

SPECIFICATIONS
SECTION 02510
WATER DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 DESCRIPTION

- A. Section includes requirements to furnish, construct, and test piping for water supply and distribution system, including fire protection.

1.2 REQUIREMENTS FOR MANUFACTURERS AND SUPPLIERS AND CONTRACTORS BEFORE DELIVERY

- A. Conduct quality assurance for furnished pipe, fittings, and valves following standards specified herein.
- B. Commission may inspect materials, including in-plant testing of valves, following Section 01450.
- C. Quality assurance for precast concrete utility structures is specified in Section 03400.
- D. Tapping Contractor: Performed successful pressure taps on cast iron, ductile iron pipe (DIP), prestressed concrete cylinder pipe (PCCP), or polyvinyl chloride (PVC) water mains.
- E. PVC pipe manufactured more than 12 months prior to installation will not be accepted.
- F. Qualifications for linestop tapping equipment installer:
 - 1. Experience: Actively engaged in linestop installation for minimum of 3 years, with at least 5 projects in the last 3 years of similar size and type.
 - 2. Field supervisory personnel: Experienced in performance of work and tasks stated herein for minimum of 3 years.

1.3 SUBMITTALS

- A. Submit following Section 01330.
 - 1. Manufacturer's shop drawings showing valves, operators, gear ratios, design flows, and pressure differential, performance charts, and parts list for all valves 16 inch and larger.
 - 2. Working drawings and calculations for pipes with welded on thrust rings.
 - 3. Proposed temporary bypass piping system.
 - a. Catalog data for pipe material.
 - b. Working drawings and description of sizes and locations.

4. Product data and coating procedure for surface preparation, prime coat and finish coat application for PCCP adapters.
 5. Manufacturer's shop drawings for linestop installation, including but not limited to: pipe taps, drilling apparatus, linestops, tapping valves and all other equipment and materials necessary to complete the work.
 6. Waiver for pipe and fittings, valves, precast concrete structures and welded on thrust rings: Submit letter naming the manufacturer who has on file with the Commission a certified standard drawing containing required Commission approved information. Provide new submittals if specifications change.
- B. Submit following Section 01450 on Contractor provided materials.
1. Certificates of Compliance or Materials Checklist Furnished by the Commission, for all applicable materials specified herein.
 2. Manufacturer's Certified Test Reports:
 - a. Valves 16 inches and larger:
 - 1) Tests specified in the referenced standards.
 - 2) Tests performed on valves and valve operators.
- C. Submit for Coated Pipe:
1. From Pipe Manufacturer.
 - a. Recommended coating thickness in cutback area on spigot end of pipe in area receiving rubber sealing gasket in jointing process.
 2. From Coating Manufacturer.
 - a. Recommended guidelines for environmental conditions to protect pipe, fittings, and valves from moisture, humidity, and temperature in area where cleaning, coating application, curing, and repair of coating is performed.
 - b. Recommended repair methods and procedures for repair of defects and damage to coating, including limits for defects or damage considered repairable.
 - 1) Include repair methods and procedures for use on Contract site and at coating applicator's site.
 - 2) Include cure times and consider all weather conditions in location of installation.
 - c. Handling and loading procedures for coated pipe, fittings, and valves.
 - d. Recommended voltage for testing coated pipe, fittings, and valves for holidays.
- D. Tapping Sleeve and Valve or Tapping Assembly and Valve: Submit before main is tapped.
1. Installation and testing instructions.
 2. Recommended maximum test pressure and length of time for testing assembly using water as test medium.
- E. Tapping Assemblies for PCCP 16 inch and Larger: Submit product data and coating procedure for surface preparation, prime coat and finish coat applications for steel coated with shop coat primer.

- F. Submit manufacturers' installation instruction for PVC pipe and fittings, joint restraint devices, and manufacturer's instructions for tapping pipe.
- G. Submit for information only:
 - 1. Contractors Experience and Supervisory Field Personnel for Linestop Tapping Equipments/Installer.
 - a. Presentation of similar experience in the last 3 years.
 - 1) Include, but not limited to, owner name, address, telephone number, contact person, date and duration of work, location, pipe information, and contents handled by the pipeline.
 - b. Supervisory field personnel and historical information of linestop experience.
 - c. At least one of the field supervisors listed must be at site when linestop operations are in progress.
 - 2. Submit copies of WSSC approved tapping card, MDE Sediment and Erosion Control Certification and American Traffic Safety Services Association (ATSSA) flagger certification.

1.4 STORAGE AND HANDLING

- A. Engineer will inspect materials on site before installation following Section 01450.
- B. Loading, unloading, handling, inspection, and storage of pipe, fittings, valves, joint accessories, and appurtenances: Follow AWWA C600 and AWWA C605, and as specified herein.
- C. Storage: Store pipe, fittings, valves, and appurtenances off ground using sound wood blocks placed on stable foundation or using other appropriate means. Allow space between rows, individual pieces and bundles with clearance below and above to allow full view for inspection purposes.
 - 1. Store in well-drained area away from brush and accessible for inspection.
 - 2. Do not stack pipe higher than 54 inches high.
 - 3. Keep spigot ends of pipe clean and clear for dimensioning purposes.
 - 4. Do not place excavated or other material over or against stored material.
 - 5. PVC pipe:
 - a. Store so it does not deform or bend.
 - b. Pipe stored outdoors or otherwise exposed to direct sunlight: Cover with canvas or other opaque material with provision for adequate air circulation.
- D. Handling: Unload and handle materials with crane, backhoe, or equipment of adequate capacity, equipped with appropriate slings or padding to protect materials from damage.
- E. Repair or Replacement:
 - 1. Repair damages or defects following approved manufacturer's recommendations.
 - 2. Remove and replace at no cost to the Commission materials deemed not repairable.

PART 2 PRODUCTS

2.1 MATERIALS

A. Pipe and Fittings:

1. General:

- a. Provide pipe and fittings of same size and material by same manufacturer, marked with manufacturer's name or trademark.
- b. Bolts and nuts: Marked, cast, or forged with identification of material and producer. Painted markings are not acceptable.
- c. The Commission will furnish:
 - 1) Mechanical joint and/or push on joint ductile iron pipe and mechanical joint bell end only fittings 14 inch and smaller Class 54 and the following appurtenances thereto:
 - a) Glands, gaskets, nuts and bolts for mechanical joints
 - b) Gaskets and lubricants for ductile iron push-on joints.
 - c) Long type solid sleeves.
 - 2) Fire hydrants and the following appurtenances thereto:
 - a) Anchoring coupling or anchoring tee.
 - b) Fire hydrant strapping appurtenances except 3/4-inch threaded bars, bolts and nuts.
 - 3) Mechanical joint valves 14-inch and smaller diameter including valve boxes therefore and 16" x 14" reducers when required to install valves.
 - 4) Manhole and vault frames and covers except for hatches and partial valve boxes which shall be furnished by the Contractor. See Section 05500 for requirements.
 - 5) Tapping sleeves and valves for existing DIP and CIP 14 inch and smaller mains with valves sizes 12 inch and smaller.
 - 6) Corporation stops and couplings for 3/4, 1, 1-1/2 and 2-inch diameter taps.
 - 7) 3/4, 1, 1-1/2 and 2-inch diameter copper pipe and the following appurtenances thereto:
 - a) Copper to copper couplings
 - b) Copper to galvanized couplings
 - c) Compression joints
 - d) Tees, 1" x 3/4", 1" x 1", 1-1/2" x 1", 1-1/2" x 3/4" and 2"x 1-1/2".
 - 8) Meter yoke setters, 3/4", 1", 1-1/2" and 2".
 - 9) Angle valve, 2".
 - 10) Brass nipple and brass fittings.
 - 11) Service saddles for water mains 4-inch through 12-inch, for ductile iron pipe.
 - 12) Curb stops, 3/4", 1", 1-1/2", 2".
 - 13) Meter housings for 5/8" thru 1-1/2" meters including frame and cover.
 - 14) Materials for house connections with outside meters 2-inch and larger diameter except meter vault.
 - 15) Reducing coupling, 1-1/2" x 1".
 - 16) Meters.
 - 17) Wedge action restrainer glands for harnessing joints on 14-inch and smaller diameter, ductile iron pipe only.

- 18) Reducers with either end larger than 14-inch diameter: Furnished by Contractor except when required for 14-inch diameter valves furnished by the Commission. 16 inch by 14 inch reducer will have Mechanical joint bell ends.
 - 19) Valve box complete.
 - 20) Curb box complete for house connection renewals.
 - 21) Air valve, 2"
 - 22) Polyethylene flat tube encasement for 14-inch and smaller ductile iron pipe and fittings.
 - 23) Polyethylene compatible adhesive tape for use with Polyethylene flat tube encasement.
- d. To obtain material furnished by the Commission, the Contractor shall notify and make arrangements with the Commission's warehouse as specified in Section 01110.
- 1) The Commission will arrange for Contract site delivery when the quantity of pipe comprises a truckload lot or more. When material is delivered directly to the job site, the Commission will so notify the Contractor at least 24 hours before delivery. The Contractor shall unload and store the material to the satisfaction of the Engineer.
 - 2) Pipe and fittings delivered direct to work site will be inspected prior to installation and will be marked either with WSSC'S logo, which means acceptable and ready for installation, or REJECTED-R which means it is rejected for installation until repaired by the manufacturer or REJECTED-NR which means it is rejected and non-repairable and shall not be installed. The Contractor shall return rejected items to the Anacostia Store yard to exchange for replacement pieces.
2. DIP:
- a. Mechanical or push on joints: AWWA C151 and AWWA C111.
 - 1) Coatings and Linings:
 - a) Exterior: Asphalt coated: AWWA C151, unless otherwise shown on Drawings.
 - b) Interior: Lined with double thickness cement and seal coated: AWWA C104.
 - 2) Class: Unless otherwise shown on Drawings, follow Special Thickness Class in AWWA C151, minimum Class 54 for 4 inch through 54 inch.
 - 3) Lengths:
 - a) 18 or 20 feet.
 - b) Pipe provided for installation on curved alignment: Pipe lengths that will not require joint to be deflected more than 80 percent of manufacturer's recommendation.
 - 4) In addition to markings required in AWWA C151, for pipe 36 inch and larger diameter, clearly mark manufacturer's pipe control number on each pipe length on face or near inside of bell.
 - 5) Imperfections:
 - a) Wrinkles or dimples:
 - (1) On spigot sealing surface: Unacceptable.

- (2) On bell and contour: Acceptable to depth of 3/16 inch, provided minimum metal thickness under imperfection is maintained.
 - (3) On pipe barrel: Acceptable to depth of 1/16 inch, provided minimum wall thickness requirements are met.
 - b) Laminations: On spigot sealing surface and those greater than 1/16 inch in depth on remaining outside surface of pipe: Unacceptable.
 - c) Pinholes: Acceptable when minimum wall thickness for designated class is maintained.
- 6) Approved manufacturers:
 - a) American Cast Iron Pipe Co.
 - b) Atlantic State Cast Iron Pipe Co. (Division of McWane, Incorporated).
 - c) Clow Water Systems Company; (Division of McWane Incorporated).
 - d) Griffin Pipe Products Company, Inc.
 - e) McWane Cast Iron Pipe Company (Division of McWane Incorporated).
 - f) United States Pipe and Foundry Co. (U.S. Pipe)
 - g) Pacific States Cast Iron Pipe Company (Division of McWane Incorporated)
- b. Fittings: For use on ductile iron bell, mechanical, or push on joint, unless shown otherwise on Drawings or Standard Details.
 - 1) Size, dimensions, and tolerances: AWWA C110 or AWWA C153 and AWWA C111.
 - 2) Mechanical joint solid sleeves: AWWA C110 or AWWA C153 and AWWA C111.
 - 3) Unless otherwise shown, furnish fittings 3 inch through 24 inch diameter having minimum pressure rating of 350 psi, and furnish fittings larger than 24 inch diameter having minimum pressure rating of 250 psi.
 - 4) Mechanical joints: See Joint Material.
 - 5) Coatings:
 - a) Exterior: Asphalt coated outside: AWWA C110 or AWWA C153.
 - b) Interior: Lined with double thickness cement and seal coated: AWWA C104.
 - c) Or, exterior and interior: Fusion bond epoxy coated: AWWA C116.
 - 6) Fittings 36 inch and larger diameter: In addition to cast markings required in AWWA C110 and C153, clearly stencil on with waterproof paint on each fitting the year, month, and day cast, lot number, and manufacturer's fitting control number.
 - 7) Approved manufacturers:
 - a) American Cast Iron Pipe Co.
 - b) Clow Water Systems Company, (Division of McWane Incorporated).
 - c) Griffin Pipe Products Company, Inc.
 - d) Tyler Pipe Industries, Inc.
 - e) Union Foundry Company, (Division of McWane, Incorporated).
 - f) United States Pipe and Foundry Co.
 - g) SIGMA Corporation.
 - h) Star Pipe Products.

- i) North American Cast Iron Products, Inc. (NACIP, Inc.)
- c. Flanged Pipe and Fittings:
 - 1) Flanged pipe: AWWA C115 and requirements for pipe above.
 - a) Approved Manufacturers for Flanged Pipe:
 - (1) American Cast Iron Pipe Company.
 - (2) Clow Water Systems Company, (Division of McWane Incorporated).
 - (3) Fast Fabricators, Inc.
 - (4) Rhawn Flange Co.
 - (5) United States Pipe and Foundry Co.
 - (6) Atlantic State Cast Iron Pipe Co. (Division of McWane, Incorporated).
 - (7) Griffin Pipe Products Company, Inc.
 - (8) McWane Cast Iron Pipe Company (Division of McWane Incorporated).
 - 2) Flanged fittings: AWWA C110 and requirements for fittings above except for flanged joints.
 - a) Flanges for fittings: Cast integrally with body and with same thickness over their entire circumference.
 - (1) Faces: Perpendicular to axis of pipe.
 - (2) Bolt holes: Equally centered and spaced.
 - (3) Joint accessories: See Joint Material.
 - b) Approved Manufacturers for Flanged Fittings:
 - (1) American Cast Iron Pipe Company.
 - (2) Clow Water Systems Company, (Division of McWane Incorporated).
 - (3) Fast Fabricators, Inc.
 - (4) Rhawn Flange Co.
 - (5) United States Pipe and Foundry Co.
 - (6) Atlantic State Cast Iron Pipe Co. (Division of McWane, Incorporated).
 - (7) Griffin Pipe Products Company, Inc.
 - (8) McWane Cast Iron Pipe Company (Division of McWane Incorporated).
 - (9) Star Pipe Products.
 - (10) Sigma Corporation.
 - (11) North American Cast Iron Products, Inc. (NACIP, Inc.)
 - c) Blind flanges for entry ports: Steel following AWWA C207
 - (1) Drill for bolt circle to match flange on entry port tee.
 - (2) Class D for total pressures (operation plus surge) up to 150 psi.
 - (3) Class E for total pressures (operation plus surge) up to 275 psi.
 - (4) Class F for total pressures (operation plus surge) up to 300 psi.
- d. Welded-on Connections (Bosses or Outlets) 8 Inch Diameter and Smaller: For DIP 24 inch and larger diameter when shown on Drawings, Standard Details, or when Contractor chooses welded on connections instead of AWWA C110 tee fittings.

- 1) Mechanical Joint or Flanged Joint: See Joint Material
- 2) Coatings:
 - a) Exterior: Asphaltic coated AWWA C151, unless otherwise shown on Drawings.
 - b) Interior:
 - (1) Line welded-on bosses with liquid epoxy coating, certified by NSF for contact with potable water.
 - (2) Line welded-on outlets with double thickness cement and seal coat: AWWA C104.
 - c) Mainline pipe: Sufficient thickness to meet Class specified, including within heat affected area:
 - (1) Welded-on bosses, minimum Class 54 or as shown on Drawings.
 - (2) Welded-on outlets, minimum Class 54 or as shown on Drawings.
 - (3) Minimum Charpy impact value is 10 foot-pounds.
 - (4) Has passed 300 psi hydrostatic test without leakage.
 - d) Approved manufacturers, welded-on bosses:
 - (1) American Cast Iron Pipe Company.
 - (2) Clow Water Systems Company (Division of McWane Incorporated).
 - (3) United States Pipe and Foundry Co.
 - e) Approved manufacturer, welded-on outlets:
 - (1) American Cast Iron Pipe Company
 - (2) Griffin Pipe Products Company, Inc.
3. External Coating System: When shown on Drawings, coat outside of pipe, fittings, valves, valve boxes and extension stems with external coating system as identified below.
 - a. General.
 - 1) Predominant method to be shop applied coatings, at pipe manufacturers shop or separate applicator's facility.
 - 2) Manufactured by single supplier.
 - 3) Coating products: Compatible and same products used throughout.
 - 4) Pipe surfaces that come in contact with potable water inside the pipeline to be coated with materials having NSF 61 certification.
 - 5) Coating Applicator: Certified as qualified by the coating manufacturer.
 - b. Handling, Transportation and Storage: Following AWWA C215 and in such a manner as to protect pipe and coating from damage.
 - 1) Coating plant: Bearing surfaces of forklift must be padded with suitable material. Web slings may also be used.
 - 2) Project site: Handle with minimum of two slings of type that will not damage coating.
 - a) Slings:
 - (1) Minimum 18 inches wide and sufficient strength to handle weight safely.
 - (2) Slings shall not pass through pipe.
 - (3) Hooks on ends of pipe will not be allowed.

- 3) Cables and chains used during transportation must be padded with approved material. Use padded horizontal separator strip between rows of piping and all contact areas where pipe will rest.
- 4) Store on padded minimum 12 inch wide skids or select loamy or sand dirt berms, or suspended from cutback ends where possible. Skid chucks used should be padded.
- c. Surface preparation: Following coating manufacturers and coating applicator's recommendation.
- d. Shop Applied Materials.
 - 1) External coating for ductile iron pipe: Polyolefin system following AWWA C215 with the following minimum properties, or approved equal.
 - a) Compounded butyl rubber adhesive coating.
 - (1) Less than 0.1% water absorption.
 - (2) Nominal thickness 10 mils.
 - b) Top Coat: High density polyethylene resin spirally extruded onto adhesive coating in multiple layers to form a seamless bonded coating with the following properties;
 - (1) Nominal thickness: 40 mils.
 - (2) Density: >0.95 (ASTM D1505).
 - (3) Elongation: >600% (ASTM D638)
 - (4) Tensile strength: <2800 psi (ASTM 638).
 - c) Total coating system:
 - (1) Thickness: 50 mils (40 mils polyethylene top coat, 10 mils butyl rubber adhesive)
 - (2) Impact resistance: >60 inch-lbs (ASTM G14)
 - (3) Cathodic disbondment: 6 mm radius (ASTM G8 of G95)
 - (4) Water absorption: 0.06% (ASTM D570)
 - d) Approved manufacturer.
 - (1) Pritec as manufactured by Bredero Shaw, Division of ShawCor Ltd.
 - (2) Or equal.
 - 2) Coating Special Systems for ductile iron fittings:
 - a) Shop applied materials: Follow AWWA C110 and AWWA C116 (fusion bonded epoxy)
 - (1) Scotchkote 206N.
 - (2) Or comparable proprietary systems.
- e. Field Applied Materials.
 - 1) Coating Repairs.
 - a) Shop applied coatings damaged in transit or during handling: Repair prior to backfilling.
 - b) As recommended by shop applied coating manufacturer and entirely compatible with original coating system.
 - 2) Coating Ductile Iron Pipe Joints: One of the following systems.
 - a) Joint wrap and repair tape: Two component extruding tape consisting of polyethylene and butyl rubber adhesive following AWWA C209.

- (1) Thickness: 35 mils (7 mils polyethylene backing, 28 mils butyl rubber adhesive).
 - (2) Adhesion: 225 oz/in width (ASTM D1000).
 - (3) Tensile strength: 15 lbs/in width (ASTM 1000)
 - (4) Water vapor transmission rate: 0.05 gm/100 in²/24 hrs.
 - (5) Dielectric strength: 23kV (ASTM D149).
 - (6) Insulation resistance 1.4 x 10⁷ M Ohms (ASTM D257)
 - (7) Tape width: As recommended by coating manufacturer.
 - (8) Use filler tape, recommended by the joint tape manufacturer to fill uneven areas at the top of pipe joint to assure smooth application of joint wrap tape.
 - (9) Approved manufacturer: Polyken 939 or equal.
 - b) Heat shrinkable sleeves designed for corrosion protection of water pipelines that utilize crosslinked polyolefin backing coated with protective, heat activated adhesive for bonding to metallic substrates and pipeline coatings following AWWA C216. Minimum properties:
 - (1) Tensile strength: 2,200 psi
 - (2) Elongation: 400%
 - (3) Volume resistivity: 10¹⁴ ohm-cm
 - (4) Water vapor transmission: 0.05
 - (5) Adhesion to steel: 25 N/cm
 - (6) Lap shear: 12 psi
 - (7) Impact: 25 in-lbs

Use filler material recommended by heat-shrink sleeve manufacturer to fill uneven area at the pipe joint to assure smooth application of heat shrink sleeve.
4. PVC Pipe and Fittings.
- a. Pipe 12 inch and smaller: AWWA C900, 14 inch and larger: AWWA C905 as modified herein or unless otherwise indicated elsewhere in Contract Documents, suitable for potable water use.
 - 1) Class and thickness: DR18 or as noted on the drawings, with DIP equivalent outer diameters.
 - 2) Potable water use: NSF61.
 - 3) Pipe markings: AWWA C900 and AWWA C905
 - 4) Joining pipes: Utilize elastomeric gasket push on joints following AWWA C900 and AWWA C905
 - 5) Approved Manufacturers:
 - a) IPEX.
 - b) JM Eagle™.
 - c) Diamond Plastics Corp.
 - d) National Pipe & Plastics, Inc.
 - e) North American Pipe Corp.
 - f) Royal Plastics Group, Ltd.
 - b. Fittings:
 - 1) Ductile iron specified herein.

- 2) Push-on rubber gasketed joints: Injection-molded meeting AWWA C907, Class 150, or fabricated meeting AWWA C900, Class 200 or AWWA C905, Class 235.
- 3) Approved Manufacturers:
 - a) Harco Fittings.
 - a) Multi Fittings
5. Tapping sleeves for existing gray iron, ductile iron, and PVC pipe 36 inch and smaller.
 - a. Cast from gray iron or ductile iron or material manufactured from ASTM A283 Grade C, ASTM A36, or equal.
 - b. Full sleeve type (with test plug) capable of containing pressure with full volume of sleeve.
 - c. Gaskets butt against existing pipe ensuring a watertight seal.
 - d. Suitable for use with Class AB or CD cast iron pipe or ductile iron for sizes 12 inches and smaller without changing either half of sleeve, unless field measurements are taken for type and outside diameter of existing pipe.
 - e. Rated at minimum 200 psi water working pressure for 12 inch and smaller diameter sleeves and minimum 150 psi working pressure for 14 inch to 24 inch.
 - f. Capable of withstanding rated working pressure without leakage past side and end gaskets and no leakage at junction of the two.
 - g. Mechanical Joint:
 - 1) Bolts, hexagonal nuts, rubber gaskets, and other accessories: AWWA C111, except provide only high strength low alloy steel bolts.
 - h. Valve flange:
 - 1) Suitable for connecting to mating end of tapping valve, which has a raised face to ensure true alignment of valve and tapping machine, following Manufacturers Standardization Society (MSS) SP60.
 - 2) AWWA C207 Class D, Class E, or Class F (match tapping valve flange) for material manufactured from ASTM A283 Grade C, ASTM A36, or equal.
 - i. Coatings and linings:
 - 1) Gray or ductile iron casted tapping sleeves AWWA C110.
 - 2) Material manufactured from ASTM A283 Grade C, ASTM A36, or equal tapping sleeves.
 - a) Interior Lining: Fusion bonded epoxy that is EPA or NSF approved for contact with potable water, a minimum thickness of 12 mils, following AWWA C213.
 - b) Exterior Coating: Fusion bonded epoxy, a minimum thickness of 12 mils, following AWWA C213.
 - j. Approved manufacturers:
 - 1) American Flow Control, Series 2800C and 1004.
 - 2) Clow Valve Company (A Division of McWane Inc.), Figure FS5205.
 - 3) M&H Valve Company (A Division of McWane Inc.), Style 1574 and 1674.
 - 4) Mueller Company, Style H-615-24.
 - 5) Tyler Pipe/Utilities Division.
 - 6) United States Pipe and Foundry Co., Ductile Iron T-9.

- 7) JCM Industries, Inc., Nash, Texas, Number JCM 412 Fabricated Steel Tapping Sleeves.
6. Tapping sleeves for existing gray iron or DIP larger than 36 inch:
 - a. Material manufactured from ASTM A283 Grade C, ASTM A36, or equal.
 - b. Full sleeve type capable of containing pressure with full volume of sleeve.
 - c. Gaskets butt against existing pipe providing watertight seal.
 - d. Rated at minimum 150 psi water working pressure.
 - e. Capable of withstanding rated working pressure without leakage past the side and end gaskets and no leakage at the junction of the two.
 - f. Furnish test plug on sleeve for field pressurization of sleeve, valve, and tapping machine assembly before making tap.
 - g. Interior Lining: Lined with fusion bonded epoxy that is EPA or NSF approved for contact with potable water, minimum thickness of 12 mils, following AWWA C213.
 - h. Exterior Coating: Fusion bonded epoxy, a minimum thickness of 12 mils, following AWWA C213.
 - i. Mechanical joint bolts, hexagonal nuts, rubber gaskets and all other accessories: AWWA C111, except provide only high strength low alloy steel bolts.
 - j. Gasket material: AWWA C111.
 - k. Valve flange:
 - 1) Manufactured: AWWA C207 Class D, Class E, or Class F (match tapping valve flange).
 - 2) Suitable for connecting to mating end of tapping valve, which has raised male face to ensure true alignment of valve and tapping machine, following MSS SP60.
 - 3) Bolts, nuts and studs: High strength, low alloy, ANSI A21.11 for end flange joints.
 - l. Marking on sleeve: Manufacturer's name or logo and barrel and outlet diameters, at a minimum. Either cast or stenciled with waterproof paint and all markings must be legible.
 - m. Approved manufacturers:
 - 1) JCM Industries, Inc., Nash, Texas.
 - a) Number JCM 412 ESS Fabricated Steel Tapping Sleeves.
 - b) Number JCM 414 ESS Fabricated Mechanical Joint Tapping Sleeves.
 - 2) Romac Industries, Inc., Seattle, Washington, Number FTS425 Steel Fabricated Tapping Sleeve.
7. Tapping Assemblies for Prestressed Concrete Cylinder Pipe 16-inch and larger:
 - a. Designed to withstand total pressure (operating plus surge).
 - b. Saddle Plates: Manufactured from ASTM A285 Grade C, ASTM A36 or equal.
 - c. Gasket: Broad, flat sealing surface and material suitable for potable water ranging in temperature from 32 degrees F to 110 degrees F.
 - d. Valve flange:
 - 1) Manufactured: AWWA C207, Class E or F (match tapping valve flange).
 - 2) Suitable for connecting to mating end of tapping valve, which has raised male face to ensure true alignment of valve and tapping machine following MSS SP60.

- 3) Bolts, nuts and studs: High strength, low alloy, ANSI A21.11.
- e. Welds.
 - 1) Interior lining: Dye-penetrant inspected for water tightness.
 - 2) Certified welders: AWWA C301, Section 1.9.2.
- f. Interior lined with cement mortar AWWA C104 or fusion bonded epoxy: EPA or NSF approved for contact with potable water, minimum thickness of 15 mils, following AWWA C213.
- g. All other steel coated with shop coat primer.
- h. Sleeve.
 - 1) Provide separate gland, which allows sleeve to be installed and annular space between pipe and sleeve to be grouted, before cutting prestressing wires.
 - 2) Use foam grouted gaskets and hard rubber spacers, to provide annular space between pipe and sleeve.
 - 3) Grout after sleeve is installed.
 - 4) Sleeves furnished with grout horns to facilitate grouting annular space.
- i. Grout: Quick-set cement mortar which does not contain calcium chloride or other material that can contribute to corrosion of existing prestressing wire.
 - 1) Approved manufacturer and product:
 - a) Sika Corporation, Sikaset NC.
 - b) Or equal.
- j. Gland:
 - 1) Equipped with load bearing set screws to transfer thrust from branch to sleeve.
 - 2) Welding gland to steel cylinder of pipe to provide watertight seal will not be permitted.
- k. Encase sleeve in minimum of 1 inch of cement mortar minimum strength 3000 psi, without calcium chlorides, after tap.
- l. Approved manufacturers:
 - 1) Hanson Pipe and Precast.
 - 2) JCM Industries, Inc., Nash, Texas, Number JCM 415, Type 1.
 - 3) Romac Industries, Inc., Seattle, Washington, Number FTS435, Style 1.
8. Adapters: PCCP to DIP.
 - a. Approved Manufacturer: Hanson Pipe & Precast for PCCP to DIP 16 inches through 54 inches diameter.
 - b. Construction: AWWA C301.
 - 1) Welding: AWS D1.1.
 - 2) Steel cylinder: Designed to withstand total pressure (working and surge pressure) or 275 psi, whichever is greater, following Barlow Formula.
 - a) Maximum allowable steel stress: 0.50 of steel yield stress.
 - b) Minimum steel cylinder thickness: 1/4 inch.
 - 3) Loads for adapters longer than 3'-0": Designed for external loads following AWWA Manual M-11.
 - 4) Adapter ends: Compatible with mating pipe ends.
 - 5) Required accessories: Complete with bolts, nuts, gaskets, and diaphragms.

- 6) Flanges: Designed for total pressure or surge of 275 psi, whichever is greater, and matching bolt size, bolt hole diameter, and bolt hole circle of mating flange.
- c. Shop Coatings.
 - 1) Machined surface: Coat with one coat of Porter Guard Alkyd Zinc Dust Coating No. 299.
 - 2) Steel surfaces: Coat with liquid epoxy that is certified by NSF for contact with potable water.
- d. Shop Surface Preparation and Coating Application: AWWA C210.
 - 1) Liquid epoxy coating systems for interior and exterior of steel component pipelines: AWWA C210.
 - 2) Approved finish coats:
 - a) PorterLine 6000.
 - b) Carboline Carboguard 891.
 - c) Tnemec Series N140 Pota-pox Plus.
 - d) Or equal.
9. Linestop.
 - a. General.
 - 1) Rated at minimum working pressure of 150 psi and hydrostatic test pressure of 300 psi.
 - 2) Lined waterways with fusion-bonded epoxy, EPA or NSF approved for potable water, minimum thickness of 12 mils, following AWWA C213.
 - 3) Exterior coating: Fusion bonded epoxy minimum thickness 12 mils, following AWWA C-213.
 - 4) Bolts, nuts and studs: High strength, low alloy following ANSI A21.11.
 - b. Tapping Saddle Assembly.
 - 1) Full encirclement, consisting of, at minimum, upper saddle plate with anchor neck, lower saddle plate, tapping flange and nozzle with gland or gasket for pressure tight seal suitable for potable water ranging in temperature from 32 degrees F to 100 degrees F. All components properly shaped and adequate strength to ensure proper mounting and pressure tight seal around existing pipe.
 - 2) Saddle plates manufactured from ASTM A283 Grade C, ATSM A36 or equal steel, clean and sound without defects that impact their service. No plugging or welding of such defects will be allowed.
 - 3) Outlet flange manufactured of same material as tapping saddle assemblies: Flat face and drill following ANSI B16.5, Class 150 flange. Provide suitable independently operating locking device in periphery of flange to secure completion plug.
 - 4) All waterways: Dye-penetrant inspected for water tightness.
 - c. Completion Plug:
 - 1) Manufactured from ASTM A283 Grade C, ASTM A36 or equal steel.
 - 2) Equipped with two circumferential grooves; one to receive the locking device from flange, and second to contain compressible "O" ring to seal pressure tight against interior diameter of nozzle.
 - d. Blind Flange:

- 1) To seal tapping saddle assembly upon removal of tapping and linestop equipment.
- 2) Manufactured from AWWA C207, Class D steel and drilled to match bolt circle of nozzle of tapping saddle assembly.
- e. Linestop Machine:
 - 1) Tapping Equipment Fabricator/Installer: Furnish folding plug head linestop capable of pressure tight seal against inside diameter of existing pipe.
 - 2) Linestop: Advance into and retract from pipeline by means of hydraulic or mechanical actuator. When retracted the folding plug head to be housed in pressure tight chamber between the actuator and tapping valve.
 - 3) Folding plug: Capable of displacing accumulated grit deposits in interior of the pipe while advancing to its linestopping position and have molded polyurethane sealing element around its perimeter and supply workable seal with interior diameter when fully advanced.
- f. Approved Tapping Equipment Fabricator/Installers:
 - 1) Hydra-Stop Services
 - 2) Flowserve US, Inc.
 - 3) Or Equal.
10. Copper Pipe and Fittings.
 - a. Pipe: Seamless, type K, and following ASTM B88.
 - b. Service Fittings: Copper following high pressure requirements of AWWA C800.
 - 1) Flared Copper tube connections: AWWA C800 for flared connections with straight threads.
 - a) Approved Manufacturers:
 - (1) A.Y. McDonald Manufacturing Company.
 - (2) Cambridge Brass.
 - (3) Ford Meter Box Company.
 - (4) Mueller Company.
 - 2) Brass Nipples: Following NSF 372 and ASTM B43
 - a) Reamed, chamfered with male NPT ends: Following ANSI/ASME B.1.20.1.
 - b) Approved manufacturers;
 - (1) A.Y. McDonald Manufacturing Company.
 - (2) Lee Brass Co.
 - (3) Merit Brass Company.
 - 3) Bronze castings: Manufactured of Copper Development Association (CDA) alloys meeting chemical and physical properties of ASTM B584 and following AWWA C800, NSF 372.
 - 4) Compression copper tube connections: Follow AWWA C800.
 - a) Elastomer seal to prevent leakage.
 - b) Corrosion resistant, e.g. stainless steel, split or gripper ring to restrain joint.
 - c) "Tighten to stop" design
 - d) Approved Manufacturers:
 - (1) A.Y. McDonald Manufacturing Company, Q style.
 - (2) Ford Meter Box Company, Q style.

- (3) Cambridge Brass, Q style.
 - (4) Mueller Company, 110 style.
 - 5) Connections with National Pipe Threaded connections (NPT): Follow ANSI/ASME B1.20.1, NSF 372, and AWWA C800 or ANSI B 16.15.
 - a) Approved manufacturers;
 - (1) A.Y. McDonald Manufacturing Company.
 - (2) Ford Meter Box Company.
 - (3) Lee Brass Company.
 - (4) Merit Brass.
 - c. Service Insulator Assemblies (Available in flare or compression styles).
 - 1) Ensure thread compatibility;
 - a) Insulator: Use same style as outlet end of corporation stop.
 - b) Compression outlet stops: Use same manufacturer.
 - 2) Approved manufacturers:
 - a) Mueller Insulated Products, Mueller Co.
 - b) Ford Meter Box Company, Inc.
 - c) A.Y. McDonald Manufacturing Company.
 - d) Cambridge Brass.
- 11. Service Saddles:
 - a. General:
 - 1) Use for 2 inch and smaller connections.
 - 2) Manufacture saddles with clamps for underground services:
 - a) Rated for minimum service of 150 psi.
 - b) Provide full support around the circumference of pipe.
 - c) Do not distort, scratch, or damage pipe when tightened.
 - d) Contains thick tapping boss, which has been precision-machined with full-length threads for watertight connection that resists pullout.
 - e) Threads: AWWA C800 with standard corporation stop thread.
 - f) Ductile Iron: ASTM A536 with epoxy coating.
 - g) Stainless Steel: ASTM A193 and ASTM A240, type 304.
 - h) Saddle body meeting ASTM A395 or A536 and AWWA C800.
 - (1) Uniform quality, true to pattern, of even grain, sound and smooth, and without cold shuts, swells, scales, blisters, sand holes, cracks or other defects.
 - (2) Surfaces: Smooth with no burnt-on sand.
 - (3) Finish: Minimum 12 mils fusion bonded meeting AWWA C213.
 - i) Double straps: Type 304 Stainless Steel.
 - j) Nuts, washers and studs: Type 304 Stainless Steel
 - k) Use watertight gaskets of Buna-N rubber meeting NSF 61 certified and ASTM D2000 or Nitrile around tap hole.
 - b. Saddles for Cast Iron or DIP.
 - 1) Approved manufacturers and models for 3 inch:
 - a) Ford Meter Box Co., Inc., Style No. FC202.
 - b) JCM Industries, Inc., Model No. 406-0413.
 - c) Mueller Company, Catalog No. DR 2S0356.

- d) Smith-Blair, Inc., Model Nos. 317-000-41309-000, 317-000-41313-000, and 317-000-41315-000, all Double Strap.
 - e) PowerSeal Pipeline Products Corporation, Model 3417DI.
 - 2) Approved manufacturers and models for 4 inch and above:
 - a) Ford Meter Box Co., Inc., Style No. FC202.
 - b) Mueller Company, Catalog No. DR2S.
 - c) A.Y. McDonald Manufacturing Company Catalog No. 4855A.
 - d) Smith-Blair, Inc., Model No. 317.
 - e) JCM Industries, Model No. 406.
 - f) PowerSeal Pipeline Products Corporation, Model 3417DI.
- c. Saddles for PVC AWWA C900 and C905 Pipe.
 - 1) Use tapping saddle manufactured specifically for AWWA C900 and C905 PVC pipe with stainless steel wide band straps, nuts and washers.
 - 2) Approved Manufacturers and Models:
 - a) Ford Meter Box Co., Inc. FC202.
 - b) Smith Blair, Inc., Model No. 317.
 - c) Mueller Company, Series DR2S.
 - d) A.Y. McDonald Manufacturing Company, Model 4855A.
 - e) PowerSeal Pipeline Products Corporation, Model 3417DI.
- d. Saddles for PCCP.
 - 1) Approved manufacturer:
 - a) JMC Industries, Inc., Model 425 ESS

B. Joint Material:

- 1. Push on and Mechanical Joints: AWWA C111, C110, C153, C900, and C905.
 - a. Mechanical joints: High strength low alloy steel tee head bolts.
 - b. Gaskets: AWWA C111
 - 1) Nitrile (NBR) Gaskets, if specified on Drawings: ANSI/AWWA C111/A211.11
- 2. Flanged Joints: AWWA C110, AWWA C115, and specified herein.
 - a. Flange bolts, nuts, and washers: Carbon steel ASTM A307, Grade B.
 - b. Nuts: Cold punched, hexagonal, trimmed, and chamfered.
 - c. Heads, nuts and threads: ANSI B1.1.
 - d. Bolts: 1/4-inch projection beyond nut when joint with gasket is assembled.
 - e. Gaskets: Full-faced, 1/8-inch thick rubber.
 - f. When flange joints are required for connecting to Class 250 gate valves with flanges, follow ANSI B16.1, Class 250, flat face flanges, unless otherwise specified.
- 3. Mechanical Couplings: Heaviest standard type for each size without pipe stops and following Drawings.
 - a. Approved manufacturers:
 - 1) Cascade Waterworks Mfg. Co., Style CDC.
 - 2) Dresser Manufacturing Division, Dresser Style No. 138.
 - 3) Powerseal Pipeline Products Corporation, Style No. 3501 and 3506.
 - 4) Romac Industries, Inc., Style 400.
 - 5) Smith-Blair, Inc. (formerly Rockwell International), Model No. 441.

4. Joint Restraining Material:
- a. Tie bolt with companion washers and bolts: Manufactured by Star National Products or equal.
 - 1) 3/4-inch Super Star Tiebolt SST-7 for pipe joints 4 through 12-inch diameter.
 - 2) Super Star Tiebolt SST- 753 for pipe joints 14 through 24-inch diameter.
 - b. Steel for strapping and harnessed joints: Minimum 3/4-inch diameter and following ASTM A588 and A307.
 - c. Wedge action restrainer glands:
 - 1) Approved manufacturers for DIP Mechanical Joint:
 - a) EBAA Iron, Inc., MEGALUG Series 11XX-DEC (with Mega-bond) MEGALUG Series 1100SD (with Mega-bond), for use with existing Mechanical joints.
 - b) Ford Meter Box Company, Inc., UNI-FLANGE Series UFR1400-DA-XX- (I or U) (with E-Coat),
 - c) Romac Industries, Inc., ROMAGRIP Series XX-RAP (with E-Coat)
 - d) SIGMA Corporation, ONE LOK Series SLDE-XPXX (with Corrsafe Coating System),
 - e) Star Pipe Products, STARGRIP, Series 3000-XX with accessories, (with Starbond Coating System).
 - f) Tyler Union, Tuf Grip Series TLD-XX-FBE with accessories (with E-coat).
 - g) Smith-Blair, Inc., 111 Cam-Lock with accessories (with fusion bonded Flex-Coat)
 - 2) Approved manufacturers for PVC Pipe:
 - a) UniFlange, Series 1500.
 - b) EBAA Iron, Series 2000PV.
 - c) Capital Industries, EZ Lok 4 inch through 12 inch diameter.
 - d) Or equal.
 - d. Restrained joint for PVC Pipe push-on joint: Meet Uni-B-13.
 - 1) Approved manufacturers:
 - a) JCM 620 Sur-Grip.
 - b) EBAA Iron, Series 1600.
 - c) UniFlange, Series 1390-C.
 - d) Or equal.
 - 2) Do not deflect PVC pipe in restrained joints. If deflection is required in restrained joint, use ductile iron pipe and fittings.
 - e. Push on restrained joint gasket for 4 inch through 24 inch DIP.
 - 1) Approved manufacturers:
 - a) United States Pipe and Foundry Co., FIELD LOK 350® for use with TYTON JOINT pipe.
 - b) American Cast Iron Pipe Co., Fast-Grip for use with Fastite pipe.
 - c) McWane Cast Iron Pipe Co., Sure Stop 350® for use with TYTON JOINT pipe.
 - d) Griffin Pipe Products Company, Inc., Talon RJ gasket for use with TYTON JOINT pipe sizes 4 through 16 inch DIP.

- f. Restrained proprietary push on joint pipe and fittings: 16 inch and larger DIP.
 - 1) Approved manufacturers:
 - a) American Cast Iron Pipe Co.
 - (1) Flex-Ring Joint, 16 inch through 36 inch.
 - (2) Lok-Ring Joint, 42 inch through 54 inch.
 - b) United States Pipe and Foundry Co., TR Flex Joint, 16 inch through 54 inch.
 - c) Clow Water Systems Company (Division of McWane, Incorporated), Super Lock 16 inch through 30 inch.
 - d) Griffin Pipe Products Company, Inc., Snap-Lok
 - (1) Snap-Lok, 16 inch through 24 inch, TYTON JOINT.
 - (2) Snap-Lok, 30 inch through 48 inch, Fastite Joint.
 - e) McWane Cast Iron Company (Division of McWane, Incorporated), McWane restrained joint for Fastite joint pipe, 36 inch.
- g. Restraint of Field Cut Proprietary Restrained Joint Pipe, 16 Inch and Larger Diameter DIP.
 - 1) Approved manufacturers:
 - a) American Cast Iron Co., Field Flex-Ring, 16 inch through 36 inch.
 - b) United States Pipe and Foundry Co., TR Flex Gripper Ring, 16 inch through 36 inch.
- h. Anchor Coupling and Anchoring Tee: Ductile iron minimum pressure rating 250 and follow coating requirements for fittings above.
 - 1) Joint: Mechanical joint with integrally cast standard mechanical joint, rotatable glands on each end that has lock against joint separation.
 - 2) Anchor Coupling Length: 12 to 13 inches.
 - 3) As manufactured by approved fitting manufacturers listed herein.

C. Valves:

- 1. Gate Valves, Resilient Seated, sizes 3 inch through 14 inch: Designed, built and tested following AWWA C509 or AWWA C515 except as modified herein.
 - a. Working pressure rating: 250 psi.
 - b. General configuration:
 - 1) Non-rising stem, resilient seated design for installation in horizontal or near horizontal pipe lines.
 - 2) Operated with AWWA, 2 inch square operating nut turned counterclockwise to open.
 - c. Valve stem material: Minimum yield strength (determined as stress producing an elongation under load of 0.5 percent, which is 0.01 inches in gage length of 2.0 inches) of 40,000 psi. Following ASTM B763, UNS alloy C99500 or ASTM B138, UNS alloy C67600 in H04 temper.
 - d. Valve stem extension: Follow Standard Details.
 - 1) Approved manufacturer:
 - a) The General Engineering Company.
 - b) Or equal.
 - e. Corrosion resistant coating:
 - 1) Fusion bonded epoxy, follow AWWA C550.

- 2) Minimum 8 mils dry film thickness.
 - 3) Applied to all ferrous metal surfaces after rendering surfaces free from grease, dirt and moisture, and performing near-white, blast cleaning following SSPC-SP10/NACE 2.
 - 4) Do not coat fasteners or machined surfaces subject to contact and relative movement against other surfaces during operation of valve or other surfaces where such coating would compromise proper installation or functionality of valve.
- f. Externally accessible bolts, nuts and washers: Type 304 Stainless steel.
- g. Direct buried valves:
- 1) Mechanical joint ends following AWWA C111.
 - 2) Non-adjustable, elastomeric stem seals.
 - a) Adjustable packing glands not permitted for direct buried applications.
 - 3) Direct operation of stem from above via 2 inch square nut.
 - a) No gear box provided.
 - 4) Approved Manufacturers and Models:
 - a) American Flow Control Series 2500 (with factory provided round yellow "NDZ" tag under operating nut).
 - b) Clow Valve Co. Model 2638...74XX, Figure No. F-6100 or Model 2639...74XX, Figure 6100.
 - c) Kennedy Valve Co. Figure No. 8571YSS or 7571YSS (YST for Type 316 SS Bolting)
 - d) M & H Valve Co. Style XX4067014002 (W/SS BOLTING) or XX7571011002 (W/SS BOLTING).
 - e) Mueller Company Catalog No. A2360LN-23-E414 (sizes 3"–12") or A2361LN-23-9020-E414 (size 14").
 - f) U.S. Pipe, Valve and Hydrant Division Catalog No. AUSPOLN-23-E414 (sizes 3"–12") or AUSP1LN-23-9020-E414 (size 14").
- h. Non-Direct buried valves.
- 1) Vertical orientation required.
 - 2) Flanged ends: ANSI B16.1 Class 125 or Class 250 if specified on Drawings.
 - 3) *Pipe plugs in valve body:
 - a) Minimum 1/2 inch for valve sizes up to 4 inches.
 - b) Minimum 3/4 inch for valve sizes larger than 4 inch.
 - c) Solid brass installed with Teflon tape seal on threads.
 - 4) Direct operation of stem from above via 2 inch square nut.
 - a) No gear box provided.
 - 5) Approved Manufacturers and Models:
 - a) American Flow Control Series 2500* (with factory provided round yellow "NDZ" tag under operating nut).
 - b) Clow Valve Co. Model 2638*...74XX, Figure No. F-6102* or Model 2639*...74XX, Figure No. F-6102.
 - c) Kennedy Valve Co. Figure No. 8561ANYSS* or 7561AYNSS* (YST for Type 316 SS Bolting).

- d) M & H Valve Co. Style XX4067024002* (W/SS BOLTING) or XX7561021002* (W/ SS BOLTING).
 - e) Mueller Company Catalog No. A2360LN-06-E414* (sizes 3”–12”), or A2361LN-06-9020-E414*(size 14”). (with factory provided rectangular yellow “WSSC” tag under operating nut).
 - f) U.S. Pipe, Valve and Hydrant Division Catalog No. AUSPOLN-06-E414*(sizes 3”–12”) or AUSP1LN-06-9020-E414* (size 14”). (with factory provided rectangular yellow “WSSC” tag under operating nut).
- i. Tapping Valves.
 - 1) Direct Buried: Vertical orientation required.
 - 2) Waterway sized to provide clearance for tapping machine cutter with minimum diameter 1/2 inch less than size of valve.
 - 3) Inlet end.
 - a) Flange: ANSI B16.1 Class 125 or Class 250 if specified on Drawings.
 - b) Flange with face having annular projection (configured following Manufacturers Standardization Society of Valve and Fitting Industry, SP-60) to center the valve in the recess of tapping sleeve flange (for gray iron and ductile iron pipe) or tapping assembly (for PCC pipe)
 - 4) Outlet end: Mechanical joint following AWWA C111.
 - 5) Direct operation of stem from above via 2 inch square nut.
 - a) No gear box provided.
 - 6) Approved Manufacturers and Models:
 - a) American Flow Control Series 2500 (with factory provided round yellow “NDZ” tag under operating nut).
 - b) Clow Valve Co. Model 2638...74XX, Figure No. F-6114 or Model 2639...74XX, Figure No. F-6114.
 - c) Kennedy Valve Co. Figure No. 8950YSS or Figure No. 7590YSS (YST for type 316 SS BOLTING).
 - d) M & H Valve Co. Style XX4751014026 (W/SS BOLTING) or XX7950011002 (W/SS BOLTING).
 - e) Mueller Company Catalog No. T2360LN-19-E414 (sizes 3”–12”) or T2361LN-19-9020-E414 (size 14”).
 - f) U.S. Pipe, Valve and Hydrant Division Catalog No. TUSPOLN-19-E414 (sizes 3”–12”) or TUSP1LN-19-9020-E414 (size 14”).
- 2. Gate Valves, Double Disc, Class 125: Built and tested following AWWA C500 with gray or ductile iron body, bronze mounted, parallel seat, double disc with nonrising stem, nut operated to open left with 2-inch square operating nut.
 - a. To withstand and operate under non-shock working pressure.
 - 1) Valves 12 inch and smaller diameter, 200 psi.
 - 2) Valves 14 inch diameter, 150 psi.
 - b. Bonnet test plugs: Allen or hexagonal socket type flush with bonnet surface.
 - c. Tapping Valves: Follow above requirements, except as modified for passage and clearance for tapping machine.
 - d. Valve ends:
 - 1) Not direct buried: Flanged Ends, ANSI B16.1 Class 125.
 - 2) Direct buried: Mechanical Joint, AWWA C111 and AWWA C500.

- 3) Tapping valves: Flange inlet.
 - a) Class 125, ANSI B16.1, suitable for connecting to tapping sleeve (gray iron or DIP) or tapping assemblies (PCCP).
 - b) American R/D 52.
 - 4) Tapping valve: Outlet.
 - a) Direct buried: Mechanical Joint, AWWA C111 and AWWA C500.
 - b) Not direct buried: Flanged Ends, ANSI B16.1 Class 125, and allowing tapping machine adapter to be attached directly to valve.
 - e. Bolts, nuts, washers, and gaskets: See Joint Material previously specified herein.
 - f. Valve Stem Extension: Follow Standard Details and as manufactured by The General Engineering Co. or equal.
 - g. Approved manufacturers:
 - 1) Flanged end:
 - a) Clow Valve Company (Division of McWane, Incorporated), Model No. F-5070.
 - b) Kennedy Valve (Division of McWane, Incorporated), Model No. F-5070.
 - c) American R/D 52.
 - 2) Mechanical joint:
 - a) Clow Valve Company (Division of McWane, Incorporated), Model No. F-5065.
 - b) Kennedy Valve (Division of McWane, Incorporated), Model No. F-5065.
 - c) American R/D 52.
 - 3) Tapping valves:
 - a) Clow Valve Company (Division of McWane, Incorporated), Model No. F-5067
 - b) Kennedy Valve (Division of McWane, Incorporated), Model No. F-5067.
3. Gate Valves, double disc, sizes 16 inch through 48 inch for high working pressure applications.
- a. Designed, built and tested following AWWA C500 except as modified herein.
 - b. Working pressure rating: Minimum 250 psi.
 - c. General Configuration:
 - 1) Non-rising stem, metal seated, parallel, double disc design for installation in horizontal or near horizontal pipe lines.
 - 2) Operated with AWWA, 2 inch square operating nut turned counterclockwise to open.
 - d. Non-Direct buried only.
 - 1) Horizontal orientation required.
 - 2) ANSI B16.1 Class 125 or 250 flanges as indicated on Drawings.
 - e. Valve Stem extension: Follow Standard Details.
 - 1) Approved manufacturer:
 - a) The General Engineering Company.
 - b) Or equal.
 - f. Corrosion resistant coating:

- 1) Follow AWWA C550 and NSF 61 certified.
 - 2) Minimum 8 mils dry film thickness.
 - 3) Tnemec N140-1211 epoxy or Amerlock 2 red oxide epoxy by Ameron International: Applied in two coats to interior and exterior ferrous metal surfaces after rendering surfaces free from grease, dirt and moisture, and performing near-white, blast cleaning following SSPC-SP10/NACE 2.
 - 4) Do not coat fasteners or machined surfaces subject to contact and relative movement against other surfaces during operation of valve or other surfaces where such a coating would compromise the proper installation or functionality of the valve.
- g. Externally accessible bolts, nuts and washers: Type 304 Stainless steel.
- h. Pipe plug:
- 1) Minimum 3/4 inch solid brass.
 - 2) Install with Teflon tape seal in tapped boss on bonnet or body.
- i. Gear case: Following AWWA C500. Sealed, grease filled with bevel gearing operated from above via 2 inch square nut. Acceptable gear ratios:

Valve Size	Ratio	Valve Size	Ratio
16"	2:1 to 4:1	30"	4:1 to 6:1
18"	3:1 to 4:1	36"	4:1 to 6:1
20"	3:1 to 4:1	42"	6:1 to 8:1
24"	3:1 to 4:1	48"	8:1

- j. Bypass gate valve: Following AWWA C500.
- 1) Locate at end of body opposite stem location.
 - 2) Operation of bypass from above via 2 inch square nut.
- k. Rollers, tracks and scrapers required or rolling disc design with tracks and scrapers acceptable in lieu of separate rollers on disc.
- l. Manufacturers and Models:
- 1) American R/D 52.
 - 2) Ludlow Rensselaer Division of Patterson Pump Co. Model List 14.
- m. Tapping Valves.
- 1) Waterway sized to provide clearance for tapping machine cutter with minimum diameter 1/2 inch less than size of valve.
 - 2) Non-Direct buried.
 - a) Horizontal orientation required.
 - b) Inlet end.
 - (1) ANSI B16.1 class 125 or 250 flange as indicated on Drawings.
 - (2) Flange with face having annular projection (configured following Manufacturers Standardization Society of Valve and Fitting Industry, SP-60) to center valve in recess of tapping flange (for gray iron and ductile iron pipe) or tapping assembly (for PCC pipe)
 - c) Outlet end: Following ANSI B16.1, class 125 or 250. Flange for connection to tapping machine adapter, as specified on Drawings.

- d) Gear case: Following AWWA C500. Sealed, grease filled with bevel gearing operated from above via 2 inch square nut. Acceptable gear ratios:

Valve Size	Ratio	Valve Size	Ratio
16"	2:1 to 4:1	30"	4:1 to 6:1
18"	3:1 to 4:1	36"	4:1 to 6:1
20"	3:1 to 4:1	42"	6:1 to 8:1
24"	3:1 to 4:1	48"	8:1

- 3) Bypass gate valve: Following AWWA C500.
- Locate at end of body opposite stem location.
 - Operation of bypass from above via 2 inch square nut.
- 4) Rollers, tracks and scrapers required or rolling disc design with tracks and scrapers acceptable in lieu of separate rollers on disc.
- 5) Approved Manufacturers and Models:
- American R/D 52.
 - Ludlow Rensselaer Division of Patterson Pump Co. Model List 14.
4. Air Valve: Combining operating features of both an air/vacuum valve and air release valve.
- Type: Universal/combination type following AWWA C512.
 - Float, plug, guide shafts and bushings: Stainless Steel Type 316.
 - Resilient seats: Buna-N.
 - Metal internal parts and body only.
 - Minimum orifice diameter as listed below the range of working pressure from 0 to 200 psi.
 - 3/16 inch for Crispin Valve.
 - 3/32 inch for APCO.
 - 3/32 inch for Val-Matic.
 - Inlet and outlet size: 2 inch NPT screwed connection.
 - Internal body parts of valves: See interior coating of valves specified herein.
 - Exterior coating of valves: Fusion bonded epoxy following AWWA C550.
 - Approved manufacturers:
 - Crispin Valve Model No. UL-20.
 - APCO, Valve and Primer Corporation Model No. 145C.
 - Val-Matic Valve and Mfg. Corporation Model No. 202C.
5. Combination Air and Vacuum Valves, 3 inch and larger.
- Air and Vacuum Valve installed in combination with Air Release Valve, following AWWA C512.
 - Air Release Valve piped out of side of air and vacuum valve, following Standard Details.
 - Float, plug, guide shafts and bushings: Stainless Steel Type 316.
 - Resilient seats: Buna-N.
 - Metal internal parts and body only.
 - Size: Air and vacuum and air release valve following Drawings.

- f. Configuration: Connecting pipe and gate valve same size as air release valve between combination air and vacuum valve and air release valve.
 - g. Inlet and outlet size:
 - 1) Air and Vacuum Valve: Inlet and outlet type following Drawings (ANSI B16.1, Class 125 or 250 flanges).
 - 2) Air Release Valve: NPT screwed connection.
 - h. Piping layout:
 - 1) See Standard Details.
 - 2) Pressure rating of gate valve: See Drawings.
 - i. Internal body parts of valves: See interior coating of valves specified herein.
 - j. Exterior coating of valves: Fusion bonded epoxy following AWWA C550.
 - k. Approved manufacturer:
 - 1) Model number, outlet, and orifice following Drawings.
 - a) Crispin Valve.
 - b) APCO, Valve and Primer Corporation.
 - c) Val-Matic Valve and Mfg. Corporation Model.
6. Pressure Reducing Valves.
- a. Maintain constant downstream pressure regardless of inlet pressure or flow fluctuations.
 - b. Design: To withstand and operate under non-shock working pressure of 180 psi.
 - c. Valve size: 12 inch and smaller.
 - d. Valve ends:
 - 1) 4 inch and larger: Flange ends, see Joint Material.
 - 2) 3 inch and smaller: NPT screwed connection.
 - e. Valve body: Ductile or Cast Iron with stainless steel trim internally.
 - f. Pressure setting for valve: See Drawings.
 - g. Reducing pilot control:
 - 1) Body: Bronze with stainless steel valve seat ring and seat ring fasteners.
 - 2) Piping and fittings: Bronze with copper.
 - 3) External strainer and ball valves.
 - h. For valves 4 inches and larger:
 - 1) Gage connections on inlet and outlet side.
 - 2) Valve position indicator.
 - i. Internal body parts of valves: See interior coating of valves specified herein.
 - j. Exterior coating of valves: Fusion bonded epoxy following AWWA C550.
 - k. Approved Manufacturers:
 - 1) Cla-Val Co., Model 90G-01ABS KC D.S. for 3 inch and smaller and Model 90G-01BCSY KC D.S. for 4 inch and larger.
7. Pressure Relief Valve.
- a. Normally closed.
 - 1) Open when pressure at valve inlet increases above setting pressure.
 - 2) Outlet side is atmospheric pressure.
 - b. Design: To withstand and operate under non-shock working pressure of 180 psi.
 - c. Valve size: 12 inch and smaller.
 - d. Valve ends: Flange ends, see Joint Material.
 - e. Valve body: Ductile or cast iron with stainless steel trim internally.

- f. Pressure setting for valve: See Drawings.
- g. Relief pilot control:
 - 1) Body: Bronze with stainless steel valve seat ring and seat ring fasteners.
 - 2) Piping and fittings: Bronze with copper.
 - 3) External strainer and ball valves.
- h. Gage connection on inside side.
- i. Internal body parts: See internal coating of valves specified herein.
- j. Exterior coating: Fusion bonded epoxy following AWWA C550.
- k. Approved Manufacturers:
 - 1) Cla-Val Co., Model 50-01BY KC D.S.
- 8. Flap Valve.
 - a. Allow passage of flow in one direction, while preventing reverse flow.
 - b. Flange end: Class 125, ANSI B16.1, suitable for connecting to ductile iron flange pipe.
 - c. Approved manufacturers:
 - 1) Clow Valve Company (Division of McWane, Incorporated), Model No. F-3012.
 - 2) Tideflex Technologies, Inc., Series 35 with stainless steel backup ring.
- 9. Valve Boxes.
 - a. See Standard Details.
 - b. Approved manufacturers:
 - 1) Bingham and Taylor Corporation.
 - 2) Bibby Ste Croix Foundries, Inc.
 - 3) Capitol Foundry of Virginia, Inc.
- 10. Interior Coating of Valves: Fusion bonded epoxy, certified by NSF for contact with potable water following AWWA C550.
- 11. Flange Bolt End Protection in Vaults: Plastic caps, shop or field filled with anti corrosion compound or lubricant.
 - a. Approved Manufacturers:
 - 1) Sap-Seal Products, Inc.
 - 2) Advance Products & Systems, Inc.
 - 3) Or equal.
- 12. Curb Stops: AWWA C800, except with working and test pressures below.

Size In Inches	Water Temperature	Working Pressure	Test Pressure
3/4, 1, & 1-1/4	Up to 100 degrees F	Not less than 150 psi in closed position	Not less than 225 psi in open position
1-1/2 & 2	Up to 100 degrees F	Not less than 200 psi in closed position	Not less than 300 psi in open position

- a. Bronze: Castings manufactured of CDA alloys meeting chemical and physical properties of ASTM B584 and following AWWA C800 and NSF 372.
- b. Copper Tube Connections: Follow AWWA C 800.
 - 1) Flare or compression connection type, fitted with coupling nuts threaded for use with copper service tube type K.

- c. Compression Connections:
 - 1) Elastomer seal to prevent leakage.
 - 2) Corrosion resistant, e.g. stainless steel, split or gripper ring to restrain joint.
 - 3) "Tighten to stop" design
 - 4) Approved Manufacturers:
 - a) A.Y. McDonald Manufacturing Company, Q style.
 - b) Ford Meter Box Company, Q style.
 - c) Cambridge Brass, Q style.
 - d) Mueller Co., 110 style.
 - d. Approved Curb Stop Manufacturers and Models:
 - 1) A.Y. McDonald Manufacturing Company, 6100 series (flare style) and 6100Q series (compression style).
 - 2) Ford Meter Box Co., Inc., B22 (flare style) and B44-Q (compression style) series.
 - 3) Mueller Co., B-25204 series (flare style) and Model No. B25209 series, (compression style).
 - 4) Cambridge Brass, 202-C (flare style) and 202-H (compression style) series.
13. Corporation Stops: ANSI/AWWA C800, except with working and test pressures below.

Size In Inches	Water Temperature	Working Pressure	Test Pressure
3/4, 1, & 1-1/4	Up to 100 degrees F	Note less than 150 psi in closed position	Not less than 225 psi in open position
1-1/2 & 2	Up to 100 degrees F	Not less than 200 psi in closed position	Not less than 300 psi in open position

- a. Bronze: Castings manufactured of CDA alloys meeting chemical and physical properties of ASTM B584 and following AWWA C800, NSF 372.
- b. Type of Threads.
 - 1) Inlet thread: Standard corporation stop thread following ANSI/AWWA C800.
 - 2) Copper tube outlet end: Flare or compression connection type, fitted with coupling nut threaded for use with copper service tube type K following ANSI/AWWA C800.
- c. Compression Connections:
 - 1) Elastomer seal to prevent leakage.
 - 2) Corrosion resistant, e.g. stainless steel, split or gripper ring to restrain joint.
 - 3) "Tighten to stop" design
 - 4) Approved Manufacturers:
 - a) A.Y. McDonald Manufacturing Company, Q style.
 - b) Ford Meter Box Company, Q style.
 - c) Cambridge Brass, Q style.
 - d) Mueller Co., 110 style.
- d. Approved Curb Stop Manufacturers and Models:
 - 1) A.Y. McDonald Manufacturing Company, 4701 B series (flare style) and 4701BQ series (compression style).

- 2) Ford Meter Box Co., Inc., FB600 series (flare style) and FB1000-XQ series (compression style).
 - 3) Mueller Co., B-25000 series (flare style) and B-25008 series (compression style).
 - 4) Cambridge Brass, 301-XXC series (flare style) and 301-XXH series (compression style).
14. Curb Boxes.
- a. See Standard Details.
 - b. Approved manufacturers:
 - 1) Geneco: 1101-2-39.
 - 2) Bingham & Taylor Corporation: ROD-39-WSSC-9010.
- D. Fire Hydrants: Follow AWWA C502 for requirements not included on WSSC approved manufacturer's drawings.
1. Approved Manufacturers and Drawings.
 - a. Kennedy Valve (Division of McWane, Incorporated), Guardian K 81D, following Kennedy Drawing No. 80783 20781, Rev. 18, dated 3/08.
 - b. Mueller Company, Super Centurion 250, following Mueller Drawing No. FH 237, Rev. F, dated 1/14/11.
 - c. United States Pipe Valve and Hydrant Division (Division of Mueller Company), Sentinel 250, following USPV&HD Drawing No. FH 288, Rev. D, dated 1/14/11.
 - d. Clow Valve (Division of McWane, Inc.), Medallion, following Clow Drawing No. D-22742, Rev. B, dated 12/10.
- E. Temporary Bypass Pipe, Hose, Fittings and Valves:
1. Withstand working pressures up to 125 psi.
 2. Follow NSF Standard 14 or 61 for potable water.
 3. Not impart objectionable color, taste, or odor to water being supplied.
 4. Temporary fire hydrant:
 - a. Consist of 4 inch by 4 inch tee or 4 inch 90° bend, with ball valve or equal, connected to end of the tee or bend and operating nut to control the valve.
 - b. Equipped with 4-1/2 inch diameter National Standard threaded nozzle with hydrant cap installed.
- F. Backflow Preventer and Basket Strainer for Temporary Water Main and Hydrostatic Testing: Reduced pressure principal type, flanged and supplied complete with integral valves, following the American Society of Safety Engineers Standard No. 1013 and AWWA C510.
1. Materials: Bronze, or liquid epoxy coated cast iron body with bronze and stainless steel working parts.
 2. Pressure Requirements: Suitable for supply pressure as high as 175 psi and hydrostatic test pressure of 350 psi.
 3. Approved manufacturers:
 - a. Conbraco.
 - b. Febco.

- c. Zurn Industries.
- d. Watts Regulator.
- 4. Basket Strainers.
 - a. Installation: Inlet side of backflow preventer following Drawings.
 - b. Strainers: Flanged ends, unless otherwise noted.
 - 1) Strainer bodies: Ductile iron, gray iron, or bronze and designed to withstand maximum working pressure of 175 psi with tapped opening for flushing strained debris.
 - c. Screens: Unless otherwise noted, stainless steel or brass sheet metal with 1/4 inch perforations.
 - 1) Open area of screen: At least 4 times inside cross-sectional area of pipe.
 - d. Approved manufacturers:
 - 1) Hersey Products, Inc.
 - 2) Mueller Co.

G. Meter Settings.

- 1. Meter Housings:
 - a. Polyethylene Meter Boxes and Extensions.
 - 1) Approved manufacturers:
 - a) Oldcastle Precast, Inc.
 - (1) 24" x 20" Top, Model No. 202001
 - (2) 30" Dia. x 30" H, Model No. 302003
 - (3) 24" x 30" (H), Model No. 242003
 - b) DFW Plastics, Inc.
 - (1) 24" x 20" Top, Model No. DFW242030TP
 - (2) 30" Dia. x 30" H, Model No. DFW3030
 - (3) 24" x 30" H, Model No. DFW2430
 - c) Or equal.
- 2. Meter Setting Outside Water Meters:
 - a. Copper Pipe: Seamless, type K and following ASTM B88.
 - b. Fittings and Accessories: Copper and 85-5-5-5 Red Brass following ASTM B62 and AWWA C800.
 - c. Approved Manufacturers and Models:
 - 1) Ford Meter Box Company.
 - a) 3/4 inch Single Meter Yoke Setter, Model No. YA-3-C13005-001-NL, following Drawing no. C13005-001, Rev. 2 dated 7/29/12 adaptable for 5/8 inch meter using two Ford A13 meter adapters.
 - b) 1 inch Single Meter Setter, Model No. YA-4-13005-003-LEX-NL following Drawing no. C13005-003, Rev. 2 dated 7/27/12.
 - c) 1-1/2 inch Single Meter Setter, Model No. VBB76-C13005-007-NL, following Drawing no. C13005-007, Rev. 1 dated 7/27/12
 - d) 2 inch Single Meter Setter, Model No. VBB87-C13005-004-NL, following Drawing no. C13005-004, Rev. 0 dated 4/10/12.

- e) 3/4 inch Double Meter Yoke Setter, Model No. DYA-3-C13005-006-NL, following Drawing no. C13005-006, Rev. 3 dated 11/27/12 adaptable for 5/8 inch meter using two Ford A13 meter adapters per meter.
 - f) 1 inch Double Meter Setter, Model No. DYA-4-C13005-005-NL, following Drawing no. C13005-005, Rev. 2 dated 7/27/12.
- 2) Mueller Company.
- a) 3/4 inch Single Meter Yoke Setter, Model No. 250B5030----01N, following Drawing no. 250B5030----01N dated 5/29/12. adaptable for 5/8 inch meter using two Ford A13 meter adapters.
 - b) 1 inch Single Meter Setter, Model No. 330B5040----01N, following Drawing no. 330B5040----01N dated 5/30/12.
 - c) 1-1/2 inch Single Meter Setter, Model No. 109B2422----05N, following Drawing no. 109B2422----05N dated 5/30/12.
 - d) 2 inch Single Meter Setter, Model No. 108B2426----05N following Drawing no. B2426----05N received 5/30/12.
 - e) 3/4 inch Double Meter Yoke Setter, Model No. 250B5030----02N, following Drawing no. 250B5030----02N, Rev. 0 dated 5/30/12, adaptable for 5/8 inch meter using two Ford A13.
 - f) 1 inch Double Meter Setter, Model No. 330B5040----02N, following Drawing no. 330B5040----02N, Rev. 0 dated 5/29/12.
- 3) A.Y. McDonald Manufacturing Company.
- a) 3/4 inch Single Meter Yoke Setter, Model No. 714G3--JJCC 44, following Drawing no. E-1-10077, Rev. A dated 6/15/12, adaptable for 5/8 inch meter using two A.Y. McDonald 10J13 meter adapters.
 - b) 1 inch Single Meter Setter, Model No. 714G427--JJQQ 660X375, following Drawing no. E-1-10076, Rev. A dated 6/15/12.
 - c) 1-1/2 inch Single Meter Setter, Model No. 721-727--WWQQ 770X13.25X375, following Drawing no. E-1-10080, Rev. A dated 6/15/12.
 - d) 2 inch Single Meter Setter, Model No. 31-724--WWQQ 770, following Drawing no. E-1-5915, Rev. 0 dated 8/3/05.
 - e) 3/4 inch Double Meter Yoke Setter, Model No. 714H327--JJQQ 64 X375, following Drawing no. E-1-10079, Rev. B dated 7/23/12, adaptable for 5/8 inch meter using two A.Y. McDonald 10J13 meter adapters per meter.
 - f) 1 inch Double Meter Setter, Model No. 714H427--JJQQ 76X375 following Drawing no. E-1-10078, Rev. A dated 6/15/12.
- 4) Cambridge Brass.
- a) 3/4 inch Single Meter Yoke Setter, Model No. 6029NL-300C4C4-UU following Drawing no. 6029NL-300C4C4-UU, Rev. C dated 12/13/12, adaptable for 5/8 inch meter using two Ford A13 meter adapters per meter.
 - b) 1 inch Single Meter Setter, Model No. 6029NL-427H6H6-UU following Drawing no. 6029NL-427H6H6-UU, Rev. E dated 12/13/12.

- c) 1-1/2 inch Single Meter Setter, Model No. 6020NL-627H7H7-UU following Drawing no. 6020NL-627H7H7-UU, Rev. C dated 6/13/12.
 - d) 2 inch Single Meter Setter Model No. 6040-7__H7H7-UU following Drawing no. 6040-7__H7H7-UU, Rev. A dated 2/8/08.
 - e) 3/4 inch Double Meter Yoke Setter, Model No. 6029DNL-327H6H5-UU following Drawing no. 6029DNL-327H6H5-UU, Rev. D dated 12/13/12, adaptable for 5/8 inch meter using two Ford A13 meter adapters per meter.
 - f) 1 inch Double Meter Setter, Model No. 6029DNL-427H7H6-UU following Drawing no. 6029DNL-427H7H6-UU, Rev. D dated 12/13/12.
3. Outlet Caps.
- a. Approved Manufacturer and Models:
 - 1) Polymer Molding, Inc.
 - a) 1 inch type K copper, blue polyethylene end cap, Model No. C-1-1/8.
 - b) 1-1/2 inch type K copper, blue polyethylene end cap, Model No. C-1-5/8.
 - c) 2 inch type K copper, blue polyethylene end cap, Model No. C-2-1/8.
 - 2) Or equal.
4. Meter Frames and Covers.
- a. Castings.
 - 1) Iron melted by any process following ASTM A48, Class 35 minimum.
 - 2) Surfaces: Sandblast clean or other approved process. Paint clean and rust free surface with 1 coat of asphaltum or coal tar.
 - b. Approved Manufacturers:
 - 1) A.Y. McDonald Manufacturing Company.
 - a) 11-1/2 inch single recess frame and cover for 20 inch diameter (at top) meter housing, 3/4 inch and 1 inch single meter setting, Model No. 74M3ACLBRTC.
 - b) 11-1/2 inch double recess frame and cover for 20 inch diameter (at top) meter housing, 3/4 inch and 1 inch double meter setting, Model No. 74M3ACLBRTT.
 - c) 20 inch single recess monitor frame and cover for 30 inch diameter meter housing, 1-1/2 inch and 2 inch single meter setting, Model No. 74M30RTLB.
 - 2) Bingham & Taylor Corporation.
 - a) 11-1/2 inch single recess frame and cover for 20 inch diameter(at top) meter housing, 3/4 inch and 1 inch single meter setting, Model No. BTA-3C/11 1/2 inch BTC3L-WS.
 - b) 11-1/2 inch double recess frame and cover for 20 inch diameter (at top) meter housing, 3/4 inch and 1 inch double meter setting, Model No. BTA-3C/11 1/2 inch BTC3L-WSDD.
 - c) 20 inch single recess monitor frame and cover for 30 inch diameter meter housing, 1-1/2 inch and 2 inch single meter setting, Model Nos. BTA2030MFC-WS and IND2030MFCWS.
 - 3) Vestal Manufacturing Company.

- a) 11-1/2 inch single recess frame and cover for 20 inch diameter (at top) meter housing, 3/4 inch and 1 inch single meter setting, Model No. 32-709 (BRMRC-20L W/LN W/RTR)
 - b) 11-1/2 inch double recess frame and cover for 20 inch diameter (at top) meter housing, 3/4 inch and 1 inch double meter setting, Model No. 32-711 (BRMRC-20L W/LN W/2RTR).
 - c) 20 inch single recess monitor frame and cover for 30 inch diameter meter housing 1-1/2 and 2 inch single meter setting, Model No. 32-048(ER2030) and 32-479 (MONITOR R&C W/LN W/RTR).
- H. Field Applied Coating: Cold applied petrolatum or petroleum wax.
 - 1. Primer, Mastic, and Tape/wrap: AWWA C217 and manufactured for buried or submerged applications.
 - 2. Petrolatum or Petroleum Wax Tape/Wrap: Minimum thickness of 40 mils.
 - 3. Approved Manufacturers:
 - a. Central Plastics Company.
 - b. Denso Incorporated.
 - c. Tapecoat Company.
 - d. Trenton Corporation.
- I. Polyethylene Encasement: AWWA C105.
 - 1. High-density cross-laminated polyethylene film (minimum 4 mil) or linear low-density polyethylene film (minimum 8 mil).
 - 2. Polyethylene flat tube: Meet appropriate minimum width for size of pipe installed following AWWA C105, Method A, secured with polyethylene compatible adhesive tape.
 - 3. Flat sheet polyethylene: Used for wrapping odd shaped appurtenances following AWWA C105, secured with polyethylene compatible adhesive tape.
 - 4. Approved Manufacturers:
 - a. AA Thread Seal Tape, Inc.
 - b. Repcor, Inc.
 - c. Infinity Plastics, Inc (except for 4 mil film, 3"-8")
 - d. Sigma Corporation
 - e. Trumbull Industries, Inc.
- J. Restrained Joint Pipe Tape.
 - 1. Description:
 - a. Material: Non-detectable type, low density, virgin grade polyethylene, acid and alkali resistant; minimum wetting tension: 35 dynes/cm, ASTM D2578.
 - b. Tape Size: 6-inch width, 4 mils thickness.
 - c. Printing: Two lines with minimum 1 inch height letters with "No-Dig Symbol" following each cycle of text.
 - 1) First line: "CAUTION-RESTRAINED JOINT PIPE" repeated every 20 to 24 inches.
 - 2) Second line: "CALL WSSC 301-206-4002"
 - d. Colors:

- 1) Tape: APWA Red.
 - 2) Lettering: Permanent Black.
2. Approved Manufacturers:
 - a. Empire Level Manufacturing Corporation, Utility Products Division, Shieldtec Underground Warning Tape.
 - b. Blackburn Manufacturing Co., Inc., Non-Detectable Underground Utility Warning Tape.
 - c. Reef Industries, Inc. Terra Tape Standard Non-Detectable.
 - d. Mutual Industries, Non-Detectable Underground Marking Tape.
 - e. Pro-Line Safety Products (A Division of Pro-Pak Ind., Inc.), Standard Non-Detectable.
 - f. Or equal.
- K. Tracer wire for PVC Pipe: TW, THW, THWN, or HMWPE insulated single-strand copper, 10 gauge or thicker wire.
- L. Rubber Annular Hydrostatic Sealing Devices.
 1. Rubber annular sealing device:
 - a. Modular mechanical type, utilizing interlocking synthetic rubber shaped to continuously fill the annular space between the pipe sleeve or opening and carrier pipe.
 - b. Links when assembled to form a continuous rubber belt around the pipe, with a pressure plate under each bolthead and nut.
 2. Materials.
 - a. Pressure Plate: Delrin Plastic ASTM D2133.
 - b. Bolts and nuts for links: Stainless Steel Type 303 or 316.
 - c. Sealing element: EPDM.
 3. Size of wall sleeve: To accommodate the carrier pipe, size as recommended by rubber annular seal manufacturer.
 4. Approved Manufacturers:
 - a. Pipeline Seal and Insulator, Inc. (Link-Seal).
 - b. Advance Products and Systems, Inc. (Innerlynx).
 - c. Or approved equal.
- M. Pipe Embedment Material: See Section 02315.
- N. Concrete: See Section 03300.
- O. Reinforced Concrete Casing Pipe: See Section 02445.
- P. Masonry: Work: See Section 04200.
- Q. Precast Concrete: See Section 03400.
- R. Wood for Blocking, Valve, and Meter Box Installations: See Standard Details.

S. Castings: Gray iron and following Section 05500.

T. Access Manhole: See Standard Details.

2.2 SOURCE QUALITY CONTROL

- A. Notify Engineer following Section 01450 for performance of factory tests required herein.
 - 1. Factory hydrostatically test 16 inch and larger diameter Class 125 double disc gate valves following AWWA C500.
 - 2. Factory hydrostatically test 16 inch and larger diameter resilient seated gate valves following AWWA C509.
 - 3. Factory hydrostatically test 16-inch and larger diameter Class 250 double disc gate valve to pass hydrostatic test of 400 psi applied between discs with no visible leakage through the metal, flanged joints, or stem seals.
 - a. Double disc gate valves:
 - 1) Test valve seats to pass factory leakage test with water between gates at working water pressure of 250 psi.
 - 2) Allowable leakage past either seat not to exceed rate of 1.0 oz./hour/inch of nominal valve size.
 - 4. Operation test for gate valves 16 inch and larger diameter: AWWA C500 and C509.

PART 3 EXECUTION

3.1 PUBLIC NOTIFICATION

- A. See Section 01110.

3.2 INSTALLATION OF WATER MAIN

- A. Inspection of Delivered Materials: See Section 01450.
- B. Handling of Pipe and Fittings: Ductile iron pipe and fittings, valves, and appurtenances following AWWA C600, and PVC pipe following AWWA C605.
 - 1. If damage or coating abrasion occurs and is repairable, repair following approved manufacturer's recommendations.
 - 2. Cement Mortar Lining:
 - a. Remove and replace rejected pipe, fittings or appurtenance at Contractor's expense.
 - b. Field cut and remove damaged section of pipe to 6 inches beyond damaged lining.
 - 3. Coated pipe.
 - a. Repair as directed by coating manufacturer.
 - b. Test coating for flaws electrically with holiday detector, following NACE SP0274 or SP0188. Repair holidays and recheck. Coating must be verified free of holidays prior to use.

4. Remove pipe, fittings, and valves when contaminated with oil, gasoline, kerosene, or other material that damages coating, and replace at no cost to the Commission.
 5. Remove foreign matter from each pipe, fitting, and valve before installing polyethylene encasement and placing in trench.
 6. Keep interior of pipe clean during installation and thereafter.
 7. Should foreign material or contaminants be observed in previously installed pipe, fittings, and valves, cease work until foreign material is removed or contaminated pipe, fittings, and valves are decontaminated or replaced.
 8. Close open ends of pipes and fittings with watertight seal during periods when work is not proceeding.
- C. Trench Excavation, Backfill, and Test Pits: Follow Section 02315 and as specified herein.
1. Before pipe installation:
 - a. Dig test pits to determine size, type, and exact location of existing pipe to which proposed pipe will connect.
 - b. Excavate sufficient trench in advance and test pit all existing underground utilities or structures, whether shown on Drawings or visually identified in the field, to:
 - 1) Verify actual locations.
 - 2) Make reasonable changes in line and grade to resolve conflicts, with Engineer's approval.
 - c. Furnish Engineer location and elevation information when previously unknown or different underground utilities or structures are encountered.
 2. Perform additional work made necessary because of failure to take above precautions at no cost to the Commission.
- D. Pipe Placement.
1. Excavate bell holes at each joint to assemble joint so entire length of each pipe barrel, fitting, and valve is supported on firm bedding or soil.
 2. Field Cutting: Smooth and at right angles to pipe axis with cutting/joints to meet pipe locations and elevations shown on Drawings.
 3. Joint Deflections: Follow manufacturer's recommendations.
 - a. Do not deflect PVC pipe at connection to DIP or fittings.
 4. Encase DIP and fittings, except externally coated pipe, in polyethylene:
 - a. DIP: AWWA C105, for Method A, secured with polyethylene compatible adhesive tape.
 - 1) Seal polyethylene with minimum two layers of tape on the DIP and overlap polyethylene at joint to provide double layer of polyethylene, secure end with minimum two layers of tape.
 - 2) Along pipe barrel, take up slack in polyethylene tube, making snug but not tight fit. Fold over on top of pipe and secure in place every three feet along the barrel of pipe with minimum 6-inch length of tape.
In wet trench area, secure in place every two feet along barrel of pipe with minimum one layer of tape around the pipe.
 - 3) For odd-shaped appurtenances, use flat sheet polyethylene: AWWA C105, Section 4.4.4, secure ends with minimum two layers of tape.

- b. PVC pipe: Encase ductile iron fittings and valves in polyethylene as specified herein. Overlap polyethylene onto PVC pipe minimum 6 inches.
- c. Fire hydrant lead pipe: Use DIP and fittings and encase in polyethylene following Standard Details.
- d. Before backfilling, inspect polyethylene for rips, punctures and other damage and repair following AWWA C105.
- 5. After placement of pipe, fittings, and valves with External Coating system and before backfilling, inspect coating for possible damage.
 - a. If damage is detected, repair and holiday test as stated herein.
- 6. PVC AWWA C900 and C905 Pressure Pipe:
 - a. Make changes in horizontal, vertical, and curved alignment shown on Drawings by using fittings, high-deflection coupling, or joint deflections in the amount permissible by manufacturer's recommendations.
 - b. Use short lengths of pipe as necessary to accomplish curvature without exceeding individual allowable joint deflections specified by manufacturer.
 - c. Do not bend pipe.
 - d. Tracer Wires for PVC Pipe:
 - 1) Tape wire to top of pipe using PVC tape every 4 feet along the pipe, and on each side of each fitting.
 - a) Tape: Minimum 2 inches wide and wrapping full circumference of pipe.
 - 2) Where required, splice with direct-bury wire connector, wire nut, or splice kit and install as recommended by manufacturer. Protect and secure splice to pipe specified above.
 - 3) Terminate tracer wire following Standard Details.

E. Restrained Joints and Buttresses.

- 1. General: Make provisions for counteracting expected thrust due to static and dynamic forces including surge at bends, tees, reducers, valves, fire hydrants, and dead-ends whether or not shown on Drawings.
- 2. Restrained Joints: Provide following Drawings and Standard Details.
 - a. Mark restrained joints at crown with 2 foot long by 4 inch wide orange paint stripe perpendicular to and centered on joint.
 - b. If testing pipeline for own convenience before backfilling is complete, provide adequate temporary blocking at no cost to the Commission.
 - c. Install restrained joints on pipe following Standard Details and manufacturer's recommended installation procedures.
 - 1) Place "RESTRAINED JOINT PIPE" tape on outside of polyethylene encasement at top of pipe with restrained joints before backfill operations have reached top of pipe.
 - a) PVC Water Main: Place "RESTRAINED JOINT PIPE" tape under tracer wire.
 - b) Secure "RESTRAINED JOINT PIPE" tape to polyethylene encasement every 4 feet along the pipe, and on each side of each fitting, using polyethylene compatible adhesive tape, wrapping full circumference of pipe.

- 2) Continue backfill operations following specifications and avoid displacement of warning tape.
- d. Apply field coating wherever restraining device installation results in bare metal surfaces, including all thread and re-bar: See FIELD APPLIED COATING OF EXPOSED FERROUS METAL specified herein.
- 3. Buttresses and Anchors: See Drawings and Standard Details. Engineer may inspect and approve excavations before buttresses and anchors are placed.
 - a. Entire face of excavation against which buttresses will bear: Firm bearing, flat and at proper angle to pipeline and reaction force.
 - b. Wood form both sides of buttress and maintain dimensions following Standard Details. Protect mechanical joint bolts from concrete.

3.3 JOINTS

A. Mechanical Joints.

- 1. Before assembling joint, clean both bell and plain end of rust and foreign matter.
- 2. Assemble joint following AWWA C111, C600, C605 and specified herein.
- 3. For pipe plain ends to be inserted into mechanical joint bells, square cut and bevel end.
 - a. Clean and lubricate joint surfaces.
 - b. Place gland on plain end followed by gasket and insert pipe into bell.
 - c. Press gasket firmly and evenly into bell recess to center plain end in bell.
 - d. Keep joint straight during assembly.
 - e. Make deflection after joint assembly but before tightening bolts.
 - 1) Do not deflect PVC pipe at connection to ductile iron or cast iron pipe or fittings.
 - f. Complete joint by alternate tightening of bolts with torque wrench set between:
 - 1) 45-60 foot/pounds for 3 inch diameter.
 - 2) 75-90 foot/pounds for 4 inch through 24 inch diameter.
 - 3) 100-120 foot/pounds for 30 inch and 36 inch diameter.
 - 4) 120-150 foot/pounds for 42 inch and 48 inch diameter.
 - g. Tighten bolts so gland and face of bell have approximately same distance between them at all times.
- 4. Where satisfactory sealing of joint is not attained at maximum permissible torque, disassemble, reclean, and reassemble joint with new gasket.
- 5. Coat uncoated metal components following FIELD APPLIED COATING OF EXPOSED FERROUS METAL specified herein.

B. Push on Joints.

- 1. File or grind bevel on plain end of field cut pipe lengths to resemble pipe as manufactured so plain end will slip into bell without hindrance or gasket damage.
 - a. Place identifying mark on pipe that is not furnished with depth mark on plain end to show depth of bell and to verify that pipe is fully set in bell.
- 2. Assemble joints following AWWA C600, AWWA C605 and specified herein.
 - a. Clean inside of bell and outside of plain end to obtain clean, smooth surfaces free of foreign matter.

- b. Insert gasket in bell.
 - c. Do not damage rubber to metal bond on restrained gaskets.
 - d. Apply thin film of gasket lubricant furnished by joint manufacturer to inside surface of gasket and to outside surface of plain end.
 - e. Push plain end into bell.
 - f. Keep joint straight while pushing.
 - g. Complete joint by forcing spigot into bell up to depth mark on spigot, using equipment designed for purpose.
 - h. DIP: Make deflection after joint is completely home.
 - 1) Do not deflect PVC pipe at connection to ductile iron or cast iron pipe or fittings.
 - i. Assembly of PVC plain end into bell: Follow PVC pipe manufacturer's recommendations.
 - j. Install restrained joints following manufacturer's recommendations.
3. Assemble proprietary restrained joint pipe and fittings following "Assemble Joints" specified above and with modifications below.
 - a. Fully extend assembled joints.
 - b. Protect exposed nuts, bolts and exposed ferrous metals following FIELD APPLIED COATING OF EXPOSED FERROUS METAL specified herein.
 - c. Make connections to field cut restrained pipe with restrained push on joint kits or mechanical joint solid sleeves restrained with wedge action restrainer glands specified herein.
 - d. No field welding of retainer rings.
 4. Coat uncoated metal components following FIELD APPLIED COATING OF EXPOSED FERROUS METAL specified herein below.

C. Flanged Joints.

1. Remove grease from flange surface using solvent-soaked rag and wipe clean of dirt and grit.
2. Align flanges accurately, using spirit level, and pipe properly supported before gasket and bolts are inserted.
 - a. Carefully place rubber gasket to ensure full flow and proper sealing of joint.
 - b. Give bolt threads light coat of thread lubricant and then insert and turn nuts by hand.
 - c. Pull up bolts with wrench, employing crossover method.
 - d. Bolt lengths and required torque: Follow manufacturer's requirements.
3. Coat uncoated metal components following FIELD APPLIED COATING OF EXPOSED FERROUS METAL specified herein below.

D. Mechanical Couplings.

1. Assemble mechanical coupling joint by placing coupling pieces on pipe ends and then place pipe ends together.
 - a. Do not exceed tolerance between pipe ends of 1/2 inch.
 - b. If tolerance is more than 1/2 inch, provide pipe spacer with 1/2 inch tolerance.
 - c. Do not exceed coupling manufacturer's recommendations for spacer size for leak proof joint assembly.

- d. Slide middle ring so it is centered at pipe ends juncture.
 - e. Place gaskets and follower rings in place and bolt up.
 - f. Tighten bolts to torque recommended by manufacturer.
- 2. Coat uncoated metal components following FIELD APPLIED COATING OF EXPOSED FERROUS METAL specified herein.
- E. Solid Sleeves.
 - 1. Install solid sleeves following Standard Detail and specified herein.
 - a. Insert spacer cut from same type and size of pipe being used inside of sleeve when using one solid sleeve.
 - 2. Coat uncoated metal components following FIELD APPLIED COATING OF EXPOSED FERROUS METAL specified herein.
- F. Polyethylene Encasement of Joints: When it is impractical to encase joints with polyethylene tubing, wrap joints with flat sheet or split length of polyethylene tube specified herein. Seal polyethylene with minimum two layers of polyethylene compatible adhesive tape.

3.4 FITTINGS, VALVES, AND ADAPTORS

- A. Install fittings and valves following Drawings.
 - 1. See Field Testing for testing before installation.
 - 2. Set fittings and valves and join pipe as specified previously herein.
 - 3. Where valves occur on end of pipeline, place plug, cap, or blind flange and secure in exposed bell before backfilling trench.
- B. Polyethylene Encasement: Wrap ductile iron fittings, blind flanges, plugs, caps, valves and other odd shaped appurtenances with polyethylene encasement following AWWA C105 and as specified herein.
- C. PVC pipe: Terminate tracer wire at bolt on fire hydrant base elbow.
- D. Install valve box with extension stem where shown or required for nut operated valves following Standard Details.
- E. Set valve box at right angle to water main, centered and plumb over valve operating nut with box cover flush with surface of finished grade or as otherwise directed.
 - 1. Before installation, exercise valve for proper working order.
 - 2. Backfill and compact under and around valve boxes to ensure no vertical loads are transmitted to valve operators or bonnets.
 - 3. When valve box is located in unpaved area to be improved, provide marker stake consisting of a piece of 2 inch by 4 inch lumber, minimum of 5 feet long and painted blue its entire length, adjacent to valve box with approximately 3 feet extended above ground.

- F. Install PCCP adapter following manufacturer's recommendations to include maximum joint opening and diapering of finished joint.
- G. Protect flange bolt thread ends and heads exposed inside vaults with properly sized bolt end protector caps filled with anti-corrosion compound or lubricant.
- H. PVC fittings: Use pressure class for fitting that is the same as, or greater than, the pressure class of the pipe to which it connects. If the pressure class is not available, use ductile iron fitting. Where fitting with restrained joints is required, use ductile iron mechanical joint.

3.5 FIRE HYDRANTS

- A. Install fire hydrants where indicated on Drawings following Standard Details. Place streamer outlet perpendicular to street.
- B. Install fire hydrant lead connection level, unless shown otherwise on Drawings.
- C. Replacing Existing Fire Hydrant to Existing Main: Follow Drawings, Standard Details and as specified herein.
 - 1. Blow off hydrant to confirm water flow (attach diffuser unless connecting to sanitary sewer).
 - 2. Leave hydrant open and close lead valve.
 - 3. Confirm fire hydrant flow has stopped.
 - 4. Test pit on lead valve and tee only to confirm existence and condition of strapping.
 - 5. Install or replace strapping as necessary from tee to valve.
 - 6. Install new lead pipe and fire hydrant to existing tee, following Standard Details.
 - 7. Remove and salvage valve and fire hydrant and deliver to Commission warehouse or as noted on Drawings.
- D. Poured Lead Joint Lead Valve and Fittings:
 - 1. Before removing existing tee and valve, clean existing pipe and check pipe for:
 - a. Lead joint valve and fittings larger than 16 inches in diameter, check outside diameter and roundness to verify that new solid sleeve and pipe will be watertight, before removing existing pipe, valves and fittings.
 - b. Lead joint valve and fittings 16 inches and smaller in diameter, with outside diameter or roundness not suitable for watertight connection, abandon as directed by Engineer.
 - 2. Do not cut existing pipe closer than 18 inches to joint bell unless joint bell will be removed.
 - 3. Reconnect existing main with new tee and solid sleeve, and install new valve, lead pipe and fire hydrant to existing tee following Standard Details.

3.6 WATER SERVICE CONNECTIONS

- A. Install water service connections from main water line to property lines at elevations indicated on Drawings, Standard Details, or at Engineer's direction.
 - 1. When elevations are not shown, install water service connections with minimum cover of 42 inches.
 - 2. To make direct service taps, apply 2 to 3 layers of polyethylene compatible adhesive tape completely around polyethylene encased pipe to cover area where tapping machine and chain will be mounted or minimum of 12 inches. Direct tap through the taped polyethylene encasement.
 - 3. When connecting to existing polyethylene encased cast or ductile iron water main, wrap water service connection pipe 3 feet from main (including corporation stop and saddle) with polyethylene encasement following AWWA C105. Seal polyethylene with minimum 2 layers of tape.
 - 4. When connecting to existing non-polyethylene encased cast or ductile iron water main, provide service insulator and field applied coating on:
 - a. Exposed water main up to 3 feet both sides of the tap (including service saddle, if used).
 - b. Service connection from water main for distance of 3 feet (including service insulator) following Standard Details and specified herein.
 - 5. Use copper pipe bending tools.
 - 6. Mark location of end of water service connection pipe at property line with piece of 2 inch by 4 inch lumber, painted blue its entire length, placed vertically from bottom of trench and extending 2 feet above grade.
 - 7. For connections from PVC water pipe, install tracer wire along the top of the water service connection pipe. Follow Tracer Wires for PVC Pipe, specified herein and Standard Details.
- B. Perform tapping of water main and insertion of corporation stop by qualified personnel having in their possession qualification card issued by the Commission for performance of this work.
 - 1. When no source of water is available from existing mains, provide potable water.
 - a. Maintain 60 psi pressure during service connection tapping process.
 - 2. Use wrenches with smooth jaws of proper size to install corporation stops and connect pipes thereto. Do not use wrenches with jaws that will score brass or copper.
 - 3. Maintain minimum of 18 inches between taps, minimum 18 inches clear from DIP bells and minimum 24 inches clear from PVC pipe bells.
 - 4. Install service saddle when tapping 3 or 4 inch diameter water main and for taps larger than 1 inch diameter on 6 inch through 12 inch diameter water mains.
 - 5. After installing saddle, field coat saddle, straps, and associated hardware following FIELD APPLIED COATING OF EXPOSED FERROUS METAL specified herein.
 - 6. After making tap and completing service connection, blow off at curb stop, pressurize, check for leaks to curb stop, and leave corporation stop in open position.
 - 7. Backfill excavated area around pipe following Section 02315 and Standard Details.
 - 8. Do not dry tap ductile iron mains without Engineer's approval.
 - a. If so approved, make tap as specified herein, including lubrication of stop during installation.

- b. Keep trench open at tap until water main has been placed in service so tap can be inspected for leakage.
- 9. PVC Water Pipe: Use of Service-tee fittings or service couplings permitted.
- 10. Tapping of PVC Pipe: AWWA C605, pipe manufacturer's recommendations, and specified herein.
- C. Assemble compression joints for type K copper pipe according to manufacturer's recommendations.
 - 1. Prepare copper pipe for connection by cleaning, deburring and rounding.
 - 2. When rounding, use copper pipe rounding tool as recommended by compression manufacturer.
 - 3. Insert pipe into connection until it is completely home, tighten nut until it stops turning at end of its internal threads.
 - 4. Pressure test connection prior to backfilling.
- D. Install service connections with outside meters following Drawings, Standard Details and as specified herein.
 - 1. Mark location of the outside water meter with a piece of 2 inch by 4 inch lumber, painted blue its entire length, placed vertically along side the setting from bottom of excavation and extending 2 feet above grade.
 - 2. Locate lumber within one foot horizontally of setting.
 - 3. Paint 4 inch high letters "WATER METER" in black on both sides of the lumber above grade.
- E. Right of way service connections: Extend to right of way or property line, whichever is closer to main.
- F. For service connections 3 inch and larger diameter, install bends as required.
- G. Replacement of Service Connections.
 - 1. Minimum size copper pipe to property line, or as directed by Engineer.
 - a. 1 inch for any existing connections of 1 inch or smaller in diameter.
 - b. 1 1/2 inch for any existing connections of 1 1/4 and 1 1/2.
 - 2. Utilize existing tap at water main unless otherwise directed by Engineer to:
 - a. Abandon existing tap and retap main line water pipe, or
 - b. Remove existing tap and plug hole.
 - 3. Replace existing curb stop or meter setting.
 - a. Use freeze coupling to cut off flow from existing water service connection. Do not use crimping tools.
- H. Area Service Connection Contracts Only.
 - 1. Engineer will issue an average of 3 work orders per week for water service connections; to be constructed in the order they are received, or as directed by Engineer.

2. Schedule work orders designated as health hazards to be substantially completed within 10 working days and other work orders to be completed within 20 working days of issuance.
3. Provide sufficient equipment and work forces to commence and complete each connection within prescribed timeframe.
4. When directed to mobilize to site designated as Emergency by Engineer start within 24 hours.
 - a. Cost incurred by the Commission due to work orders not completed within timeframe specified herein may be deducted from monies owed Contractor.
 - b. Issuance of new work orders may be suspended until outstanding work orders are completed.
 - c. Complete cleanup, restabilization, and restoration as weather permits on each service connection location before leaving site to commence work at another location.
 - 1) Restore non-paved areas following Section 02920.

3.7 CHLORINATION

- A. Chlorinate and dechlorinate following Section 02511 and specified herein.
- B. Install 1 inch or 2 inch diameter corporation stops and couplings in water mains for chlorination as required.
 1. Remove stops not used for services and replace with plug.
- C. While the sample analysis is being performed, Contractor may pressurize main for purpose of making taps for service connections, by installing temporary jumper with approved backflow preventer to isolate main.
 1. Remove as soon as taps are completed.
- D. Place mains in service when analysis is complete and approved by Engineer.

3.8 VAULTS AND MANHOLES

- A. Access Manhole: Required when shown on Drawings and following Standard Details.
- B. Valve Vaults and Manholes: See Drawings, applicable sections of specifications, and Standard Details.

3.9 LINESTOP

- A. Before ordering linestop tapping saddle assembly.
 1. Clean existing pipe, make circumferential measurement of pipe and check for roundness to verify sleeve will fit.

2. Repair any damage to existing pipe coating with suitable coating material to original line of coating as directed by pipe manufacturer's technical representative at no additional expense before backfilling.

B. Installation of linestop.

1. Excavate around existing pipe so as not to disturb thrust blocking.
2. Clean existing pipe.
3. Check pipe outside diameter and roundness to verify assembly will fit.
4. Provide all materials and equipment, to perform installation of linestop.
5. Provide blocking/support following Drawings.
6. Approved Tapping Equipment Fabricator/Installer to install tapping saddle assembly to pipe and to insert linestop into pipe for line isolation.
7. After linestop is no longer required, approved Tapping Equipment Fabricator/Installer to remove linestop and install completion plug and blind flange.

3.10 CONNECTION TO EXISTING MAIN BY TAPPING ASSEMBLY OR SLEEVE

A. Before ordering Tapping Assemblies or Tapping Sleeves for existing pipe larger than 12 inches:

1. Confirm existing pipe type, clean pipe, make circumferential measurement and check for roundness of pipe to verify sleeve will fit.
2. Repair any damage to existing pipe coating with suitable coating material to original line of coating as directed by pipe manufacturer's technical representative at no additional expense before backfilling.

B. Tapping Assembly and Valve Procedure for PCCP.

1. Before placing assembly:
 - a. Clean existing PCCP.
 - b. Check pipe outside diameter and roundness to verify assembly will fit.
2. Install assembly and valve.
3. Keep center of assembly within middle third of standard nominal length of PCCP.
4. Air test or hydrostatically test assembly following manufacturer's instructions to ensure watertightness in presence of Engineer before making tap.
5. Encase steel saddle and U-bolts in concrete following manufacturer's recommendations.

C. Tapping Sleeve and Valve Procedure for Gray Iron and DIP and PVC pipe.

1. Before Tapping Pipe:
 - a. Clean existing pipe and check pipe outside diameter and roundness to verify that sleeve will fit.
 - b. Install test plug on sleeve for field pressurization of sleeve, valve and tapping machine assembly.
 - c. Air test or hydrostatically test sleeve following manufacturer's instructions to ensure watertightness in presence of Engineer.
2. Install sleeve and valve.

3. Keep closest edge of sleeve minimum of 9 inches from face of existing joint bell for ductile iron and gray iron pipe.
4. In addition to cast markings required in AWWA C110, cast or stencil with waterproof paint, the class designation of connecting pipe (AB or CD).
5. PVC Pipe:
 - a. Use only cutting/tapping tools and machines made specifically for cutting AWWA C900 pipe.
 - b. Keep closest edge of sleeve minimum of 15 inches from face of existing joint bell.
 - c. Install tapping machine without damage, scarring, or distortion to pipe.
 - d. Support tapping sleeve and valve so its weight is not carried by pipe.
 - e. Before backfilling, fill void under sleeve with compacted granular material or flowable fill.
6. After tapping sleeve installation is complete on existing gray iron or DIP, field coat tapping sleeve following FIELD APPLIED COATING OF EXPOSED FERROUS METAL specified herein.

D. Approved Tapping Contractors.

1. All Counties Tapping & Testing Inc., 4-12 inch DI/CI.
2. Antron Tapping Service, Inc., 4-12 inch DI/CI/PCCP.
3. Aqua New Jersey, Inc., 6-20inch CI/PCCP.
4. B. K. Utilities Tapping Service, 4-12 inch DI/CI.
5. Cherry Hill Construction, Inc., 1-24 inch, DI/ CI/ PCCP/Transite (asbestos cement).
6. DHC Corporation, 4-12 inch DI/CI.
7. Hydra Stop, Inc., all sizes DI/CI/PCCP.
8. Hydro Tap Service, Inc., 4-16 inch DI/CI, all sizes PCCP, and linestops.
9. Mega Tap, 1-12 inch DI/CI/PCCP.
10. Owens & Dove, 4-16 inch DI/CI/PCCP.
11. Penniman & Browne, Inc., 1/2-16 inch PCCP/PVC/DI/CI/RCP/steel.
12. Pennsylvania American Water, 6-20 inch CI/ DI/ Transite (asbestos cement)/PCCP.
13. Price Brothers, all sizes PCCP.
14. Pro Tapping, Inc., 3/4-36 inch DI/CI/PCCP/Transite (asbestos cement).
15. Quality Cut Tapping Service, 4-16 inch DI/CI/PCCP.
16. TDW Services, Inc., all sizes DI/CI/PCCP.
17. The Sunbury Municipal Authority, 4-24 inch CI.
18. W. D. Fox Tapping and Welding, Inc., DI/CI/Transite (asbestos cement)/PCCP.
19. Western Berks Water Authority, 36" x 16" DI.

3.11 INSTALLATION OF CASING PIPE IN OPEN CUT

- A. Install casing pipe in open cut following Section 02315 and 02530, and specified herein.

3.12 CONNECTIONS TO EXISTING MAINS

- A. Certain information is shown on Drawings relative to existing pipe and other construction.

1. This information was transferred from existing records and is not guaranteed to be accurate.
- B. Before pipe installation see Excavation under INSTALLATION OF WATER MAIN previously specified herein.
1. Do not cut existing pipe closer than 18 inches to joint bell unless joint bell will be removed.
- C. Shutdowns.
1. Mains smaller than 16 inches: Operate valves for shutdown. Mains 16 inches and larger: Commission will operate valves for shutdown.
 - a. The Commission cannot warrant that mains will be dry and free from all leakage.
 - b. After bacteriological analysis is completed and approved by the Engineer, provide written request to shut down main 3 working days prior to intent.
 - c. When new PRV is added to system and/or pressure zone boundary changes are required, provide written request to shut down main 5 working days prior to intent.
 - d. Intent to shut down mains between the hours of 4 p.m. and 7:30 a.m. and on Saturdays, Sundays, and holidays requires 5 working days written request.
 - e. Shutdowns will not occur without Engineer's approval and in the presence of his/her designee.
 2. Pump and dewater to make necessary connections to existing water mains.
 3. Maintain safe working distance from unrestrained closed valve.
 - a. Safe working distance from closed, unrestrained valve chart

Pipe Diameter (Inches)	Length of Straight Pipe in Front of Valve (Feet)
4	65
6	90
8	120
10	150
12	185
14	215
16	250
20	320
24	395
30	525
36	660

Length of straight pipe is the amount of buried straight pipe on dewatered side of closed, unrestrained valve to prevent the valve from moving. No bends, joint deflections, gaps between plain-end inside couplings, or tunnels are to be within the designated length of straight pipe.

4. Make connections with greatest possible speed. Working more than 8 hours, at nighttime, or on weekends, requires prior permission from Engineer.
 5. Will not be scheduled or performed on day before, day of or day after the following days:
 - a. New Years Day.
 - b. Good Friday.
 - c. Easter.
 - d. Beginning of Passover.
 - e. Memorial Day.
 - f. Independence Day.
 - g. Labor Day.
 - h. Rosh Hashanah.
 - i. Yom Kippur.
 - j. Thanksgiving.
 - k. Hanukkah.
 - l. Christmas.
 6. Provide excavation and backfill required for shutdowns.
 7. Cooperate and coordinate with Commission forces.
 8. Commission will notify consumers prior to shutdown.
- D. When making connection to existing PCCP utilizing ductile iron to PCCP adapter, Contractor may tack weld adapter to existing PCCP.
1. Repair damage to gasket or pipe adapter at no cost to the Commission.
- E. When connecting to existing polyethylene encased pipe, overlap joint following AWWA C105, Method A.
1. When connecting polyethylene encased pipe to non-encased pipe, overlap polyethylene 3 feet onto non-encased pipe following AWWA C105. Seal polyethylene with minimum two layers of compatible adhesive tape.

3.13 FIELD APPLIED COATING OF EXPOSED FERROUS METAL AND PIPE CONNECTIONS OF DISSIMILAR MATERIALS

- A. Coat exposed ferrous metal surfaces of joints, couplings, and uncoated steel with primer and tape coating system after installation.
 1. Do not coat stainless steel or high strength low alloy steel nuts and bolts.
- B. Surface Preparation: Clean surfaces of rust, scale, soil, mud, oil, grease, and other contaminants by hand or power tool following SSPC-SP2 or SP3 and other appropriate means as recommended by coating manufacturer.
 1. Remove excess moisture and provide surface dryness as recommended by coating manufacturer.
- C. Application: Apply primer in uniform manner to clean and dry surfaces following coating manufacturer's recommendations.

1. Fill complex and irregular surfaces with appropriate mastic or filler tape to eliminate bridging; then apply tape/wrap to primed and filled surfaces following coating manufacturer's recommendations.
 2. When coating restraining rods or strapping, apply tape wrap longitudinally, i.e., cigarette wrapped.
 3. Where metal being coated enters concrete, overlap coating onto concrete by minimum of 2 inches after placement of concrete.
- D. Inspection: After field coating of specified items, conduct visual inspection to verify complete coverage has been accomplished.
1. Repair damaged or incompletely coated surfaces following coating manufacturer's recommendations.

3.14 ABANDONMENT

- A. Cap ends of mains as shown and place required concrete blocking to retain cap on water main to remain in service.
- B. For abandonment of water mains, construct brick or 2500 psi concrete bulkhead 9 inches thick, or install approved plug or cap at each location where pipe was cut or valve removed.
1. Instead of above, Contractor may fill severed abandoned pipe with flowable fill.
- C. Where mains are to be abandoned and removed to a fitting or valve, cut and plug main at fitting or valve.
1. When shown on Drawings remove fire hydrants and valves, including lead joint tees when encountered; salvage and deliver removed fire hydrants and valves to the Commission Depot.
 2. Pipe, fittings, and other appurtenances that are removed, but not required to be salvaged become property of Contractor.
 - a. Remove and dispose of offsite.
- D. Abandon service connections 2 inches and smaller in diameter by:
1. Closing the corporation stop and disconnect the copper.
 2. Capping corporation stop.
 3. Removal of curb box.
 4. Removal of meter setting in its entirety or when relocating service connection remove meter setting 1 foot below existing ground, crimp existing service near bottom of meter box, fill meter box with dirt and compact to existing grade.
- E. Abandonment of service connections 3 inches and larger.
1. Removal of Existing Gate Valve.
 - a. For mechanical joint gate valve and fittings, remove existing gate valve and install mechanical joint plug to existing tee.
 - b. For tapping sleeve and valve connections, remove existing gate valve from existing tapping sleeve assembly.

- 1) Install blind flange to existing flange end of tapping sleeve assembly.
 - c. For lead joint valve and fittings, remove existing gate valve and existing tee.
 - 1) Before removing existing tee and valve, clean existing pipe and check pipe diameter and roundness to verify that solid sleeve will fit pipe before removing existing pipe, valves, and fittings.
 - 2) Do not cut existing pipe closer than 18 inches to joint bell unless joint bell will be removed.
 - 3) Reconnect existing main with new pipe and solid sleeve.
 2. Plug or cap ends of existing service connection abandoned sections.
- F. After abandonment or removal of pipe, fittings, and valves with External coating system: Field coat damaged and field cut pipe remaining in service following requirements for External coating systems, stated previously herein.
- G. Abandonment of Valve Vaults.
1. Remove valve vault top slab and lower vault walls to minimum depth of 2 feet below finish grade.
 2. Fill remainder of vault with lean mix concrete or flowable fill following Section 03300
 3. Salvage frames and covers.
 - a. Reuse when approved.
 - b. Deliver surplus frames and covers to the Commission Depot.

3.15 FIELD TESTING

- A. Before hydrostatic leak test and installation of double disc and resilient-seated gate valves.
1. Operate valves at site from fully closed to fully open and return to fully closed position.
 2. Observe for proper movement of discs and gate, and smooth function of valve parts.
 3. If required, correct until satisfactory performance is demonstrated.
- B. Before installation, hydrostatically test double disc and resilient-seated gate valves 16 inch and larger diameter for leakage at site in orientation as when installed.
1. Vent air from valve before conducting test.
 2. Double disc gate valves:
 - a. Apply hydrostatic test pressure equal to valve's rated working pressure between discs for 15 minutes.
 - 1) Rated working pressure: 150 psi unless otherwise noted.
 - 2) Leakage past disc not to exceed 1 ounce per hour per inch of nominal valve size.
 - 3) No leakage through metal, flanged joints, or stem seals.
 - b. Alternatively, provide bulkhead, tapped as necessary, on 1 side of closed valve. Perform hydrostatic leakage test, as described above, between bulkhead and disc.
 - 1) Repeat test on other side of valve.

3. Resilient seated gate valves:
 - a. Apply hydrostatic test pressure equal to valve's rated working pressure with gate in open position for 15 minutes.
 - 1) Rated working pressure: 150 psi unless otherwise noted.
 - 2) No leakage through metal, pressure-containing joints or stem seals.
 - b. Alternatively, provide bulkhead, tapped as necessary, on 1 side of closed valve. Perform hydrostatic leakage test, as described above.
 - 1) Repeat test on other side of valve.

C. Hydrostatic tests for water pipes.

1. For pipe 36-inch and larger diameter, an internal visual inspection will be made by the Commission of entire test section before ends are closed for test.
 - a. Coordinate and assist as required with internal visual inspection.
2. Close ends of test sections with caps or plugs properly blocked or restrained to withstand pressures to be imposed.
3. Do not use existing or new WSSC pipe or appurtenances for temporary restraint or support during test.
4. Do not use resilient seated gate valves in closed position as the pressure boundary of a test section when test pressure exceeds 250 psi.
5. Equip and conduct hydrostatic tests with pressures computed by the Commission and described herein.
 - a. When pipe installation is ready for testing and approved backfill operations completed, notify Engineer in writing 5 working days in advance of test.
 - b. Perform chlorination simultaneously with hydrostatic test unless otherwise approved by Engineer.
 - c. Conduct preliminary test to ensure main is ready for final test.
 - d. Provide pressure gage recorder capable of printing continuous record of pressure test readings (by Dickson Pressure Recorders, Model Numbers PW457 or PR81000), and charts, for testing.
 - e. Water meter for testing: Furnished by the Commission.
 - f. Protect and shelter testing equipment.
 - g. Set up testing equipment following Standard Details, and conduct tests on pipe following AWWA C600.
 - 1) Pressure Test:
 - a) Hydraulic gradient following Drawings.
 - b) Pressure (operation plus surge) to be induced at low point of test section for pressure test is equal to elevation of hydraulic gradient minus low point elevation of water main section to be tested, multiplied by 0.433, plus surge pressure as shown below:

<u>Diameter of Pipe</u>	<u>Psi</u>
3-inch to 10-inch	120
12-inch to 14-inch	110
16-inch to 18-inch	100
20-inch	90
24-inch	85

30-inch	80
36-inch	75
42-inch to 60-inch	70

- c) Fill length of water main to be tested with water, expelling air and subject it to pressure computed as described above.
- d) Maintain this pressure for minimum of 2 hours.
- 2) Leakage Test:
 - a) Conduct leakage test consecutively with pressure test.
 - b) For leakage test induce pressure at high point of test section that is equal to elevation of high hydraulic gradient minus high point elevation of water main section to be tested, multiplied by 0.433, but never less than 100 psi.
 - c) Maintain this pressure for minimum of 8 hours.
 - d) Calculate maximum allowable leakage for water main using formula:

$$L = \frac{SD\sqrt{P}}{133,200}$$

where:

L = maximum allowable leakage, gallons/hour.

S = length of pipe in test section, in feet.

D = nominal diameter of tested pipe, in inches.

P = average test pressure, pounds per square inch, which will be computed by averaging test pressures at low point and pressure at high point above.

- 6. Pipes 14 Inch and Smaller: Conduct 2 hour combination pressure/leakage test.
 - a. For 14 inch and smaller diameter mains the Contractor has the option for 2 hour test to substitute the recording gage with a Calibrated Needle Pressure Gage with zero leakage.
 - b. After installation of the water service connections, conduct a 2 hour pressure test at 125 psi, utilizing either option to conduct the test.
 - 1) Not to be conducted on replacement and relocation projects without Engineer's direction.
- D. Hydrostatically test thrust restraint system of double disc and resilient-seated gate valves, 16 inch and larger diameter, after valve installation and successful testing of water main.
 - 1. Double disc gate valves:
 - a. Pressure test each side of closed valve for no less than 1 hour to same pressure used for water main pressure test, while other side is depressurized.
 - b. Dewatering of depressurized side is not necessary.
 - c. Pressure not to exceed twice rated working pressure of valve.
 - d. Repeat test on other side of valve.
 - e. Repair leaks or damages to valve body, vault, piping, joints, fittings, or appurtenances in vault at no cost to the Commission.

- f. Do not operate valve when water pressure is greater than valve's rated working pressure.
- 2. Resilient-seated gate valves:
 - a. Pressure test each side of closed valve for no less than 1 hour to same pressure used for water main pressure test, while other side is depressurized.
 - b. Dewatering of depressurized side is not necessary.
 - c. Pressure not to exceed 250 psi.
 - d. Repeat test on other side of valve.
 - e. Repair leaks or damages to valve body, vault, piping, joints, fittings, or appurtenances in vault at no cost to the Commission.
 - f. Do not operate valve when water pressure is greater than 250 psi.
- E. Should test results show displacement, damage, or leakage in excess of allowable amount, repair displacement, damage, and eliminate leakage.
 - 1. Retest until specified conditions are met, to Engineer's requirement, at no cost to the Commission.
 - 2. Commission will observe test for each segment once without charge to Contractor.
 - a. Cost of further tests will be deducted from monies owed Contractor at prevailing hourly rates published by the Commission.
 - 3. Additional water use resulting from failed water main test shall be metered in gallons with the Commission reimbursed for water use at the prevailing rates.
- F. PVC Water Pipe Continuity Testing.
 - 1. Test tracer wire for continuity, in presence of Engineer, after backfill is complete and before Substantial Completion.
 - 2. Notify Engineer in writing 5 working days in advance to schedule testing.
 - 3. Continuity test to consist of locating the PVC water pipe and water services with an electronic-type pipe locator.
 - 4. If test for continuity is negative, repair or replace as necessary to achieve continuity.

3.16 TEMPORARY BYPASS WATER SERVICE SYSTEM

- A. Provide telephone numbers to Engineer for designated after hours emergency work crew before installation of bypass system.
- B. Remove no more than 5,000 feet of existing main from service at one time unless Engineer approves otherwise.
- C. Before water main to be replaced or cleaned and lined is shut down, provide temporary bypass piping system of adequate size to provide water service and fire protection to affected properties as required herein and as directed by the Engineer:
 - 1. Notify Engineer:
 - a. At least 24 hours in advance for installation of temporary connections.
 - b. When additional bypass services are made.
 - c. When problems develop with any meters or services.

- D. Use nearest available fire hydrant for connection to temporary bypass system.
 - 1. Where fire hydrants cannot be used, excavate and tap existing water main at Engineer's direction.
 - 2. Provide backflow preventers on temporary bypass piping at connection to source.
 - 3. Make temporary bypass service attachments to fire hydrants in a manner that will allow removal with minimum effort in case of emergency.
 - 4. Provide temporary fire hydrants.
 - a. Provide markers that are clearly visible from street.
 - b. Brace hydrants
 - c. Spacing as follows;
 - 1) Single family residential area.
 - a) Spacing maximum 500 feet apart measured along an improved roadway and within 400 feet from the most distant corner of any dwelling.
 - 2) Townhouses and garden apartments.
 - a) Spacing maximum 250 to 300 feet apart measured along an improved roadway and within 300 feet from the most distant corner of any building.
 - 3) Commercial, industrial, high-rise, and elevator type apartments.
 - a) Spacing maximum 250 to 300 feet apart measured along an improved roadway.
- E. Provide temporary service connection to each property affected by required water main shutdowns.
 - 1. Connect temporary service by removing outside meter and making temporary connection to existing service connection; connection to house hose bib; or at Engineer's direction.
 - 2. Provide valved "Y" on house hose bibs when used for temporary service connection.
 - 3. Provide Engineer 48 hours notice before removing meters.
 - 4. Cap removed meters at both ends.
 - 5. Place in clear plastic bags and hang inside meter pit to prevent damage, switching and misplacement for pickup by Commission.
 - 6. Protect meters and meter cover.
 - 7. Use notched meter covers when temporary services are connected.
 - 8. Where double meters exist, label meters with address.
 - 9. Adjust meter housing or curb stop to existing grade.
 - 10. Coordinate with Engineer for existing meter readings and in/out sheets.
 - 11. Meters improperly installed will be removed and correctly installed by the Commission.
 - d. A cost of \$500 per incident will be deducted from payment to Contractor.
- F. Placement and protection of temporary bypass piping system.
 - 1. Do not install between November 15 and March 1.
 - 2. Do not place during freezing weather and if already installed, protect from freezing.
 - 3. Provide cap and sampling connection at downstream end of each separate bypass piping segment.

- a. Do not loop downstream end of segment back to or near inlet of segment.
 - 4. Cover sections of temporary bypass lines that cross driveways or sidewalks and ramp with bituminous cold mix.
 - 5. Protect concrete and brick driveways to prevent discoloration from bituminous material.
 - 6. Place bypass lines at road crossings below the existing road surface.
 - 7. Place sections of bypass or services that cross sidewalks with barricades, ramps, and fluorescent paint.
 - 8. Place crossings of bypass lines parallel and/or perpendicular to handicap ramps, below existing grade.
 - 9. Install and support temporary bypass piping at storm drain inlet crossing so that piping and supports do not impede storm water from entering storm drain inlet.
- G. House to house connections are prohibited.
- H. Temporary bypass piping for existing service connections 3 inch and larger diameter and temporary fire protection: Minimum 4 inch diameter.
- I. Disinfect temporary bypass piping, including temporary house services, utilizing distribution system residual.
- 1. Commission will take bacteriological samples within 3 working days after receipt of written notification from Contractor that disinfection is complete.
 - 2. Results of sample analysis will be available within 3 calendar days after sampling.
 - 3. If samples are not approved, chlorinate and notify the Engineer to take new samples for testing.
 - 4. Cost of the additional disinfection, samples and testing: Contractor's expense.
 - 5. After samples are approved by the Commission, place bypass piping in service.
- J. If temporary bypass requires placement outside of Town Limits, acquire necessary permits.
- K. Maintenance or repair of temporary bypass piping system.
- 1. Respond to Commission's notification within 30 minutes and arrive at work site within 2 hours of notification.
 - 2. Provide adequate equipment, materials, and labor to take remedial actions within 1 hour of arrival at site in order to restore temporary bypass system in a timely manner at no cost to the Commission.
 - 3. Call radio room (301-206-4002) immediately after arriving at the work site and after work has been completed.
 - 4. Failure to respond back to Commission within 30 minutes, failure to arrive at work site within 2 hours or failure to take remedial action within 1 hour of arrival on site:
 - a. \$500 fee per remedial action event and cost incurred by the Commission to restore service assessed to Contractor.

PART 4 MEASUREMENT AND PAYMENT

4.1 PIPE

- A. Measurement: By linear foot of various types and sizes measured horizontally along centerline of pipe with no deductions made for lengths of fittings, connections, or valves, except:
 - 1. Fire hydrant leads will be measured beginning at water main centerline to hydrant centerline.
- B. Payment: At unit price for each linear foot for each size listed in Bid Schedule.
 - 1. Payment includes test pits required by Contract Documents, excavation, bedding and backfill; installation of pipe, fittings, valves, valve boxes, branch connections, connections to new and existing mains, corporation stops, and couplings for chlorination.

4.2 SERVICE CONNECTIONS

- A. Measurement: By linear foot of various types and sizes provided measured horizontally along centerline of pipe from center of main to property line following Standard Details.
 - 1. No deductions will be made for lengths of fittings, connections, or valves.
- B. Payment: At unit price for each linear foot for each size listed in Bid Schedule.
 - 1. Payment includes excavation, bedding and backfill; installation of pipe, fittings, curb stops, corporation stops, valves, valve boxes, and connections to new and existing mains.

4.3 SERVICE CONNECTION WITH OUTSIDE METER

- A. Measurement: By linear foot of various types and sizes measured horizontally along centerline of pipe from center of main to the limits following Drawings and Standard Details.
 - 1. No deductions will be made for lengths of fittings, connections, or valves.
- B. Payment: At unit price for each linear foot for each size listed in Bid Schedule.
 - 1. Payment includes excavation, bedding and backfill; installation of pipe, fittings, valves, valve boxes, meter setting, meter, and connections to new and existing mains.

4.4 EXTEND AND RECONNECT EXISTING WATER SERVICE CONNECTIONS TO NEW MAIN

- A. Measurement: By linear foot measured horizontally along center line of pipe from centerline of existing main to centerline of new main.
 - 1. No deductions will be made for lengths of fittings, connections, or valves.
- B. Payment: At unit price for each linear foot listed in Bid Schedule.

1. Payment includes excavation, bedding and backfill; installation of pipe, fittings, corporation stops, valves, valve boxes, reconnection to new main, and temporary water service.

4.5 RECONNECTION OF EXISTING WATER SERVICE CONNECTIONS

- A. Measurement: By each complete in place.
- B. Payment: At unit price for each listed in Bid Schedule.
 1. Payment includes excavation, bedding and backfill; installation of fittings, corporation stops, valves, valve boxes, reconnection to new main; and temporary water service.

4.6 REPLACEMENT OF SERVICE CONNECTIONS

- A. Measurement: By linear foot of various types and sizes provided measured horizontally along centerline of connection from center of main to property line, including each branch on the backside of double meter setting, following Standard Details.
 1. No deductions will be made for lengths of fittings, connections, or valves.
- B. Payment: At unit price for each linear foot listed in Bid Schedule.
 1. Payment includes excavation, bedding and backfill; installation of pipe, fittings, corporation stops, valves, valve boxes, curb stops or meter setting and meter, as required; abandonment of existing service connection, connection to new and existing mains; and temporary water service.

4.7 FIRE HYDRANTS

- A. Measurement: By each complete in place, including connection to fire hydrant lead following Standard Details.
- B. Payment: At unit price for each listed in Bid Schedule.
 1. Payment includes excavation, bedding and backfill; incidental appurtenances and installation of fire hydrant.
 2. Excludes fire hydrants installed on meter vault bypass piping.

4.8 STRUCTURES

- A. Measurement: By each for valve manholes and vaults, blowoffs, and entry port manholes of various types and sizes provided complete, in place.

- B. Payment: At unit price for each of various types and sizes as listed in Bid Schedule.
 - 1. Payment includes excavation, bedding and backfill; installation of pipe, valves and fittings from main, provision of flanged pipe and fittings, manholes, vaults, other materials not furnished by the Commission and incidentals following Drawings and Standard Details.
 - 2. Payment does not include mainline pipe, mainline valves or mainline fittings.

4.9 METER VAULTS

- A. Measurement: By each of various types and sizes provided complete in place, including frame and cover.
- B. Payment: At unit price for each of various types and sizes listed in Bid Schedule.
 - 1. Payment includes excavation, bedding and backfill, installation of pipe, fittings, fire hydrants, valves, and valve boxes that make up bypass and are within vault area between 2 bypass tees or taps, and incidentals following Standard Details.

4.10 PIPE IN TUNNELS OR CASINGS

- A. Measurement: By linear foot measured horizontally along centerline of pipe.
- B. Payment: At unit price for each linear foot for each size listed in Bid Schedule.
 - 1. Payment includes bulkheads casing spacers, incidental appurtenances and installation of pipe following Drawings and Standard Details.

4.11 CASING PIPE INSTALLED IN OPEN CUT

- A. Measurement: By linear foot measured horizontally along centerline of pipe from bulkhead to bulkhead.
- B. Payment: At unit price for each linear foot listed in Bid Schedule.
 - 1. Payment includes excavation, bedding and backfill; casing pipe, and incidental appurtenances following Drawings and Standard Details.

4.12 OUTSIDE METER SETTING ONLY

- A. Measurement: By each complete in place, at Engineer's direction.
- B. Payment: At fixed contingent unit price or unit price for each of various types and sizes listed in Bid Schedule.
 - 1. Payment includes excavation, backfill and bedding, installation of meter setting, housing, and appurtenances following Drawings and Standard Details and disposal of existing meter setting and housing.

4.13 MOBILIZATION: See Section 01110.

4.14 ABANDONMENT OF SERVICE CONNECTIONS

- A. Measurement: By each of various types and sizes abandoned in separate trench from new or renewed service, complete in place.
- B. Payment: At unit price or contingent unit price for various types and sizes listed in Bid Schedule.
 - 1. Payment includes excavation, abandonment of existing service connection, and backfill.

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