type 304.
- 5. Bolts: ASTM A193 Stainless Steel, Type 304.
- 6. Nuts: ASTM A194 Stainless Steel, Type 304.
- 7. Branch Outlet: Heavy Stainless Steel Pipe
- 8. Provide approved stainless steel tapping sleeves.
- 9. Do not use stainless steel sleeves for taps greater than seventy-five percent (75%) of pipe diameter.

C. Welded-steel tapping-sleeve bodies may be used in lieu of cast or ductile iron bodies for following sizes and with following restrictions:

- 1. Flange: AWWA C207, Class D, ANSI 150 pound drilling.
- 2. Gasket: Affixed around recess of tap opening to prevent rolling or binding during installation.
- 3. Steel sleeves are restricted to use on pipe sizes six inches (6 In) and larger.
- 4. Body: Heavy, welded-steel construction; top half grooved to retain neoprene O-ring seal permanently against outside diameter of pipe.

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5. Bolts: AWWA C500 Section 3.5; coated with one hundred percent (100%) vinyl resin or corrosive resistant material.
  6. Steel Sleeves Finish: Fusion-bonded epoxy coated to minimum twelve (12) mil thickness.
  7. Finished Epoxy Coat: Free of laminations and blisters; and remain pliant and resistant to impact with non-peel finish.
  8. Provide approved steel tapping sleeves.
  9. Tapping Sleeves: Provide with three-quarters inch (3/4 In) NPT test opening for testing prior to tapping. Provide three-quarters inch (3/4 In) bronze plug for opening.
  10. Do not use steel sleeves for taps greater than seventy-five percent (75%) of pipe diameter.
- D. Tapping Valves: Meet requirements of Section 02410 – Gate Valves with following exceptions:
1. Inlet Flanges:
    - a. AWWA C110; Class 125.
    - b. AWWA C110; Class 150 and higher: Minimum eight (8) hole flange.
  2. Outlet: Standard mechanical or push-on joint to fit any standard tapping machine.
  3. Valve Seat Opening: Accommodate full-size shell cutter for nominal size tap without contact with valve body; double disc.
  4. Valves must be open left (counterclockwise).
- F. Valve Boxes: Standard Type "A" valve boxes conforming to requirements of Section 02440 – Valve Boxes, Meter Boxes and Meter Vaults.

## **PART III: EXECUTION**

### **3.1 APPLICATION**

- A. Install tapping sleeves and valves at locations and of sizes shown on the Drawings. Install sleeve so valve is in horizontally level position unless otherwise indicated on the Drawings or approved by the Project Manager.
- B. Clean tapping sleeve, tapping valve and pipe prior to installation and in accordance with manufacturer's instructions.
- C. When tapping concrete pressure pipe, size on size, use shell cutter one (1) standard size smaller than water line being tapped.
- D. Do not use Large End Bell (LEB) increasers with next size tap unless existing pipe is asbestos-cement.

### **3.2 INSTALLATION**

- A. Verify outside diameter of pipe to be tapped prior to ordering sleeve.
- B. Tighten bolts in proper sequence so that undue stress is not placed on pipe.
- C. Align tapping valve properly and attach to tapping sleeve. Insert

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insulation sleeves into flange holes of tapping valve and pipe. Make insertions of sleeves on pipe side of tapping valve. Do not damage insulation sleeves during bolt tightening process.

- D. Make tap with sharp, shell cutter:
  - 1. For twelve inch (12 In) and smaller tap, use minimum cutter diameter one-half inch (1/2 In) less than nominal tap size.
  - 2. For sixteen inch (16 In) and larger tap, use manufacturer's recommended cutter diameter.
- E. Withdraw coupon and flush cuttings from newly-made tap.
- F. Wrap:
  - 1. For twelve inch (12 In) and smaller tap, wrap completed tapping sleeve and valve in accordance with Section 02260 – Polyethylene Wrap.
  - 2. For sixteen inch (16 In) and larger tap, apply coal tar epoxy around completed tapping sleeve and valve. The coal tar epoxy shall be applied with minimum of two (2) coats. Each coat of coal tar epoxy shall have minimum dry film thickness of sixteen (16) mils.
- G. Place concrete thrust block behind tapping sleeve (not over tapping sleeve and valve).
- H. Request inspection of installation prior to backfilling.
- I. Backfill in accordance with Section 02125 – Excavation and Backfill for Utilities.

**END OF SECTION**

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**SECTION 02425  
WATER METERS**

**PART I: GENERAL**

**1.1 GENERAL REQUIREMENTS**

- A. Water meters, sub-meters, irrigation meters and fire service meters.

**1.2 MEASUREMENT AND PAYMENT**

A. Unit Prices:

1. Measurement for water meters is on a unit price basis for installation of each meter type and size.
2. Payment includes vault, piping and appurtenances necessary for complete installation of meter.
3. Measurement for relocating and reinstalling meter with new box is on a unit price basis for each meter relocated and reinstalled.
4. No separate payment for adjustment of meter or meter box unless otherwise shown in the Drawings.
5. Refer to Section 01270 – Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum):

1. If Contract is Stipulated Price Contract, payment for work is in this Section is included in Total Stipulated Price.

**1.3 REFERENCES**

A. ASME – American Society of Mechanical Engineers.

1. ASME B16.1 – Cast-Iron Pipe Flanges and Flanged Fittings.

B. AWWA – American Water Works Association.

1. AWWA C510 – Standard for Double Check Valve Backflow – Prevention Assembly.
2. AWWA C700 – Standard for Cold-Water Meters – Displacement Type.
3. AWWA C701 – Standard for Cold-Water Meters – Turbine Type for Customer Service.
4. AWWA C702 – Standard for Cold-Water Meters – Compound Type.
5. AWWA C703 – Standard for Cold-Water Meters – Fire Service Type.
6. AWWA Manual M6 – Water Meters – Selection, Installation, Testing and Maintenance.

C. CFTS – City of Friendswood Technical Specifications.

**1.4 SUBMITTALS**

- A. Conform to requirements of Section 01330 – Submittal Procedures.
- B. Submit written certification of calibration and test results.
- C. Submit manufacturer's certification that meters meet applicable

requirements of this Specification Section.

- D. Submit accuracy registration test certification from manufacturer for each three inch (3 In) through ten inch (10 In) diameter meter.

#### 1.5 QUALITY CONTROL

- A. Submit manufacturer's warranty against defects in materials and workmanship for one year (1 Yr) from date of Substantial Completion.
- B. Provide vendor's unconditional guarantee that performance of each meter meets applicable AWWA standards and AWWA Manual M6 as follows:
  - 1. Displacement type: Ten years (10 Yrs) from installation or register registration specified in TABLE 4.1 – GALLON REGISTRATION in this Section, whichever comes first.
  - 2. Turbine type: One year (1 Yr) from date of installation.
  - 3. Compound type: One year (1 Yr) from date of installation.
  - 4. Fire service type: One year (1 Yr) from date of installation.
  - 5. Operations of hermetically sealed register, one inch (1 In) to two inch (2 In) diameter, shall be unconditionally guaranteed for fifteen years (15 Yrs).
- C. Provide manufacturer's unconditional guarantee for each sealed register against leakage, fogging, discoloration and stoppage for fifteen years (15 Yrs) from date of installation.
- D. Vendor shall replace meters that become defective within guarantee period with meters that comply with this Technical Specification. The City shall return defective meters to vendor at vendor's expense. Meters repaired or replaced under this guarantee must meet accuracy limits for new meters upon receipt and accuracy limits for remaining period of guarantee for the original meter.

#### 1.6 EASEMENT REQUIREMENTS

- A. Install water meters and shut-off valves (stop boxes) in the City right-of-way line when possible.
- B. When not possible to install water meters and shut-off valves (stop boxes) in the right-of-way, then install in utility easement, if available.

### PART II: PRODUCTS

#### 2.1 GENERAL

- A. Provide meters of size as indicated on the Drawings, unless otherwise indicated.
- B. Meters shall be Neptune. NO EXCEPTIONS.
- C. Provide bolted split casings. Main casings of meters and external fasteners: Copper alloy with minimum seventy-five percent (75%) copper for one inch (1 In) to two inches (2 In), bronze or cast iron, hot-dipped galvanized or epoxy coating for three inches (3 In) and larger.
- D. Straightening Vanes: Non-corrosive material compatible with case

- material.
- E. Intermediate gear train shall not come into contact with water and shall operate in suitable lubricant.
  - F. Registers:
    - 1. Lens: impact resistant.
    - 2. Register box: tamper resistant by means of tamper screw or plug.
    - 3. Register capacity of meters:
      - a. One inch (1 In) meters: nine million nine hundred ninety-nine thousand nine hundred and ninety gallons (9999990 Gal). There shall be six (6) mobile and one (1) stationary digits. The last digit shall be stationary, white on black background. The tens and hundreds digits shall be mobile and white on a black background. The first four digits (millions to thousands) shall be black on a white background.
      - b. Two inch (2 In) meters and larger: ninety-nine million nine hundred ninety-nine thousand nine hundred gallons (99999900 Gal). There shall be six (6) mobile and two (2) stationary digits. The last two digits shall be stationary, white on black background. The hundreds digit shall be mobile and white on a black background. The first four digits (tens of millions to thousands) shall be black on a white background.
    - 4. If used, Automatic Meter Reading (AMR), shall adhere to the following: provides pulse, contact closure, piezo switch or encoder generated output signal, compatible with the City's radio and telephone AMR systems. Provide minimum twelve foot (12 ft) wire when permanently connected to register. Register box: tamper resistant by means of tamper screw or plug: Register: permanently sealed, straight-reading, center-sweep test hand, magnetic driven, U.S. gallons.
  - G. Connections: one inch (1 In: threads at each end; one and one-half inches (1-1/2 In) to two inches (2 In): two (2) bolt oval flanges each end; three inches (3 In) and larger: flange at each end.
    - 1. Connections three inches (3 In) or larger shall be in a vault and shall have a by-pass.
  - H. Stamp manufacturer's meter serial number on outer case. Stamp manufacturer's meter serial number on outside of register lid when provided. Manufacturer's serial numbers shall be individual and not duplicated.
  - I. Meters: Provide approved meters equipped with AMR type register to connect to the City of Friendswood's AMR system, when required.
  - J. Manufacturing quality control shall permit successful interchangeability from one (1) meter to another of same size including registers, measuring chambers and units, discs or pistons as units, change gears, bolts, nuts and washers without affecting accuracy of new meter.

- K. For water meter vaults provide:
  - 1. One-quarter inch (1/4 In) steel or aluminum with stainless steel hinge pins. Door shall open to ninety degrees (90°) and automatically lock in that position.
  - 2. Provide approved meter vault covers.

## 2.2 METER APPLICATIONS

- A. Sizes one inch (1 In) to two inch (2 In) Meters: Displacement type [except for constant flow where two inch (2 In) turbine may apply].
- B. Sizes three inch (3 In) and above Meters:
  - 1. Turbines:
    - a. Processing plants
    - b. Manufacturing facilities
    - c. Lawn sprinkler systems
    - d. Effluent water in treatment plants
    - e. Booster (pump) stations
    - f. Level controlled tank filling operations
    - g. Fire hydrants (transients)
    - h. Inter-systems sale or transfer
    - i. Sewer credit/sub-meter
  - 2. Compounds:
    - a. Multi-family dwellings
    - b. Motels and hotels
    - c. Hospitals
    - d. Schools
    - e. Restaurants
    - f. Office buildings
    - g. Dormitories, nursing homes, department stores, shopping malls and other commercial establishments

Note: Provide fire service type meter for sizes larger than six inches (6 In).
  - 3. Fire Service Type: For designated fire protection lines. Provide proportional or compound type fire service meter assembly (AWWA C703) when customer elects to use combination of potable and fire protection services in lieu of separate domestic meters and fire services.

## 2.3 MATERIALS

- A. Cold-Water Meters:
  - 1. Displacement Type: AWWA C700; sizes one inch (1 In) up to and including two inches (2 In); oscillating disc or piston of magnetic drive type; bolted split-case design, with either being removable.
  - 2. Turbine Type: AWWA C701; Class II; sizes three inches (3 In) through ten inches (10 In); flanged; straight-through measuring chamber; rotor construction: polypropylene or similar non-rubber material with specific gravity of approximately 1.0,

equipped with near frictionless replaceable bearings in turbine working against rotor shaft positioned thrust bearing. Transient/Fire Hydrant Meter Inlet: Female fitting for attachment to hose nozzle with National Standard Fire hose thread. Outlet: two inch (2 In) nipple with National Pipe Thread. Include restriction plate to limit flow through meter to four hundred gallons per minute (400 gpm) at sixty-five pounds per square inch (65 psi).

3. Compound Type: AWWA C702; sizes two inches (2 In) through six inches (6 In). Measuring chambers: For use in continuous operation; separate units of copper alloy [minimum eighty-four percent (84%) copper] or approved polymer material, inert in corrosive potable water; with centering device for proper positioning. Measuring pistons: Non-pilot type with division plates of rubber covering vulcanized to stainless steel or other approved material of sufficient thickness to provide minimum piston oscillation noise. Measuring discs: Flat or conical type, one piece, mounted on monel or 316 stainless steel spindle. Measuring chamber strainer screen area: Twice area of main case inlet.
4. Fire-Service Type: sizes four inches (4 In) through ten inches (10 In); turbine-type, compound type, proportional type; AWWA C703, with separate check valve conforming to AWWA C510. Determine size of fire meter by adding fire flow and domestic flow.

## 2.4 STRAINERS

- A. Displacement Potable Water Meters one inch (1 In) through two inches (2 In): Self-straining by means of annular space between measuring chamber and external case or with strainer screens installed in meter. Provide rigid screens which fit snugly, are easy to remove, with effective straining area at least double that of main case inlet.
- B. Potable Water Meters two inch (2 In) diameter and larger: Equip with separate external strainer with bronze body for diameters less than eight inches (8 In). Eight inch (8 In) diameter and larger may be cast iron, hot-dipped galvanized or epoxy coating. Strainers: Bolted to inlet side of meter, detachable from meter, easily removable lid. Strainer screen: Made of rounded cast bronze, stainless steel wire, having nominal screen size of three and one half (3-1/2) mesh-per-inch (U.S. Series) not less than forty-five percent (45%) clear area.
- C. Provide separate approved external strainers (when required by meter manufacturer) approved for use in fire service metered connections by Underwriters Laboratories. Bodies: Cast iron or copper alloy. Ends: Flanged in accordance with ASME B16.1, Class 125. Provide stainless steel basket. Strainers shall be detachable from meter.

## 2.5 CONNECTIONS AND FITTINGS

- A. Provide pipe for connections in accordance with Section 02215 – Ductile Iron Pipe (DIP) and Fittings and Section 02235 – Polyvinyl Chloride (PVC) Pipe. Use restrained joints and flanged joints only.
- B. Fittings:
  - 1. For meters two inches (2 In) and smaller: Same type of fittings as Outlet End fittings for Curb Stop in accordance with Section 02430 – Water Tap and Service Line Installation.
  - 2. For meters three inches (3 In) and larger: Restrained ductile iron; push-on bell joints or mechanical joint fittings between water line and meter vault; Class 125 flanged inside meter vaults; cement mortar lined and sealed.

## 2.6 LAYING LENGTHS

- A. Minimum laying lengths for meter and standard strainer shall be as shown on the Drawings.

## PART III: EXECUTION

### 3.1 TAPPING AND METER SERVICE INSTALLATION

- A. Refer to Section 02420 – Tapping Sleeves and Valves for tapping requirements.
- B. Meter Service Line:
  - 1. Use pipe and fittings conforming to requirements of Section 02215 – Ductile Iron Pipe (DIP) and Fittings or Section 02235 – Polyvinyl Chloride (PVC) Pipe.
  - 2. Limit pulling and deflecting of joints to limits recommended by manufacturer.
  - 3. Make vertical adjustments with offset bends where room shall permit. Minimize number of bends.
  - 4. Provide minimum of ten (10) pipe diameters of straight pipe length upstream and downstream of meter vault.

### 3.2 METER FITTING HOOKUP

- A. Support meter piping and meter, level and plumb, during installation. Support meters three inches (3 In) and larger with concrete at minimum of two (2) locations.
- B. Use round flanged fittings inside meter box or vault except for mechanical joint to flange adapter. Provide full-face one-eighth inch (1/8 In) black neoprene or red rubber gasket material on flanged joints. Provide bolts and nuts made from approved corrosion-resistant material.
- C. Tighten bolts in proper sequence and to correct torque.
- D. Visually check for leaks under normal operating pressure following installation. Repair or replace leaking components.

### 3.3 METER BOX AND VAULT INSTALLATION

- A. Conform to requirements of Section 02440 – Valve Boxes, Meter Boxes and Meter Vaults.

- B. Perform adjustment to existing meter in accordance with Section 02440 – Valve Boxes, Meter Boxes and Meter Vaults.
- C. Meters three inches (3 In) and larger shall be installed in a meter vault conforming to requirements of Section 02440 – Valves Boxes, Meter Boxes and Meter Vaults, and shall have by-pass installed.

### 3.4 TESTING

- A. Accuracy registration tests shall be conducted in accordance with latest revision of AWWA standard for type and size of meter.
  - 1. Tests shall be run by manufacturer prior to shipping to the City of Friendswood. Meters may be tested at random at the City's discretion.
  - 2. Accuracy of displacement meters during guarantee period shall be as follows:
    - a. Initial period: Eighteen months (18 Mos) from date of shipment or twelve months (12 Mos) from date of installation: ninety-eight and one-half percent (98.5%) to one hundred one and one-half percent (101.5%) at standard and minimum flow rates; ninety-eight percent (98%) to one hundred and one percent (101%) at low flow rates.
    - b. Second period: AWWA new meter accuracy tested as specified in TABLE 4.2 – METER TEST FLOW RATE – 2ND PERIOD in this Section.
    - c. Third period: AWWA new meter accuracy for standard flow rates and AWWA repair meter accuracy for minimum flow rate tested in TABLE 4.3 – METER TEST FLOW RATE – 3RD PERIOD.
  - 3. Minimal acceptable accuracy in percent of low flow registration for turbine meters shall be as specified in TABLE 4.4 – MINIMAL ACCEPTABLE ACCURACY FOR METERS in this Section.

**PART IV: TABLES**

**4.1 – GALLON REGISTRATION**

Size (inch)	Registration (million gallons)
5/8, 3/4	1.5
1	2.5
1-1/2	5.0
2	10.5

**4.2 – METER TEST FLOW RATE**

GUARANTEE PERIOD			TEST FLOW RATE
Meter Size (inches)	Age of Meter (years)	Or Gallons (million*)	Rate (gpm)
5/8	>1 to <5	0.5	1/4
1	>1 to <5	1.0	3/4
1-1/2	>1 to <5	2.5	1-1/2
2	>1 to <5	5.5	2

\* Total Registration

**4.3 – METER TEST FLOW RATE – 3RD PERIOD**

GUARANTEE PERIOD			TEST FLOW RATE
Meter Size (inches)	Age of Meter (years)	Or Gallons (million*)	Rate (gpm)
5/8	>5 to <10	1.5	1/4
1	>5 to <10	2.5	3/4
1-1/2	>5 to <10	5.0	1-1/2
2	>5 to <10	10.0	2

\* Total Registration

**4.4 – MINIMAL ACCEPTABLE ACCURACY FOR METERS**

Meter Size (inches)	Minimum Flow (gpm)	% Accuracy Required
2	3	95
3	5	95
4	15	95
6	20	95
8	20	95
10	30	95

**END OF SECTION**

**SECTION 02430  
WATER TAP AND SERVICE LINE INSTALLATION**

**PART I: GENERAL**

**1.1 GENERAL REQUIREMENTS**

- A. Tapping existing mains and furnishing and installing new service lines for water.
- B. Relocation of existing small water meters.
- C. The Technical Specifications identify requirements for both small-diameter [less than or equal to twenty inches (20 In)] water lines and large-diameter [greater than twenty inches (20 In)] water lines. When the Specifications for large-diameter water lines differ from those for small-diameter water lines, paragraphs for large-diameter water lines shall govern for large-diameter pipe.

**1.2 MEASUREMENT AND PAYMENT**

- A. Unit Prices.
  - 1. Payment for water taps and service lines three-quarters inch (3/4 In) through one inch (1 In) is on a unit price basis for each installation. Separate measurements shall be made for "short side", "long side" and "extra long side" connections as defined in Paragraph 1.4, Definitions.
  - 2. Payment for water taps and service lines one and one-half inch (1-1/2 In) through two inch (2 In) is on a unit price basis for each installation. Separate measurements shall be made for "short side", "long side" and "extra long side" connections as defined in Paragraph 1.4, Definitions.
  - 3. Payment for "short side", "long side" and "extra long side" includes locating water line, tap installation and connection to meter and restoring site.
  - 4. Payment for each small meter includes labor, materials, and equipment to relocate existing small meter.
  - 5. No additional payment shall be made for bedding, backfill, compaction, push under pavement, etc.
  - 6. Refer to Section 01270 – Measurement and Payment for unit price procedures.
- B. Stipulated Price (Lump Sum):
  - 1. If Contract is Stipulated Price Contract, payment for work in this Section is included in Total Stipulated Price.

**1.3 REFERENCES**

- A. AWWA – American Water Works Association.
  - 1. AWWA C800 – Standard for Underground Service Line Valves and Fittings.

2. AWWA C900 – Standard for Polyvinyl Chloride (PVC) Pressure Pipe, four inch (4 In) through twelve inch (12 In), for Water Distribution.
- B. CFTS – City of Friendswood Technical Specifications.

#### 1.4 DEFINITIONS

- A. Short Side Connection: Service line connecting proposed curb stop, located inside water meter box, to water line on same side of street.
- B. Long Side Connection: Service line connecting proposed curb stop, located inside water meter box, to water line on opposite side of street or from center of streets where supply line is located in street center such as boulevards and streets with esplanades. Distance for long side connection shall not exceed sixty linear feet (60 Lf) at right angles to water line.
- C. Extra-Long Side Connection: Service line connecting proposed curb stop, located inside water meter box, to water line on opposite side of street or from center of street where supply line is located in street center such as boulevards and streets with esplanades. Distance for extra-long side connection is greater than sixty linear feet (60 Lf) at right angles to water line.

## PART II: PRODUCTS

### 2.1 MATERIALS

- A. Service Lines:
  1. Copper Tubing: In accordance with Section 02205 – Copper Tubing.
  2. Polyethylene Tubing (PE): In accordance with Section 02230 – Polyethylene Plastic Tubing (PE).
  3. Polybutylene tubing is not permitted.
- B. Corporation Stops: AWWA C800 as modified in this Section:
  1. Inlet End: AWWA standard thread.
  2. Valve Body: Tapered plug type, O-ring seat ball type, or rubber seat ball type.
  3. Outlet End: Compression connection for use with Type K, soft copper or compression type fitting.
- C. Provide taps for water line types and sizes in as specified in TABLE 4.1 – PIPE TAPPING SCHEDULE in this Section.
- D. Dual Strap Saddles: Red brass body and straps; ductile-iron; vinyl-coated body and straps; or ductile-iron, vinyl-coated body and stainless-steel straps.
- E. Taps for PVC Water Lines: Use dual-strap or single, wide-band strap saddles which provide full support around circumference of pipe and bearing area of sufficient width along axis of pipe, two inches (2 In) minimum, ensuring that pipe shall not be distorted when saddle is

- tightened. Provide approved stainless-steel tapping saddle with AWWA standard thread.
- F. Taps for Steel Pipe: Not allowed.
  - G. Curb Stops and Brass Fittings: AWWA C800 as modified in this Section.
    - 1. Inlet End: Compression-type fitting
    - 2. Valve Body: Straight-through or angled, meter-stop design equipped with following:
      - a. O-ring seal straight plug type.
      - b. Rubber seat ball type.
    - 3. Outlet End: Female, iron-pipe thread or swivel-nut, meter-spud thread on three-quarters inch (3/4 In) and one inch (1 In) stops and two (2) hole flange on one and one-half inch (1-1/2 In) and two inch (2 In) sizes.
    - 4. Fittings: Provide approved fittings. Use same size open end wrenches and tapping machines as used with respective fittings.
    - 5. Factory Testing of Brass Fittings:
      - a. Submerge in water for ten seconds (10 sec) at eighty-five pounds per square inch (85 psi) with stop in both closed and open positions.
      - b. Reject fitting that shows air leakage: The Project Manager may confirm tests locally. Entire lot from which samples were taken shall be rejected when random sampling discloses unsatisfactory fittings.
  - H. Angle Stops: In accordance with AWWA C800; ground-key, stop type with bronze lockwing head stop cap; inlet and outlet threads conform to application tables of AWWA C800; and inlets flared connection or compression.
    - 1. Outlet for three-quarter inch (3/4 In) and one inch (1 In) size: Meter swivel nut with saddle support.
    - 2. Outlet for one and one-half inch (1-1/2 In) through two inch (2 In) size: O-ring sealed meter flange, iron pipe threads.
  - I. Fittings: In accordance with AWWA C800 and following:
    - 1. Castings: Smooth, free from burrs, scales, blisters, sand holes, and defects which would make them unfit for intended use.
    - 2. Nuts: Smooth cast and has symmetrical hexagonal wrench flats.
    - 3. Flare-Joint Fittings: Smooth cast. Machine seating surfaces for metal-to-metal seal to proper taper or curve, free from pits or protrusions.
    - 4. Thread fittings, of all types, shall have N.P.T. or AWWA threads, and protect male threaded ends in shipment by plastic coating, or approved equal.
    - 5. Compression tube fittings shall have Buna-N beveled gasket.
    - 6. Stamp of manufacturer's name or trademark and of fitting size shall be on the body.

### **PART III: EXECUTION**

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**3.1 GENERAL**

- A. For service lines and lateral connections larger than those allowed in Pipe Tapping Schedule, branch connections and multiple taps may be used. Space corporation stops a minimum of two feet (2 Ft) apart.
- B. Tapped collars of appropriate sizes: Approved in new construction only provided they are set at right angles to proposed meter location.
- C. Use tapping machine manufactured for pressure tapping purposes for two inch (2 In) and smaller service taps on pressurized water lines.
- D. For new meter or when existing meter is in conflict with proposed pavement improvements, locate water meters one foot (1 Ft) inside the City right-of-way, or when this is not feasible, one foot (1 Ft) on curb side of sidewalk if sufficient right-of-way is available. Contact the Project Manager when major landscaping or trees conflict with service line and meter box location. No additional payment shall be made for work on customer side of meter.
- E. New location and installation of existing small meter shall conform to requirements of this Section.

**3.2 SERVICE INSTALLATION**

- A. Set service taps at right angles to proposed meter location and locate taps in upper pipe segment within forty-five degrees (45°) of pipe springline.
- B. Install service lines in open-cut trench in accordance with Section 02125 – Excavation and Backfill for Utilities. Install service lines under paved roadways, other paved areas and areas indicated on the Drawings in bored hole.
- C. Lay service lines with minimum of thirty inches (30 In) of cover as measured from top of curb or in absence of curbs, from centerline elevation of crowned streets or roads. Provide minimum of eighteen inches (18 In) of cover below flow line of ditches to service lines.
- D. Service lines across existing street (push-unders): Pull service line through prepared hole under paving. Use only full lengths of tubing. Take care not to damage copper tubing when pulling it through hole. Compression-type union shall be permitted only when span underneath pavement cannot be accomplished with a full standard length of tubing. Use only one (1) compression-type union for each full length of tubing.
- E. Maintain service lines free of dirt and foreign matter.
- F. Install service lines so that top of meter shall be eight inches (8 In) to twelve inches (12 In) below finished grade.
- G. Anticipate existing sanitary sewers to have cement-stabilized sand backfill to bottom of pavement. Include cost of such crossings in the unit price for services.

**3.3 CURB STOP INSTALLATION**

- A. Set curb stops or angle stops at outer end of service line inside of meter box. Secure opening in curb stop to prevent unwanted material from entering. In close quarters, make S-curve in field. Do not flatten tube. In three-quarter inch (3/4 In) and one inch (1 In) services, install meter coupling, swivel-nut, or curb stop ahead of meter. Install straight meter coupling on outlet end of meter.

**3.4 SEQUENCE OF OPERATIONS**

- A. Open trench for proposed service line in accordance with Section 02125 – Excavation and Backfill for Utilities.
- B. Install curb stop on meter end of service line.
- C. With curb stop open and prior to connecting service line to meter in slack position, open corporation stop and flush service line thoroughly. Close curb stop, leaving corporation stop in full-open position.
- D. Check service line for apparent leaks. Repair leaks before proceeding.
- E. Schedule inspection with the Project Manager prior to backfilling. After inspection, backfill in accordance with Section 02125 – Excavation and Backfill for Utilities.
- F. Install meter box centered over meter with top of lid flush with finished grade. Meter box: Refer to Section 02440 – Valve Boxes, Meter Boxes, and Meter Vaults.

**PART IV: TABLES**

**TABLE 4.1 – PIPE TAPPING SCHEDULE**

PIPE TAPPING SCHEDULE				
WATERLINE TYPE AND DIAMETER	SERVICE SIZE			
	3/4"	1"	1-1/2"	2"
4" Cast Iron or Ductile Iron	DSS, WBSS	DSS, WBSS	DSS, WBSS	DSS, WBSS
4" Asbestos Cement	WBSS	WBSS	DSS, WBSS	DSS, WBSS
4" PVC (AWWA C900)	DSS, WBSS	DSS, WBSS	DSS, WBSS	DSS, WBSS
6" and 8" Cast Iron or Ductile Iron	DSS, WBSS	DSS, WBSS	DSS, WBSS	DSS, WBSS
6" and 8" Asbestos Cement	DSS, WBSS	DSS, WBSS	DSS, WBSS	DSS, WBSS
6" and 8" PVC (AWWA C900)	DSS, WBSS	DSS, WBSS	DSS, WBSS	DSS, WBSS
10" and 12" Cast Iron or Ductile Iron	DSS, WBSS	DSS, WBSS	DSS, WBSS	DSS, WBSS
10" and 12" Asbestos Cement	DSS, WBSS	DSS, WBSS	DSS, WBSS	DSS, WBSS
10" and 12" PVC (AWWA C900)	DSS, WBSS	DSS, WBSS	DSS, WBSS	DSS, WBSS
16" and UP Cast Iron and Ductile Iron	DWBSS	DWBSS	DWBSS	DWBSS
16" and UP Asbestos Cement	DWBSS	DWBSS	DWBSS	DWBSS
16" and UP PVC (AWWA C900)	DWBSS	DWBSS	DWBSS	DWBSS

DSS – DUAL STRAP SADDLES  
 WBSS – WIDE BAND STRAP SADDLES  
 DWBSS – DUAL WIDE BAND STRAP SADDLES

**END OF SECTION**

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**SECTION 02435  
FIRE HYDRANT ASSEMBLIES**

**PART I: GENERAL**

**1.1 GENERAL REQUIREMENTS**

- A. Fire hydrants.
- B. Adjustment of fire hydrants and gate valves.

**1.2 MEASUREMENT AND PAYMENT**

- A. Unit Prices:
  - 1. Payment is on a unit price basis for each fire hydrant assembly, including six inch (6 In) gate valve and box, installed regardless of barrel depth.
  - 2. Payment for fire hydrant branches (leads) is on linear foot basis for each branch installed. Separate pay items are used for open-cut and augered branches.
  - 3. No separate payment for salvaged fire hydrants returned to the City's Public Works yard.
  - 4. Refer to Section 01270 – Measurement and Payment for unit price procedures.
- B. Stipulated Price (Lump Sum):
  - 1. If Contract is Stipulated Price Contract, payment for work in this Section is included in Total Stipulated Price.

**1.3 REFERENCES**

- A. AWWA – American Water Works Association.
  - 1. AWWA C550 – Standard for Protective Epoxy Interior Coatings for Valves and Hydrants
  - 2. AWWA C502 – Standard for Dry-Barrel Fire Hydrants
  - 3. AWWA C503 – Standard for Wet-Barrel Fire Hydrants
- B. CFTS – City of Friendswood Technical Specifications.
- C. Federal Standard A-A-2962A – Enamel, Alkyd, Solvent Based Low VOC.

**1.4 SUBMITTALS**

- A. Conform to requirements of Section 01330 – Submittal Procedures.
- B. Submit name of hydrant manufacturer, type of bonnet paint and engineering control drawing number for hydrant proposed for use.

**PART II: PRODUCTS**

**2.1 HYDRANTS**

- A. Provide approved fire hydrants.
- B. The Project Manager may, at any time prior to or during installation of hydrants, randomly select furnished hydrant for disassembly and

laboratory inspection, at the Contractor expense, to verify compliance with the Specifications. When hydrant is found to be non-compliant, replace, at the Contractor's expense, all hydrants with new hydrants that comply with the Specifications.

- C. Provide lower hydrant barrel fabricated from Ductile Iron Pipe (DIP) as single piece, connected to upper hydrant barrel by means of joint coupling that shall provide three hundred sixty degree (360°) rotation of upper barrel.
- D. Fire Hydrants shall be American Flow Control B-84-B-5 or Mueller Super Centurion 250, 3 nozzle fire hydrants (2 each 2 1/2" NST and 1 each 4 1/2" NST) Factory coated RED. NO EXCEPTIONS.

## 2.2 LEADS

- A. Branches (Leads): Conform to requirements of Section 02501 – Ductile Iron Pipe (DIP) and Fittings, Section 02250 – Steel Pipe and Fittings and Section 02235 – Polyvinyl Chloride Pipe (PVC).

## 2.3 AUDITING

- A. Cycle Fire Hydrant and Valve to seals, Plugs, etc.
- B. Flow-test each hydrant in accordance with AWWA C502, AWWA C503, and AWWA Manual M17 – Installation, Field Testing and Maintenance of Fire Hydrants.
- C. Lubricate hydrant internals and connections following manufacturers' specifications for maintenance and lubrication.
- D. Top Coat Repair/Repaint hydrant as needed in accordance with 2.4 of this Specification.

## 2.4 HYDRANT PAINTING

- A. New hydrants and refurbished hydrants shall be coated as specified herein.
- B. Exterior Above Traffic Flange (Including Bolts & Nuts).
  - 1. Thoroughly clean and wash off any dirt or loose debris.
  - 2. Remove surface rust by wire brushing, sandblasting, or other approved method.
  - 3. Roughen shiny surfaces with light sanding to improve adhesion.
  - 4. Spot prime areas with one of the following spray primers:
    - a. Rust-Oleum brand Clean Metal Primer;
    - b. Rust-Oleum brand Profession Primer;
    - c. Rust-Oleum brand Rusty Metal Primer;
    - d. Rust-Oleum brand Rust Reformer Rust Converting Primer; or
    - e. Krylon brand Rust Tough Rust Fix Converting Primers
    - f. Primer color shall be Gray.
  - 5. After recommended drying time for the Primer, the top coat shall be as follows:
    - a. Hydrant Barrels – All hydrant barrels shall be painted

- using Sherwin-Williams Polane SP Polyurethane Enamel Paint. Total dry film thickness (DFT) of two (2) mils to three (3) mils. Barrel color shall be: RED.
- b. Bonnet – All hydrant bonnets shall be painted using Sherwin-Williams Polane SP Polyurethane Enamel Paint. Total dry film thickness (DFT) of two (2) mils to three (3) mils. Bonnet color shall be: SILVER

## **PART III: EXECUTION**

### **3.1 INSTALLATION**

- A. Set fire hydrant plumb and brace at locations and grades as shown on the Drawings.
- B. Place twelve inch by twelve inch (12 In x 12 In) yellow indicators (plastic, sheet metal, plywood or other material approved by the Project Manager) on pumper nozzles of new or relocated fire hydrants installed on new water lines not in service. Remove indicators after new water line is tested and approved by the Project Manager.
- C. Do not cover drain ports when placing concrete thrust block.
- D. Place pea gravel from top of pipe to six inches (6) above barrel connection as shown in the City of Friendswood Standard Details.
- E. Obtain the Project Manager's approval in writing prior to installation of hydrants which require changes in bury depth due to obstructions not shown on the Drawings. Unit price adjustments shall not be allowed for changes in water line flow line or fire hydrant barrel length caused by obstructions.
- F. Plug branch lines to valves and fire hydrants shown on the Drawings to be removed. Deliver fire hydrants designated for salvage to Public Works Facility.
- G. Install branches (leads) in accordance with Section 02400 – Water Lines.
- H. Coating Requirements:
1. Shall be Sherwin-Williams Polane SP Polyurethane Enamel Paint. NO EXCEPTIONS.
  2. Apply coatings in strict accordance with manufacturer's recommendations. No requirements of this Technical Specification shall cancel or supersede written directions and recommendations of the specific manufacturer so as to not jeopardize the integrity of an applied system.
  3. Furnish affidavit of compliance that coatings furnished complies with requirements of this Technical Specification and referenced standards, as applicable.
- I. Remove and dispose of unsuitable materials and debris in accordance with requirements of Section 01580 – Waste Material Disposal.

**END OF SECTION**

**SECTION 02440  
VALVE BOXES, METER BOXES AND METER VAULTS**

**PART I: GENERAL**

**1.1 GENERAL REQUIREMENTS**

- A. Valve boxes for water service.
- B. Meter boxes for water service.
- C. Meter vaults for water service.

**1.2 MEASUREMENT AND PAYMENT**

- A. Unit Prices:
  - 1. No separate payment shall be made for valve boxes under this Section. Include payment in the unit price for Section 02400 – Water Lines.
  - 2. No separate payment shall be made for meter boxes under this Section. Include payment in the unit price for Section 02430 – Water Tap and Service Line Installation.
  - 3. Payment for each size of meter vaults is on the unit price basis per vault. Payment shall be made for each vault installed, regardless of depth.
  - 4. Refer to Section 01270 – Measurement and Payment for unit price procedures.
- B. Stipulated Price (Lump Sum):
  - 1. If Contract is Stipulated Price Contract, payment for work in this Section is included in Total Stipulated Price.

**1.3 REFERENCES**

- A. ASTM – American Society for Testing and Materials.
  - 1. ASTM A48 – Standard Specification for Gray Iron Castings.
  - 2. ASTM D256 – Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
  - 3. ASTM D638 – Standard Test Method for Tensile Properties of Plastics.
  - 4. ASTM D648 – Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.
  - 5. ASTM D790 – Standard Test Methods for Flexural Properties of Un-reinforced and Reinforced Plastics and Electrical Insulating Materials.
  - 6. ASTM D2240 – Standard Test Method for Rubber Property-Durometer Hardness.
- B. CFTS – City of Friendswood Technical Specifications

**1.4 SUBMITTALS**

- A. Conform to requirements of Section 01330 – Submittal Procedures.

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- B. Submit manufacturers' product data for following items for approval:
  - 1. Each type of valve box and lid.
  - 2. Each type of meter box and cover.
  - 3. Each type of meter vault frame and cover.
- C. Submit design calculations and shop drawings for precast vault elements, sealed by a Professional Engineer licensed by the State of Texas.
- D. Submit shop drawings for cast-in-place meter vaults for approval if proposed construction varies from the Drawings.
- E. Submit manufacturer's certification that plastic meter boxes meet requirements of Paragraph 2.5, Plastic Meter Boxes.

## **PART II: PRODUCTS**

### **2.1 VALVE BOXES**

- A. Provide approved Type A, cast-iron/ductile-iron, slide-type, valve boxes. Design of valve box shall minimize stresses on valve imposed by loads on box lid.
- B. Cast letter "W" into lid, one-half inch (1/2 In) in height and raised three-thirty-seconds inch (3/32 In), for valves serving potable water lines.
- C. Unless otherwise specified, constructed of uncoated cast iron.
- D. Riser Pipe:
  - 1. Provide six inch (6 In) PVC, Class 150, DR 18, riser pipes in accordance with Section 02235 – Polyvinyl Chloride Pipe (PVC) or
  - 2. Six inch (6 In) ductile-iron, thickness Class 51 riser pipes in accordance with Section 02215 – Ductile Iron Pipe (DIP) and Fittings.
  - 3. Provide single section of pipe.
- E. Concrete for valve box placement:
  - 1. For locations in new concrete pavement, provide strength and mix design of new pavement.
  - 2. For other locations, provide concrete for sidewalks conforming to requirements of Section 02805 – Concrete Paving.
- F. Valve box lids are to be painted blue.

### **2.2 METER BOXES**

- A. Provide meter boxes for five-eighths inch (5/8 In) through one inch (1 In) meters of the following materials:
  - 1. Non-traffic bearing locations: Cast iron, concrete or plastic.
  - 2. Traffic bearing locations: Cast iron or concrete.
- B. Provide meter boxes for one and one-half inch (1-1/2 In) and two inch (2 In) meters of concrete.
- C. Provide meter box with reading lid: Provide lids with spring-type latching devices. Lids shall contain sufficient metal that meter box can be easily

located with metal detector. Cast words "CITY OF FRIENDSWOOD" and "WATER METER" into lid with letters of one-half inch (1/2 In) height and raised three-thirty-seconds inch (3/32 In).

- D. Meter box dimensions shall conform to the following approximate dimensions:
  - 1. Length: At top – fifteen and one-half inches (15-1/2 In); at bottom twenty inches (20 In).
  - 2. Width: At top – twelve and one-half inches (12-1/2 In); at bottom fourteen and three-quarters inches (14-3/4 In).
  - 3. Height: Twelve inches (12 In).
- E. Extensions: Meter box extensions three (3 In) inches and six inches (6 In) in height shall be available from the manufacturer as a standard item.

### 2.3 CAST-IRON METER BOXES

- A. Cast-Iron Boxes: Clean and free from sand blow-holes or other defects conforming to requirements of ASTM A48, Class 30B. Bearing surfaces shall be machined so that covers seat evenly in frames.
- B. Boxes and lids shall have dipped, coal-tar-pitch, varnish finish.
- C. Provide lock-type meter boxes when required by the Drawings. Lock mechanisms shall work with ease.

### 2.4 CONCRETE METER BOXES

- A. Concrete Meter Boxes: Made of Class B concrete, with minimum four thousand pounds per square inch (4000 psi) compressive strength, conforming to requirements of Section 03300 – Structural Concrete. Construct to dimensions shown on the Drawings.
- B. Castings: Free from fractures, large or deep cracks, blisters or surface roughness or any other defects that may affect serviceability.

### 2.5 PLASTIC METER BOXES

- A. Plastic Meter Boxes: Made of high density polyethylene conforming to the following ASTM standards:
  - 1. ASTM REQUIREMENT:
    - a. D256 Impact Strength = One and nine-tenths foot-pounds per inch (1.9 Ft-Lb/In) (Izod, Notched).
    - b. D256 Impact Strength = Six and four-tenths foot-pounds per inch (6.4 Ft-Lb/In) (Izod, Un-Notched).
    - c. D638 Tensile Strength (2.0 min.) = Three thousand four hundred pounds per square inch (3400 psi).
    - d. D648 Deflection Temperature = One hundred seventy degrees Fahrenheit (170° F).
    - e. D2240 Shore D, Hardness, fifty-five (55) to sixty-five (65) Impact Strength, Falling Dart Method: One hundred sixty inch-pounds (160 In-Lb).
    - f. D790 Flexural Modulus = Ninety thousand pounds per square inch (90,000 psi).

- B. Meter boxes shall meet the following test requirements:
  - 1. Static Load: Not less than two thousand five hundred pounds (2500 psi) using six inch (6 In) disc with direct compression exerted at center of top of meter box with solid plastic lid.
  - 2. Deflection: Not less than one thousand pounds (1000 Lbs) load required to deflect top edge of meter box one-eighth inch (1/8 In).
- C. Meter box body, without lid, shall weigh approximately seven pounds (7 Lbs).

## 2.6 METER VAULTS

- A. Meter vaults may be constructed of precast concrete or cast-in-place concrete unless a specific type of construction is required by the Drawings.
- B. Concrete for Meter Vaults: Class B concrete, conforming to requirements of Section 03300 – Structural Concrete with minimum compressive strength of four thousand pounds per square inch (4000 psi) at twenty-eight days (28 D).
- C. Reinforcing steel for meter vaults: Conform to requirements of Section 03200 – Reinforcing Steel.
- D. Grates and Covers: Conform to requirements of Section 02315 – Frames, Grates, Rings and Covers.

## PART III: EXECUTION

### 3.1 EXAMINATION

- A. Obtain approval from the Project Manager for exact location of meter vault.
- B. Verify lines and grade are correct.
- C. Verify compacted subgrade shall support loads imposed by vaults.
- D. At no time shall a valve box, meter box or meter vault be installed in a driveway, sidewalk or wheelchair ramp.

### 3.2 VALVE BOXES

- A. Install riser pipe with suitable length for depth of cover indicated on the Drawings or to accommodate actual finish grade.
  - 1. Install with bell on top of valve.
  - 2. Place riser pipe in plumb, vertical position.
- B. Install valve box and riser piping plumbed in a vertical position. Provide six inches (6 In) telescoping freeboard space between riser pipe top butt end and interior contact flange of valve box, for vertical movement damping. End of riser pipe resting on valve shall be notched out sufficiently to provide a snug fit around the valve bonnet and to center valve inside of pipe.
- C. Set, align and adjust valve box so that lid is level with final grade.

- D. Install twenty-four inch by twenty-four inch (24 In x 24 In) concrete valve collar using Class A concrete, conforming to requirements of Section 03300 – Structural Concrete with minimum compressive strength of three thousand pounds per square inch (3000 psi) at twenty-eight days (28 D).
- E. Paint covers of new valve boxes in blue when installed for completion and acceptance by the City.

### 3.3 METER BOXES

- A. Install cast iron or plastic boxes in accordance with manufacturer's instructions.
- B. Construct concrete meter boxes to dimensions shown on the Drawings.
- C. Adjust top of meter boxes to conform to cover elevations specified in Paragraph 3.5, Frame and Cover for Meter Vaults.
- D. Do not locate under paved areas unless approved by the Project Manager. Use approved traffic type box with cast iron lid when meter must be located in paved areas.
- E. Locate Meter Boxes in the City right-of-way, perpendicular to the centerline of the roadway.

### 3.4 METER VAULTS

- A. Construct concrete meter vaults to dimensions shown on the Drawings. Do not cast in presence of water. Make bottom uniform. Verify lines and grades are correct and compacted subgrade shall support loads imposed by vaults.
- B. Precast Meter Vaults:
  - 1. Install precast vaults in accordance with the manufacturer's recommendations. Set level on a minimum three inch (3 In) thick bed of sand conforming to requirements of Section 02140 – Utility Backfill Materials.
  - 2. Seal lifting holes with cement-sand mortar or non-shrink grout.
- C. Meter Vault Floor Slab:
  - 1. Construct floor slabs of six inch (6 In) thick reinforced concrete. Slope floor one-quarter inch per foot (1/4 in/ft) toward sump. Make sump twelve inches (12 In) in diameter or twelve inches (12 In) square and four inches (4 In) deep, unless other dimensions are required by the Drawings. Install dowels at maximum of eighteen inches (18 In), center-to-center for keying walls to floor slab.
  - 2. Precast floor slab elements may be used for precast vault construction
- D. Cast-in-Place Meter Vault Walls:
  - 1. Key walls to floor slab and form to dimensions shown on the Drawings. Minimum wall thickness shall be four inches (4 In).
  - 2. Cast walls monolithically: One (1) cold joint shall be allowed when vault depth exceeds twelve feet (12 ft).
  - 3. Set frame for cover in concrete.

**3.5 FRAME AND COVER FOR METER VAULTS**

- A. Set cast iron frame in a mortar bed and adjust elevation of cover as follows:
1. In unpaved areas, set top of meter box or meter vault cover two inches (2 In) to three inches (3 In) above natural grade.
  2. In paved areas, set top of meter box or meter vault cover flush with adjacent concrete but no higher than one-half inch (1/2 In).

**3.6 BACKFILL**

- A. Provide bank run sand in accordance with Section 02140 – Utility Backfill Materials and backfill and compact in accordance with Section 02125 – Excavation and Backfill for Utilities.
- B. In unpaved areas, slope backfill around meter boxes and vaults to provide a uniform slope one to five (1:5) slope from top to natural grade.
- C. In paved areas, slope concrete down from meter box or vault to meet adjacent paved area.

**END OF SECTION**

**SECTION 02445  
CUT, PLUG AND ABANDONMENT OF WATERLINES**

**PART I: GENERAL**

**1.1 GENERAL REQUIREMENTS**

- A. Cut, plug and abandonment of water lines.

**1.2 MEASUREMENT AND PAYMENT**

A. Unit Prices:

1. Payment for cut, plug and abandonment of water lines is on a unit price basis for each cut, plug and abandonment performed. Separate payment shall be made for each size of water line.
2. Refer to Section 01270 – Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum):

1. If Contract is Stipulated Price Contract, payment for work in this Section is included in Total Stipulated Price.

**1.3 SUBMITTALS**

- A. Conform to requirements of Section 01330 – Submittal Procedures.  
B. Submit product data for proposed plugs and clamps for approval.

**1.4 REFERENCES**

- A. CFTS – City of Friendswood Technical Specifications.

**PART II: PRODUCTS**

**2.1 MATERIALS**

- A. Concrete for reaction blocks: Class C conforming to requirements of Section 03300 – Structural Concrete.  
B. Plugs and clamps: Applicable for type of pipe to be plugged.

**PART III: EXECUTION**

**3.1 APPLICATION**

- A. Do not begin cut, plug and abandonment operations until replacement water line has been constructed, disinfected, tested and service lines have been transferred to replacement water line.  
B. Install plug, clamp and concrete reaction block and make cut at location shown on the Drawings.  
C. Main to be abandoned shall not be valved off and shall not be cut or plugged other than at its supply water line or as shown on the Drawings.  
D. After water line to be abandoned has been cut and plugged, check for other sources feeding abandoned water line. When sources are found,

notify the Project Manager immediately. Cut and plug abandoned water line at point of other feed as directed by the Project Manager.

- E. Plug or cap ends or openings in abandoned water line in manner approved by the Project Manager.
- F. Remove and dispose of surface identifications such as valve boxes and fire hydrants. Valve boxes in improved streets, other than shell, may be filled with concrete after removing cap.
- G. Backfill excavations in accordance with Section 02125 – Excavation and Backfill for Utilities.
- H. Repair street surfaces in accordance with Section 02845 – Pavement Repair and Resurfacing.

**END OF SECTION**

**SECTION 02450  
HYDROSTATIC TESTING OF WATERLINES**

**PART I: GENERAL**

**1.1 GENERAL REQUIREMENTS**

- A. Field hydrostatic testing of newly installed water waterlines.

**1.2 MEASUREMENT AND PAYMENT**

A. Unit Prices:

1. No separate payment shall be made for hydrostatic testing of waterlines under this Section. Include cost in the unit price of waterlines being tested.
2. Refer to Section 01270 – Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum):

1. If Contract is Stipulated Price Contract, payment for work in this Section is included in Total Stipulated Price.

**1.3 REFERENCES**

- A. CFTS – City of Friendswood Technical Specifications.

**PART II: PRODUCTS – NOT USED**

**PART III: EXECUTION**

**3.1 PROCEDURE**

- A. Load the waterlines.
- B. Hydrostatically Test waterlines.
- C. If granular/tablet chlorine was not installed during the installation, then charge the line with either chlorine solution or chlorine gas and hold the super-chlorinated water in system for twenty-four (24) hours.
- D. Flush waterlines until the chlorine content meets Technical Specification 02455 – Disinfection of Waterlines section 3.3.A.4.

**3.2 PREPARATION**

- B. Charge the system via a water truck or equipment separate from the City water distribution system. Water for testing shall be at no cost to the Contractor in accordance with the City Ordinances. To obtain the water, the Contractor must obtain a transient meter from the City for use at a nearby fire hydrant. A deposit is required for a transient meter.
- C. Plan waterline tests in lengths between valves or plugs, of not more than

four thousand feet (4000 Ft).

- D. Hydrostatic tests must be scheduled at least twenty-four (24) hours in advance for the Project Manager to witness.

### 3.3 TEST PROCEDURES

- A. Furnish, install, and operate connections, pump, meter, and gages necessary for hydrostatic testing.
- B. Allow pipeline to sit a minimum of twenty-four hours (24 Hrs) from time it is initially charged until testing begins, to allow pipe wall or lining material to absorb water. Periods of up to seven days (7 D) may be required for mortar lining to become saturated.
- C. Expel air from all waterlines and apply a minimum test pressure of one hundred fifty pounds per square inch (150 psi) for a minimum of four hours (4 Hrs).
  - 1. Fire line Testing is required to be two hundred pounds per square inch (200 psi) for a minimum of two hours (2 Hrs).
- D. Begin pressure test by 9:00 a.m. unless otherwise approved by the Project Manager. Maintain test pressure for required amount of time. When large quantity of water is required to maintain pressure during test, discontinue testing until cause of water loss is identified and corrected.
  - 1. At no time shall a hydrostatic test start after 1:00 P.M.
- E. Keep valves inside pressure reducing stations closed during hydrostatic pressure test.

### 3.4 ALLOWABLE LEAKAGE FOR WATERLINES

- A. During hydrostatic tests, no leakage shall be allowed for sections of water lines consisting of welded joints.
- B. Maximum allowable leakage for water lines with rubber gasketed joints: Three and nineteen-hundredths gallons (3.19 Gal) per inch nominal diameter per mile of pipe per twenty-four hours (24 Hrs) while testing.
  - 1. The following formula shall be used, either manually or electronically, for the amount of leakage:

$$L = \frac{NDP^2}{7400}$$

where: L = Allowable leakage, gallons per hour (Gal/Hr)  
N = Number of joints in the length of the pipe  
D = Nominal diameter of the pipe, in inches (In)  
P = Average test pressure during the leakage test, pounds per square inch (psi)

- C. For meter run installation, when work cannot be isolated and line fails pressure test, visual inspection of work by the Project Manager for leakage during pressure test may be used to fulfill requirements of this Section.

**3.5 CORRECTION FOR FAILED TESTS**

- A. Repair joints showing visible leaks on surface regardless of total leakage shown on test. Check valves and fittings to ensure that no leakage occurs that could affect or invalidate test. Remove cracked or defective pipes, fittings and valves discovered during pressure test and replace with new items.
- B. The Project Manager shall require failed lines to be disinfected after repair and prior to retesting. Conduct and pay for subsequent disinfection operations in accordance with requirements of Section 02455 – Disinfection of Waterlines. Pay for water required for additional disinfection and retesting.
- C. After the second (2nd) failed test;
  - 1. For City Projects, the Project Manager shall deduct the amounts of money from the Contract as stated in Section 01140 – Work Restrictions for each additional test taken.
  - 2. For Private Development, the Contractor shall pay the City the amount stated in Section 01140 – Work Restrictions for each additional test, before the test is taken.
- C. Repeat test until satisfactory results are obtained.

**3.6 COMPLETION**

- A. Upon satisfactory completion of testing, remove risers remaining from disinfection and hydrostatic testing and backfill excavation promptly.

**END OF SECTION**

**SECTION 02455  
DISINFECTION OF WATERLINES**

**PART I: GENERAL**

**1.1 GENERAL REQUIREMENTS**

- A. Disinfection of potable water lines.

**1.2 MEASUREMENT AND PAYMENT**

A. Unit Prices:

1. No separate payment shall be made for disinfection of water lines under this Section. Include cost in the unit price of water lines being disinfected.
2. Refer to Section 01270 – Measurement and Payment for unit price procedures.

B. Payment for Testing and Retesting.

1. Subsequent disinfection operations which may be necessary due to nonconforming or incomplete construction shall be charged to the Contractor for each additional Bacterial Test.
2. Charge shall consist of base charge of eighteen dollars (\$18.00) per sample.

C. Stipulated Price (Lump Sum):

1. If Contract is Stipulated Price Contract, payment for work in this Section is included in Total Stipulated Price.

**1.3 REFERENCES**

A. AWWA – American Water Works Association.

1. AWWA B300 – Hypochlorites.
2. AWWA B301 – Standard for Disinfecting Water Mains.
3. AWWA C651 – Standard for Disinfecting Water Mains.

B. CFTS – City of Friendswood Technical Specifications.

C. TCEQ – Texas Commission on Environmental Quality

1. TCEQ – Approved Disinfection Methods and Products.

**PART II: PRODUCTS**

- A. Liquid Chlorine (gas) conforming to AWWA B301.

- B. Sodium Hypochlorite conforming to AWWA B300.

- C. Calcium Hypochlorite conforming to AWWA B300.

**PART III: EXECUTION**

**02455-1**

**3.1 CONDUCTING DISINFECTION**

- A. Promptly disinfect water lines constructed before bacteriological tests are conducted on water lines and before water lines are connected to the City water distribution system.
- B. Water for disinfection and flushing shall be furnished by the City without charge.
- C. Unless otherwise provided in the Contract Documents, the Contractor shall be responsible for disinfection of water lines.
- D. Coordinate chlorination operations through the Project Manager. A minimum of forty-eight hours (48 Hrs.) notice shall be given.

**3.2 PREPARATION**

- A. Provide temporary blind flanges, cast-iron sleeves, plugs, necessary service taps, copper service leads, risers and jumpers of sizes, location and materials and other items needed to facilitate disinfection of new water lines prior to connection to the City water distribution system. Normally, each valved section of water line requires two (2) each three-quarter inch (3/4 In) taps. A two inch (2 In) minimum blow-off is required for water lines up to and including six inch (6 In) diameter.
- B. Use fire hydrants as blow-offs to flush newly constructed water lines eight inch (8 In) diameters and above. Where fire hydrants are not available on newly constructed water lines, install temporary blow-off valves within ten feet (10 Ft.) of charging end and any dead end, and remove promptly upon successful completion of disinfection and testing.
- C. Slowly fill each section of pipe with water in manner approved by the Project Manager.
  - 1. For lines chlorinated with calcium hypochlorite (granular or tablet form) the average water velocity when filling pipeline should be less than one foot per second (1 ft./sec) and shall not, under any circumstance, exceed two feet per second (2 ft./sec). Before beginning disinfection operations, expel air from pipeline.
  - 2. For lines chlorinated with either Liquid chlorine or sodium hypochlorite the average water velocity when filling pipeline should be less than three foot per second (3 ft./sec) as shown in Table 4.3 – Flow Rates and Openings. Where such flow rates are not possible, flushing the maximum expected flow rate for two to three (2-3) volumes of waterline may be acceptable. Before beginning disinfection operations, expel air from pipeline.
- D. Backfill excavations immediately after installation of risers or blow-offs.
- E. Install blow-off valves at end of water line to facilitate flushing of dead-end water lines. Install permanent blow-off valves according to the Drawings.

**3.3 DISINFECTION BY THE CONTRACTOR**

- A. The following procedure shall be used when disinfection by the Contractor is required by the Contract Documents:

**02455-2**

1. Use not less than one hundred parts of chlorine (100 CL) per million parts of water (1,000,000 H<sub>2</sub>O).
2. Introduce chlorinating material to water lines in accordance with AWWA B300, AWWA B301, and AWWA C651. When using chlorine gas or sodium hypochlorite, chemicals shall be introduced into system at a point no farther than ten feet (10 Ft.) downstream of the beginning of the new water main. Calcium Hypochlorite materials shall be used in the quantities listed in Table 4.1 – Calcium Hypochlorite Granules Installation and Table 4.2 – Calcium Hypochlorite Tablets Installation.
3. After line has been charged with water, a chlorine test shall be taken and must be a minimum twenty-five parts free chlorine (25.0 CL) per million parts of water (1,000,000 H<sub>2</sub>O) or greater for disinfection. After this level has been achieved, water shall stay in contact for a minimum of twenty-four hours (24 Hrs.). During this period all valves and fire hydrants shall be fully open and closed at least twice; once at the beginning and once at the end of the twenty-four hour (24 Hr.) period.
4. After contact period of twenty-four hours (24 Hrs.) a free chlorine residual test shall be taken and shall not be less than:
  - a. two-tenths parts free chlorine (0.2 CL) per million parts of water (1,000,000 H<sub>2</sub>O) for calcium hypochlorite. If the residual is less than two-tenths parts free chlorine (0.2 CL) per million parts of water (1,000,000 H<sub>2</sub>O), then re-chlorinate the system starting over from 3.3.A.1; or
  - b. ten parts free chlorine (10.0 CL) per million parts of water (1,000,000 H<sub>2</sub>O) for calcium hypochlorite. If the residual is less than ten parts free chlorine (10.0 CL) per million parts of water (1,000,000 H<sub>2</sub>O), then re-chlorinate the system starting over from 3.3.A.1; and
  - c. if the residual passes then flush system with clean water using Fire Hydrants and approved blow-offs until chlorine is no less than two-tenths part of free chlorine (0.2 CL) per million parts of water (1,000,000 H<sub>2</sub>O) or five-tenths part of total chlorine (0.5 CL) per million parts of water (1,000,000 H<sub>2</sub>O) and not greater than three and nine-tenths parts free or total chlorine (3.9 CL) per million parts of water (1,000,000 H<sub>2</sub>O).
5. Flush duration shall be until the furthest flushing outlet from the City water supply reaches the conditions of 3.3.A.4 and Table 4.3 – Flow Rates and Openings.
6. Open and close valves in lines being sterilized several times during contact period.
7. If chemical compound is used for sterilizing agent, place in pipes as directed by the Project Manager.

**3.4 BACTERIOLOGICAL TESTING**

- A. All Bacteriological Testing shall be in accordance with Technical Specification 02465 – Procedure For Sampling Bacteriological Tests (BAC-T).

**PART IV: TABLES**

**4.1 Calcium Hypochlorite Granules Installation:**

- A. Weight of calcium hypochlorite granules to be placed at the beginning of the main and at each 500 foot interval.

Pipe Diameter	Calcium Hypochlorite Granules
4"	1.7 oz.
6"	3.8 oz.
8"	6.7 oz.
10"	10.5 oz.
12"	1.5 oz.
14" and larger	D <sup>2</sup> x 1.5 oz.
Where D is the inside pipe diameter in feet, D= d/12.	

**4.2 Calcium Hypochlorite Tablets Installation:**

- A. Number of 5 gram calcium hypochlorite tablets requires for dose of 25 ppm based on 3.25 grams available chlorine per tablet.

Pipe Diameter	Number of 5 gram tablets per length of pipe				
	13' length or less	18' length	20' length	30' length	40' length
4"	1	1	1	1	1
6"	1	1	1	2	2
8"	1	2	2	3	4
10"	2	3	3	4	5
12"	3	4	4	6	7
16"	4	6	7	10	11

4.3 Flow Rates and Openings:

A. Required flow rates and openings to flush pipelines at 3.0 ft. /sec.

Number of 5 gram tablets per length of pipe						
Pipe Diameter	Velocity in (gpm)	Size of taps used / number taps required			Number of Hydrant Outlets	
		1"	1 ½"	2"	2 ½"	4 ½"
4"	120	1	–	–	1	1
6"	260	–	1	–	1	1
8"	470	–	2	–	1	1
10"	730	–	3	2	1	1
12"	1,060	–	–	3	2	1
16"	1,880	–	–	5	3	1

END OF SECTION

**SECTION 02460  
WET CONNECTIONS**

**PART I: GENERAL**

**1.1 GENERAL REQUIREMENTS**

- A. Wet connections for new water lines and service lines to existing water lines.

**1.2 MEASUREMENT AND PAYMENT**

- A. Unit Prices:
  - 1. Payment for wet connections shown on the Drawings is on a unit price basis for each wet connection. Separate payment shall be made for each size of water line.
  - 2. No compensation shall be given for extra work or for damages occurring as result of incomplete shutoff.
  - 3. Refer to Section 01270 – Measurement and Payment for unit price procedures.
- B. Stipulated Price (Lump Sum).
  - 1. If Contract is Stipulated Price Contract, payment for work in this Section is included in Total Stipulated Price.

**1.3 REFERENCES**

- A. AWWA – American Water Works Association.
  - 1. AWWA C800 – Standard for Underground Service Line Valves and Fittings.
- B. CFTS – City of Friendswood Technical Specifications.

**1.4 DEFINITIONS**

- A. Wet connections consist of isolating sections of pipe to be connected with existing valves, draining isolated sections and completing connections.
- B. Connection of two inch (2 In) or smaller lines, which may be referred to on the Drawings as "two inch (2 In) standard connections" or "gooseneck connections" shall be measured as two inch (2 In) wet connections. This item is not to be used as part of two (2) inch service line.

**PART II: PRODUCTS**

**2.1 MATERIALS**

- A. Pipe shall conform to requirements of applicable portions of Sections 02200 through 02285 related to piping materials and to water distribution.
- B. Corporation cocks and saddles shall conform to requirements of Section 02430 – Water Tap and Service Line Installation.
- C. Valves shall conform to requirements of Section 02410 – Gate Valves.

- D. Brass fittings shall conform to requirements of AWWA C800.

### **PART III: EXECUTION**

#### **3.1 CONNECTION OPERATIONS**

- A. Plan wet connections in manner and at hours with least inconvenience public. Notify the Project Manager at least seventy-two hours (72 Hrs) in advance of making connections.
- B. Do not operate valves on water lines in use by the City. The City of Friendswood Public Works Department shall handle, at no cost to the Contractor, operations involving opening and closing valves for wet connections.
- C. Conduct connection operations when the Project Manager is at job site. Connection work shall progress without interruption until complete once existing water lines have been cut or plugs have been removed for making connections.

#### **3.2 TWO INCH (2 IN) WET CONNECTIONS**

- A. Tap water line: Use corporation cocks, saddles, copper tubing as required for line and grade adjustment and brass fittings necessary to adapt to existing water line. Use two inch (2 In) valves when indicated on the Drawings for two inch (2 In) copper gooseneck connections.

**END OF SECTION**

**SECTION 02465  
PROCEDURE FOR SAMPLING BACTERIOLOGICAL TESTS  
(BAC-T)**

**PART I: GENERAL**

**1.1 GENERAL REQUIREMENTS**

- A. No water lines shall be opened to the existing City utilities until all bacteriological testing of those lines have passed.

**1.2 MEASUREMENT AND PAYMENT**

A. Unit Prices:

1. No separate payment shall be made for Bacteriological Testing of water lines under this Section. Include cost in the unit price of water lines being tested.
2. Refer to Section 01270 – Measurement and Payment for unit price procedures.

B. Payment for Testing and Retesting.

1. Subsequent disinfection operations which may be necessary due to nonconforming or incomplete construction shall be charged to the Contractor for each additional Bacteriological Test.
2. If the City is taking the samples, the charge shall consist of base charge of eighteen dollars (\$18.00) per sample. Note that each testing location will have two (2) samples therefore it is thirty-six dollars (\$36.00) per testing location. Checks are to be made payable to Eastex Environmental.

C. Stipulated Price (Lump Sum):

If Contract is Stipulated Price Contract, payment for work in this Section is included in Total Stipulated Price.

**1.3 REFERENCES**

- A. AWWA – American Water Works Association.  
AWWA C651 – Standard for Disinfecting Water Mains.
- B. CFTS – City of Friendswood Technical Specifications.
- C. TCEQ – Texas Commission on Environmental Quality  
TCEQ – Approved Disinfection Methods and Products.

**PART II: PRODUCTS – NOT USED**

**PART III: EXECUTION**

- 3.1 UNDER NO CIRCUMSTANCES SHALL ANY PERSON, OTHER THAN AUTHORIZED CITY PERSONNEL, OPEN OR OPERATE ANY VALVE THAT

IS CONNECTED TO AN EXISTING CITY SERVICE MAIN, BE IT A TAPPING SLEEVE AND VALVE (TS&V) MADE BY THE CONTRACTOR OR AN EXISTING STUB OUT.

### 3.2 CONDUCTING DISINFECTION

- A. Promptly disinfect water lines constructed before tests are conducted on water lines and before water lines are connected to the City water distribution system.
- B. Water for disinfection and flushing shall be furnished by the City without charge for the first two (2) sets of tests. If additional testing is needed, please refer to Section 3.4.E.
- C. Unless otherwise provided in the Contract Documents, the Contractor shall be responsible for disinfection of water lines.
- D. Coordinate chlorination operations through the Project Manager. A minimum of forty-eight hours (48 Hrs) notice shall be given.
- E. Chlorination procedures for new lines shall be performed in accordance with City of Friendswood Technical Specification 02455 – Disinfection of Waterlines.

### 3.3 SAMPLING STATIONS

- A. Provide all necessary materials for Sampling Stations.
- B. A testing station shall be two inch (2 In) minimum service lead or a one inch (1 In) meter service with a half inch (1/2 In) Hose Bib.
- C. Location Requirements:
  - 1. One (1) Sampling Station is required for every One Thousand Two Hundred Feet (1,200 Ft) of waterline.
  - 2. One (1) Sampling Station is required at the end of the line.
  - 3. One (1) Sampling Station is required at every branch of the line longer than one (1) joint of pipe (20 feet).
- D. Use of Fire Hydrants for Sampling of Bacteriological Tests shall not be allowed.
- E. Service lead with a hose bib connection shall be allowable.

### 3.4 PROCEDURE FOR SAMPLE TAKING

- A. After disinfection and flushing of water lines, Bacteriological Tests shall be performed by the City at 10:00 A.M. Tuesdays and Thursdays. The Project Manager shall need to be informed of prospective testing forty-eight hours (48 Hrs.) before these times, no exceptions.
- B. Only authorized City Personnel shall operate the valves that attach the waterline being tested to the existing City Infrastructure, NO EXCEPTIONS.
- C. The following procedure shall be used when sampling waterlines for Bacteriological Testing (BAC-T):
  - 1. All water lines shall have been disinfected in accordance with City of Friendswood Specification 02455 – Disinfection of Waterlines.

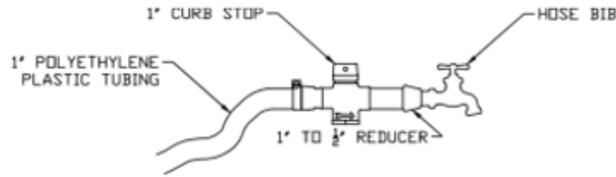
2. All water lines shall have been hydrostatically tested in accordance with City of Friendswood Specification 02450 – Hydrostatic Testing of Waterlines.
  3. Waterlines shall have been flushed fully flushing chlorinated water from the waterline until normal residual chlorine is obtained at the end of the waterline.
  4. Project Manager and Contractor identify and label the sampling locations.
  5. If the Contractor is using another TCEQ accredited laboratory in lieu of the City’s Laboratory, an authorized representative shall be onsite for chain of custody verification and witnessed by the Project Manager.
  6. Test samples shall be taken in a sterile bottle treated with sodium thiosulfate, labeled for the location, and listed as “Construction Sample.”
  7. Before opening the sampling location, coat with a disinfection solution of sodium hypochlorite from a spray bottle on the inside and outside of the hose bib. If the sampling is reused for other locations, then each time the whole testing apparatus shall be disinfected inside and outside, before being reattached for sampling. Collector shall wear sterile gloves and block all possible wind.
  8. Waterline is to sit for a minimum of sixteen hours (16 Hrs.) prior to samples being taken without flushing or in any way flowing the water in the line.
  9. There shall be two (2) tests taken at each location. Collect one (1) sample at the location as soon as the hose bib is opened, and collect the second sample after fifteen minutes (15 Mins.) of the hose bib running.
  10. Test results should be available within three days (3 Dys.) and shall be in written form only for acceptance. Verbal approval or disapproval is non-binding for testing purposes.
  11. Any one (1) test that fails is a fail of all tests being taken, and the waterline that the tests represent.
- D. After two (2) failed sets of tests, the line shall be re-chlorinated and flushed before any further tests can be taken. The Contractor shall be responsible for additional disinfection of water lines based upon Texas Commission on Environmental Quality (TCEQ) requirements.
- E. After two (2) failed samples, the **cost of multiple re-testing will be charged at \$750.00 dollars per flushing point for water usage and \$475.00 for labor costs per set for each additional set of Bacteriological Tests taken.**

### 3.5 COMPLETION

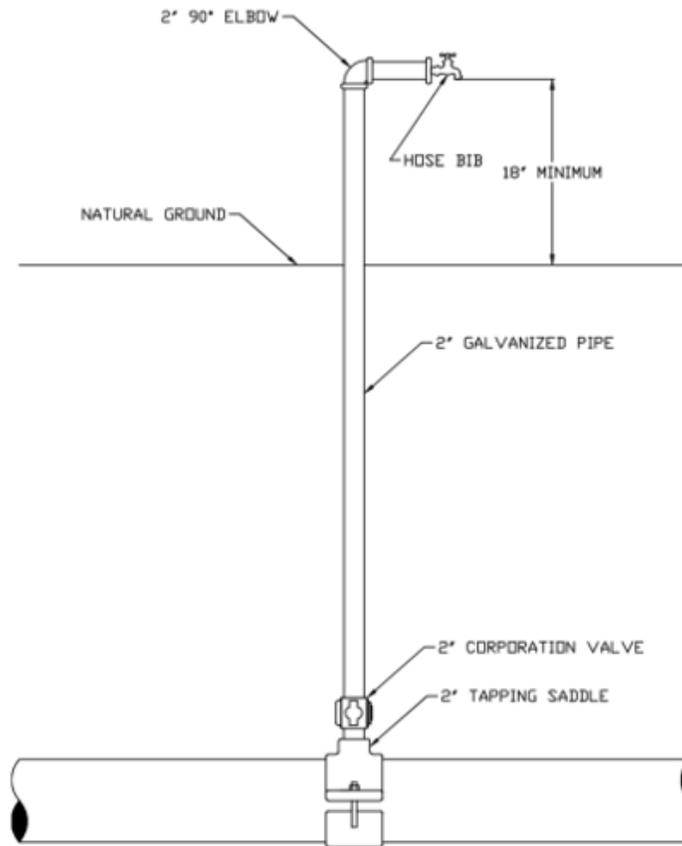
Upon passing test results having been received in writing, the waterline will be put in service as part of the City’s Infrastructure and no one but

an authorized City Employee shall be able to operate any valves attached to the new line.

**PART IV: SAMPLING STATIONS**



1" METER SERVICE TESTING STATION



2" BLOW-OFF TESTING STATION

**END OF SECTION**