

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Water distribution and fire protection piping.
 - 2. Pipe fittings, valves, and valve boxes.
 - 3. Hydrants.
 - 4. Anchors and thrust blocks.
 - 5. Miscellaneous water system appurtenances.
 - 6. Connections to existing water systems.
 - 7. Disinfection and testing of new systems and appurtenances.
- B. Contractor shall coordinate work between all Subcontractors, sections, and trades required for the proper completion of the work.
- C. Contractor is responsible for all health and safety.

1.2 COORDINATION WITH JURISDICTIONAL AUTHORITY

- A. Contractor shall notify and coordinate the work of this Section with the local authority having jurisdiction over water supply, whether public or private system owner/operator.
- B. Obtaining permits or approvals which may be required to perform the work of this section, including all costs, fees and taxes required or levied.
- C. Contractor shall obtain all required approvals for connection to, or extension of, any portion of the domestic or fire protection water systems.
- D. The closing of valves necessary for making connections with the existing water systems will be done by Contractor with the assistance of Engineer. Sufficient notice shall be given the jurisdictional authority for a planned connection. No allowance will be made for any delay in the closing of valves. A 48-hour notice shall be given to adjacent buildings/residences affected by the shutdown, and shall be done by Contractor to the satisfaction of jurisdictional authority and Engineer. Jurisdictional authority or Engineer may require the work be completed outside of normal working hours during low use time periods.

1.3 ACTION SUBMITTALS

- A. CTHPB Documentation Submittals: Comply with Division 01 Section "Sustainable Design Requirements" and provide the following in addition to other action submittals:
 - 1. Product Data for Credit 5d: For adhesives and sealants, documentation including printed statement of VOC content.
 - 2. Product Data for Credit 5d: For paints and coatings, including printed statement of VOC content.

3. Product Data for Credit d8: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
4. Product Certificates for Credit d10: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
5. Certificates for Credit d13: Chain-of-custody certificates indicating that products specified to be made from certified wood comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.
6. Laboratory Test Reports for Credit b4: For composite wood and agrifiber products, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

1.4 REFERENCES

- A. Reference herein to any technical society, organization, group or regulation are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable.
- B. Code of Federal Regulations (CFR).
 1. 29 CFR 1926, Safety and Health Regulations for Construction.
- C. State of Connecticut.
 1. Standard Specifications for Roads, Bridges, Facilities and Incidental Construction, Form 818 and any supplements.
- D. ASTM International (ASTM)
 1. ASTM B88—Standard Specification for Seamless Copper Water Tube.
 2. ASTM F477—Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
 3. ASTM D3139—Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
 4. ASTM A536—Ductile Iron Castings.
 5. ASTM D1557—Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
- E. American National Standards Institute (ANSI)
 1. ANSI A21.50—Thickness Design of Ductile-Iron Pipe
 2. ANSI A21.51—Ductile-Iron Pipe, Centrifugally Cast, for Water
 3. ANSI A21.4—Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water

4. ANSI A21.10—Ductile-Iron and Gray-Iron Fittings, 3 in through 48 in (75 mm through 1200 mm), for Water and Other Liquids
 5. ANSI 61—Drinking Water System Components—Health Effects
- F. American Water Works Association (AWWA)
1. AWWA C104—Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
 2. AWWA C110—Standard for Ductile-Iron and Gray-Iron Fittings.
 3. AWWA C111—Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 4. AWWA C150—Standard for Thickness Design of Ductile-Iron Pipe.
 5. AWWA C151—Standard for Ductile-Iron Pipe, Centrifugally Cast.
 6. AWWA C207—Standards for Steel Pipe Flanges for Waterworks Service—Sizes 4 In. through 144 In. (100 mm Through 3,600 mm).
 7. AWWA C502—Standard for Dry-Barrel Fire Hydrants.
 8. AWWA C504—Standard for Rubber-Seated Butterfly Valves.
 9. AWWA C509—Standard for Resilient-Seated Gate Valves for Water Supply Service.
 10. AWWA C550—Standard for Protective Epoxy Interior Coatings for Valves and Hydrants.
 11. AWWA C651—Disinfecting Water Mains.
 12. AWWA C900—Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In.–12 In. (100 mm–300 mm), for Water Transmission and Distribution.
 13. AWWA C800—Standard for Underground Service Line Valves and Fittings.
- G. State of Connecticut
1. State Building Code, including all Amendments, Supplements, and Errata.
- H. Local Jurisdictional Authority
1. Comply with standards of the Local Jurisdictional Authority. Should this Specification differ from those standards, the standards of the Local Jurisdictional Authority will govern.

1.5 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods required for proper performance of the work in this Section.
- B. Use equipment of adequate size, capacity and quantity to accomplish the work of this Section in a timely manner.
- C. Maintain all temporary facilities and controls in proper and safe condition throughout the progress of the work.

1.6 COORDINATION WITH JURISDICTIONAL AUTHORITY

- A. Contractor shall notify and coordinate the work of this Section with the local authority having jurisdiction over water supply, whether public or private system owner/operator.
- B. Contractor shall obtain all required approvals for connection to, or extension of, any portion of the domestic or fire protection water systems.
- C. Service Interruption: Provide Jurisdictional Authority five (5) days advanced notice for any planned interruption associated with the work. Comply with customer notification requirements of the Jurisdictional Authority.
- D. Jurisdictional Authority may require the work be completed outside of normal working hours during low use time periods.

1.7 SAFETY

- A. Contractor shall conduct all excavation activities in conformance with applicable regulations, including those relating to warning signs, excavation safety, sheeting, shoring, and stabilization.
- B. Contractor shall provide and maintain barricades, signs, lights, etc., required for the protection of personnel, materials and property. Temporary barricades, etc. shall conform all applicable codes and regulations, and shall be lighted at night with lanterns, flares and reflectorized paint as required for safety. Adapt barricades, signs, lights, etc. to evolving site conditions throughout the progress of the work.
- C. Provide other safety devices as required, including adaptation of such safety devices to changing site conditions, to prevent unauthorized entry to construction areas and open excavations. Provide warning signs and other temporary construction safety devices necessary for proper completion of the work in compliance with applicable safety regulations.
- D. Contractor shall properly design and furnish all labor, materials, equipment, and tools necessary to completely construct the excavation support system, permanent or temporary, including sheet piling, trench shields, trench boxes, timber trench shoring, pneumatic/hydraulic shoring, steel sheeting or sheeting using other materials, sloping and benching. All of the proper materials and all equipment necessary to protect employees in excavations against cave-ins shall be furnished and installed.
- E. Any time an excavation is to remain open, at a minimum, provide full enclosure with safety barriers and fencing, warning signs, and additional safety control measures as appropriate.

1.8 SUBMITTALS

- A. Copies of all permits and/or approvals from Jurisdictional Authority.
- B. Shop Drawings:
 - 1. Submit shop drawings, descriptive literature, or both, showing pipe materials and appurtenances to be furnished. Shop Drawings shall be submitted to Engineer for approval prior to ordering materials.
 - 2. Shop drawings showing the configuration, dimensions, layout, and spacing of major and minor components such as pipe, joints, restraints, valves, and other proposed details of assembly. Show in large-scale details any unique assembly, and/or installation requirements.

- C. Copies of manufacturer-provided installation instructions, operation instructions, and maintenance material for all equipment furnished under this Section.
- D. Manufacturer's warranties and associated warranty registration data in Owner's name. Submit two (2) copies of each warranty to Engineer in the manufacturer's/supplier's standard form or if there is no standard form available, in a form specified by Engineer.
- E. As-Built Drawings.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Storage of pipe, fittings, valves, hydrants and other water line appurtenances on the site shall be in accordance with the manufacturer's recommendations, subject to the approval of Engineer.
- B. Care shall be taken in loading, transporting and unloading to prevent injury to the pipe, fittings, valves, hydrants, and other water line appurtenances. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before laying and no piece shall be installed which is found to be defective. Any damage to pipe and fitting coatings shall be repaired as directed by Engineer.
- C. Pipe, fittings, valves, hydrants and other water system appurtenances which are defective from any cause, including damage caused by handling, and determined by Engineer as non-repairable, shall be unacceptable for installation and shall be replaced at no cost to the Owner.
- D. Pipe, and all water system appurtenances that are damaged or disturbed through any cause prior to acceptance of the work shall be repaired, realigned or replaced as required by Engineer at no additional cost to the Owner.

PART 2 PRODUCTS

2.1 GENERAL

- A. The drawings are diagrammatic only and are intended to indicate the extent, but not all details, of the system, which shall be constructed. All materials and fittings are not shown; but Contractor shall furnish and install all materials and fittings required for the complete system.

2.2 DUCTILE IRON PIPE

- A. Centrifugally-cast ductile iron pipe, AWWA C151/A21.51, thickness Class 52, AWWA C150/A21.50. Pipe shall be furnished in 18-foot or 20-foot nominal lengths, unless otherwise required by Jurisdictional Authority standards.
- B. Pipes shall be cement-mortar lined in accordance with ANSI A21.4-03/AWWA C104, except that the cement lining shall be double thickness.
- C. The exterior of all pipe shall be factory coated, with a double coat of asphaltic material conforming to ANSI A21.51-02/AWWA C151. The interior of all pipe shall have a seal coat of bituminous material applied over the cement lining in accordance with ANSI A21.4-03/AWWA C104.

2.3 DUCTILE IRON PIPE FITTINGS

- A. Ductile iron pipe fittings shall have a pressure rating of 350 psi and shall conform to AWWA C110/ANSI A21.10-03. All fitting shall be compatible with pipe.

- B. The type of fittings for pipe and valve connections shall be determined by Contractor in accordance with the requirements shown on the Drawings prior to ordering the fittings.
- C. Fittings shall be cement-mortar lined and coated as specified for pipe.

2.4 DUCTILE IRON PIPE COUPLINGS

- A. Couplings and accessories shall be pressure rated at least equal to that of the pipe. Couplings shall be Dresser Style 153, Smith Blair 441 style, Rapidfit by Cascade Waterworks, or approved equal. Couplings shall be provided with corrosion resistant nuts and bolts. The interior of the coupling shall be epoxy-coated. Epoxy coating shall conform to AWWA C550-01.
- B. Transition couplings for joining pipe of different diameters shall be provided with corrosion resistant nuts and bolts.
- C. After assembly, all exterior surfaces including the bolts and nuts shall be completely coated with two coats of a heavy-duty protective asphaltic coating.

2.5 JOINTS FOR DUCTILE IRON PIPE

- A. Joints shall be mechanical joints, ANSI A21.11-00/AWWA C111-80. Mechanical joints shall be provided with required gaskets, lubricants and accessories conforming to ANSI A21.11-00/AWWA C111-80.
- B. Restrainers shall be MEGALUG by EBBA Iron, MJ Field Lok Gasket by U.S. Pipe & Foundry, Allgrip 3600 by Star Pipe Products, or approved equal.

2.6 GATE VALVES

- A. Gate valves shall be resilient seated conforming to the requirements of AWWA C509-01 and the requirements of the local water authority.
- B. Gate valves shall be cast iron body, bronze mounted, double disk, non-rising stem, O-ring type stuffing box.
- C. Gate valves shall open to the left (counter clockwise) and shall be mechanical joint type.
- D. Bolts, studs and nuts shall be made from a corrosion-resistant material such as low-zinc bronze, nickel copper alloy, or stainless steel.
- E. The operating nut shall be 2 inches square at the base, tapering to $1\frac{15}{16}$ inches square at the top.

2.7 BUTTERFLY VALVES

- A. Butterfly valves are generally used on pipe 16 inches and greater in diameter, and shall be installed in accordance with the standard practices of the Jurisdictional Authority.
- B. Butterfly valves shall be pressure Class 150B mechanical joint end with ductile iron body conforming to ASTM A536-84, Grade 65-45-R and stainless steel body seat, all in accordance with ANSI F1433-97/AWWA C504-00 Rubber-Seated Butterfly Valves.

2.8 VALVE BOXES

- A. Each gate valve shall be provided with a valve box and cover.

- B. Valve boxes shall be of the adjustable, telescoping, heavy-pattern type designed and constructed to prevent the direct transmission of traffic loads to the pipe or valve.
- C. Valve boxes shall be cast iron, asphalt coated with cast iron covers. The smallest inside diameter of the shaft shall not be less than 5¼ inches. The lower section of the box shall be designed to enclose the operating nut and stuffing box of the valve. Provisions shall be made for adjustment through at least 6-inches vertically while retaining a lap of at least 4 inches between sections.
- D. Covers shall be close fitting and substantially dirt-tight. The top of the cover shall be flush with the top of the box rim. Unless otherwise required by the Jurisdictional Authority, the word "WATER" shall be cast in the top surface of the cover.

2.9 HYDRANTS

- A. Hydrants: AWWA C502.
 - 1. Type of Thread: National Standard.
 - 2. Number of Outlets: 2 at 2½-inch hose connections and 1 at 4½-inch steamer connection.
 - 3. Diameter of Opening: 4½ inch.
 - 4. Size and Type of Inlet Connection: 6-inch mechanical joint
 - 5. Direction of Opening: Open left.
 - 6. Depth of cover: 5' feet minimum.
 - 7. Size and Shape of Operating Nut: Pentagonal.
 - 8. Bolts and nuts: corrosion-resistant material.
- B. Coatings: Two coats of primer; final finish color as required by the Jurisdictional Authority.

2.10 TAPPING SLEEVE AND VALVE

- A. Tapping sleeves: AWWA C223, bolted-sleeve type with mechanical joint connection to the existing water pipe and flanged end outlets for connecting the tapping valves. Tapping sleeves shall be suitable for a working water pressure of 200 psi and outlet flanges shall conform to the 125-pound American Standard with Cor-Ten or cadmium plated cast iron nuts and bolts.

2.11 THRUST BLOCKS

- A. Thrust blocks shall be installed in accordance with the details shown on the Drawings and/or as required by the Jurisdictional Authority.
- B. Concrete: Minimum 28-day compressive strength of 3,000 psi.
- C. In certain areas, thrust blocks cannot be used because of the density of other utilities and inability to construct thrust blocks bearing against "undisturbed soil". In such case, restrained joints shall be used at that location.

2.12 CORPORATION STOPS AND CURB STOPS

- A. Corporation stops: ball type corporation valves threaded to a receive compression-type fitting as manufactured by Mueller Co., Ford Meter Box Co., Grand Junction Pipe & Supply, or approved equal.
- B. Curb stops: ball valve threaded to receive compression-type fittings by Mueller Co., Ford Meter Box Co., Grand Junction Pipe & Supply, or approved equal.
- C. Stops shall be sized to receive the service tubing without the use of enlargement/reduction fittings.

2.13 SERVICE BOXES

- A. Service boxes shall be cast iron improved extension type with arch pattern base. Covers shall be held in place with bronze bolts and the word "WATER" shall be cast into the top surface of the cover. Service box shafts shall have a minimum inside diameter of 2½ inches. Service boxes shall be as manufactured by Mueller Co., Ford Meter Box Co., Grand Junction Pipe & Supply, or approved equivalent.

2.14 WATER SERVICE

- A. Services, two inches or smaller: Copper water tubing, Type K, ASTM B88 and ANSI Standard 61 for underground water service.
 - 1. Joints: Three part compression couplings or an approved equal.
- B. Water Service Fittings: Fittings, couplings, adapters, check valves and service saddles shall be in conformance with AWWA C800.
- C. Services, 3 inches and greater: Ductile iron pipe or as otherwise required by the Jurisdictional Authority.

2.15 METER PITS/VAULTS

- A. As required by Jurisdictional Authority.

2.16 BACKFLOW PREVENTERS

- A. As required by Jurisdictional Authority.

2.17 PRESSURE REDUCING VALVES

- A. As required by Jurisdictional Authority.

2.18 METERS

- A. As required by Jurisdictional Authority.

2.19 BEDDING

- A. Unless otherwise indicated, bedding shall consist of screened gravel, maximum size ¾ inches and minimum size ⅜ inches.
- B. When clay, wet, soft or silty soil conditions prevail, ¾-inch crushed stone shall be used for bedding.

2.20 PIPE AND APPURTENANCE ENCASEMENT

- A. Encasement shall be polyethylene in accordance with AWWA ANSI-AWWA C105/A21.5-99(10). Polyethylene encasement shall be v-bio enhanced polyethylene encasement style only and consist of three co-extruded layers of linear low-density polyethylene (LLDPE) film that are fused into one.

PART 3 EXECUTION

3.1 GENERAL

- A. Verify site conditions before proceeding with demolition work. Field check the accuracy of the Drawings and inspect structures, utilities, and other site features prior to start of work and notify Engineer in writing, of any hazardous conditions and/or discrepancies.
- B. All water pipes, fittings, valves, hydrants and other appurtenances shall be installed at the locations as shown on the Drawings and/or directed by Engineer.
- C. The proposed location and vertical alignment may be altered to avoid conflicts with existing and proposed utilities, as approved by Engineer.

3.2 LAYING DUCTILE IRON PIPE AND FITTINGS

- A. Ductile iron pipe and fittings shall be installed in accordance with the requirements of AWWA C600.
- B. Each length of pipe shall be laid with firm, full and even bearing throughout its entire length, in a trench prepared and maintained in accordance with Section 31 2310—Earthwork.
- C. All pipe shall be clean before laying. When installation is stopped for any reason, the open ends of the pipe shall be closed by watertight plugs or other approved means. If water is in the trench when work is resumed, the plug shall not be removed until the trench has been dewatered and all danger of water entering the pipe has been eliminated.
- D. Fittings, in addition to those shown on the Drawings, shall be provided if required to avoid utility conflicts.
- E. When cutting of pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of pipe to be used with a push-on bell shall be beveled to conform to the manufactured spigot end. Cement lining shall be undamaged.
- F. Maximum allowable deflection for pipe laid without fittings shall not exceed the allowable amount established by the pipe manufacturer and shall not exceed those shown in AWWA C600.
- G. The pipe shall be laid with a minimum cover of 4½ feet (4.5 ft) below finished grade, unless otherwise required by the Municipality or directed by Engineer.

3.3 JOINTING DUCTILE IRON PIPE, PUSH-ON TYPE

- A. Push-on joints shall be made in strict accordance with the manufacturer's instructions. A rubber gasket shall be inserted in the groove of the bell end of the pipe and the joint surface cleaned and lubricated using the pipe manufacturer's suggested methods and materials. The plain end of the pipe to be laid shall be inserted in alignment with the bell of the pipe to which it is to be jointed and pushed home with a jack or by other means. After joining the pipe, a metal feeler gauge shall be used to make certain that the rubber gasket is correctly located and has not been twisted or otherwise displaced.

3.4 JOINTING MECHANICAL JOINT PIPE AND FITTINGS

- A. Mechanical joints shall be made in strict accordance with the manufacturer's instructions. Mechanical joints shall be made by first cleaning the surfaces against which the gaskets will come in contact with a wire brush. The gasket, bell and spigot shall be lubricated by washing with soapy water just prior to assembling the joint. After the nuts have been made up finger tight, the bottom nut, then top and then diametrically opposite nuts shall be progressively tightened. Bolts shall be tightened to the torques listed:

Bolt Size (Inches)	Range of Torque (Foot-Pounds)
5/8	45-60
3/4	75-90
1	85-100

- B. After installation, a heavy bitumastic coating shall be applied to all bolts and nuts.
- C. Restraining device shall be ductile iron and shall have dimensions such that it can be used with the standardized mechanical joint bell and tee-head bolts conforming to ANSI A21.11 and ANSI A21.53-00/AWWA C153 latest revision.

3.5 CONCRETE THRUST BLOCKS

- A. Where pipes change horizontal and vertical direction, at hydrants, tees and other fittings, and wherever abnormal thrust forces may be developed, the Contractor shall construct thrust and anchor blocks as detailed on the Drawings. They shall be concrete, of minimum dimensions as detailed on the drawings or of adequate additional size to suit actual conditions to withstand pressures anticipated, and shall be founded in undisturbed soil.
- B. Concrete for thrust blocks shall have a minimum 28-day compressive strength of 3,000 psi.
- C. Fittings, which do not use thrust blocks resting against natural occurring material with passive resistance pressure of 1,500 psf, shall be installed with a restrained joint system as specified in Article 3.7.

3.6 RESTRAINED JOINTS

- A. Restrained joints shall be installed at bends, reducers, tees, valves, dead ends, and hydrants. The minimum length of pipe to be restrained on either side of the joint shall be as shown on the table below. The fittings of the new piping shall be for restrained joints, as marked on the Drawings.

Number of Joints to Restrain
on Either Side of Fitting

Fitting Type	Number of Joints to Restrain on either Side of Fitting (Based on 18-foot pipe length)
90 Degree bend	3
45 Degree bend	2
22 1/2 degree bend	2
Tee, Branch	3
Tee, Run	2

- B. No restraining is required in the direction of the existing pipe if only a short length of it is exposed in the trench for making a connection.
- C. Restrained joint assemblies for push-on pipe and fittings shall be made in strict accordance with the manufacturer's recommended installation procedures.
- D. Restrained joint assemblies for mechanical joint pipe shall be EBAA Iron MEGALUG, Cascade Waterworks Rapidfit, U.S Pipe Co. MJ Field Lok, or approved equivalent.

3.7 WATER / SANITARY SEWER SEPARATION

- A. When a sewer pipe crosses above or below a water pipe, Contractor shall comply with these following procedures:

1. Relation to Water Mains

- a. Horizontal Separation: Whenever possible, sewers shall be laid below, and at a minimum at least 10 feet, horizontally, from any existing or proposed water main. Should local conditions prevent a lateral separation of 10 feet, a sewer may be laid closer than 10 feet, but no closer than 2 feet, to a water main if:
 - 1) It is laid in a separate trench, or
 - 2) It is laid in the same trench with the water main located at one side on a bench of undistributed earth, and
 - 3) In either case, the elevation of the top (crown) of the sewer is at least 18 inches below the bottom (invert) of the water main.
- b. Vertical Separation: Whenever sewers must cross under water mains, the sewer shall be laid at such an elevation that the top of the sewer is at least 18 inches below the bottom of the water main. When the elevation of the sewer cannot be varied to meet the above requirements, the water main shall be relocated to provide this separation or reconstructed with mechanical-joint pipe for a distance of 10 feet on each side of the sewer. One full length of water main should be centered over the sewer so that both joints will be as far from the sewer as possible.
- c. When it is impossible to obtain horizontal and/or vertical separation as stipulated above, both the water main and sewer shall be constructed of mechanical-joint cement lined ductile iron pipe, or other equivalent based on watertightness and structural soundness. Both pipes shall be pressure tested by an approved method to assure watertightness, or both pipes shall be encased in concrete.

3.8 GATE VALVES AND BOXES

- A. Valves shall be set in firmly compacted and shaped soil. Where the soil in the trench subgrade is found to be soft, loose, freshly filled earth, unstable or unsuitable as a base, the unsuitable material shall be excavated to such additional depth and width as required. The excavated area shall be backfilled with gravel or crushed stone, compacted and shaped.
- B. Valve boxes shall be set centered and plumb over the operating nuts of all valves. The top of each valve box shall be set to finished grade with at least 10 inches of overlap remaining

between the upper sections for vertical adjustment. Minimum overlap for lower, extension pieces shall be 4 inches.

- C. Boxes shall be adequately supported during backfilling to maintain vertical alignment.

3.9 TAPPING SLEEVES AND GATE VALVES

- A. Installation shall be made under pressure and the flow of water through the existing pipe shall be maintained at all times. The diameter of the tap shall be a minimum of $\frac{1}{4}$ inch less than the inside diameter of the branch line.
- B. The entire operation shall be conducted by workmen thoroughly experienced in the installation of tapping sleeves and valves, and under supervision of qualified personnel furnished by the manufacturer. The tapping machine shall be furnished by the Contractor.
- C. Contractor shall determine the location of the existing pipe to be tapped to confirm that interference will not be encountered from existing utilities or a joint or a fitting. No tap shall be made closer than 3 feet from a pipe joint.
- D. Pipe upon which tapping sleeve is to be installed shall be thoroughly cleaned of all foreign matter with scraping tools and wire brushes to a minimum of six inches beyond each side of the sleeve. The cleaned area shall be washed with a hypochlorite solution. The interior of tapping valve shall also be washed with hypochlorite solution.
- E. Tapping sleeves and valves with boxes shall be set vertically and squarely centered on the pipe to be tapped. Adequate support shall be provided under the sleeve and valve during the tapping operation. Thrust blocks shall be provided behind all tapping sleeves. The supporting earth around and under the valve and sleeve shall be compacted. After completing the tap, the valve shall be flushed to ensure that the valve set is clean.
- F. Before backfilling, all exposed portions of any bolts used to hold the two halves of the sleeve together shall be heavily coated with two coats of bituminous paint.

3.10 HYDRANTS

- A. Hydrants shall be installed at the locations and in conformance with the details shown on the drawings.
- B. Each hydrant shall be set vertically and be properly braced. Hydrants shall be installed with thrust blocks or restrained joints as specified in Articles 3.6 and 3.7. Care shall be taken to ensure that thrust block concrete does not plug the drain ports.

3.11 WATER SERVICES

- A. Service Pipe: Care shall be exercised in placing and laying of services to prevent kinks or sharp bends and contact with sharp stones or ledge which would damage to the pipe. At least 6 inches of sand shall be placed adjacent to, under, and above the pipe, and no stone larger than 2 inches shall be placed over the pipe until the depth of backfill above the pipe is in excess of 1 foot.
- B. Corporation Stop: Taps to the pipe shall be threaded and shall be made at the horizontal diameter of the main. The tap shall be made by means of a tapping machine manufactured for this purpose and supplied by the Contractor. The tap and drill shall be kept sharp and shall have threads matching those of the stop. Corporation stop threads shall be coated with sealing compound and the stop screwed firmly into the water with the key upward and the inlet end

projecting at least 1/8-inch beyond the inside face of the pipe. The corporation stop shall be left in the on (open) position after installation of the service pipe.

- C. Curb Stop and Curb Boxes shall be of a size equal to the size of the service pipe and shall be installed in the locations shown on the drawings, or as ordered by Engineer. The boxes shall be set in a vertical position and flush with the proposed finish grade.
- D. Ductile Iron Service Pipe: ductile iron service pipe connections to the water main shall be made with tee fittings or tapping sleeves.

3.12 POLYETHYLENE ENCASEMENT

- A. Installation of polyethylene encasement shall be in accordance with the recommended procedures contained in ANSI A21.5-99/AWWA C105 and when directed by Engineer Water Department or Engineer.
- B. Care shall be taken during backfilling to prevent damage to polyethylene wrap. backfilling shall be in accordance with AWWA C600-99.

3.13 PRESSURE TESTING

- A. Hydrostatic and leakage test shall be conducted in accordance with AWWA Standard C600-99 and C900-97, and as directed by Engineer. Testing shall be conducted by a certified Independent Water Testing Company.
- B. Conduct pipe tests after concrete thrust blocks have cured to the required 3000-psi strength. Fill pipe 24 hours prior to testing, and apply test pressure to stabilize system. Use only potable water.
- C. Prior to pressure testing, the entire pipe section shall be flushed to remove any rocks or debris, which may have inadvertently entered the pipe during construction.
- D. Once the pipe section has been filled at normal pressure and all entrapped air removed, the Contractor shall raise the pressure to 150 psi or two times the operating pressure (whichever is greater) by a special pressure pump, taking water from a small tank of proper dimensions for satisfactorily measuring the rate of pumping into the pipe. This pressure shall be maintained for a minimum of 2 hours, during which time the line shall be checked for leaks. Measured rate of water leakage shall not exceed the allowable leakage listed below.

Maximum Allowable Leakage

Test Pressure (psi)	Nominal Pipe Diameter (inches)	Allowable Leakage (gallons per hour per 1,000 feet of pipeline)
PART 1 150	PART 2 4	PART 3 0.36
PART 4 150	PART 5 6	PART 6 0.55
PART 7 150	PART 8 8	PART 9 0.74
PART 10 150	PART 11 10	PART 12 0.92
PART 13 150	PART 14 12	PART 15 1.10
PART 16 150	PART 17 16	PART 18 1.47

- A. Interior piping in vaults, buildings, etc. shall have zero leakage.
- B. Should leakage exceed this rate, the Contractor shall immediately locate the leak or leaks and repair them. Pipe will be accepted only when leakage is zero, or less than the allowable amount.

Approval does not absolve the Contractor from responsibility if leaks develop later within the period of warranty.

18.2 DISINFECTION

- A. Before being placed in service, all new water pipe shall be chlorinated in accordance with AWWA C651-99 Standard for Disinfecting Water Mains or Engineer requirements/regulations, whichever is the more stringent.
- B. The location of the chlorination and sampling points will be determined by the jurisdictional authority in the field. Taps for chlorination and sampling shall be installed by Contractor. Contractor shall uncover and backfill the taps as required.
- C. The pipe section being disinfected shall be flushed to remove discolored water and sediment from the pipe. a 25-mg/l chlorine solution in approved dosages shall be inserted through a tap at one end while water is being withdrawn at the other end of the pipe section. The chlorine concentration in the water in the pipe shall be maintained at a minimum 25-mg/l available chlorine during filling. To assure that this concentration is maintained, the chlorine residual shall be measured at regular intervals in accordance with procedures described in Standard Methods and AWWA M12, Simplified Procedure for Water Examination [Section K].
- D. During the application of the chlorine, valves shall be manipulated to prevent the treatment dosage from flowing back into the pipe supplying the water. Chlorine application shall not cease until the entire pipe section is filled with chlorine solution. The chlorinated water shall be retained in the pipe for at least a twenty-four hour period. the treated water shall contain chlorine residual throughout the length of the pipe section as indicated in AWWA C651-99.
- E. Following the chlorination period, all treated water shall be flushed from the pipe section and replaced with water from the distribution system. Prior to disposal of treated water the Contractor shall check with local authorities to determine if the discharge will cause damage to the receiving body or sewer and, if required, the Contractor shall neutralize the chlorinated water in accordance with AWWA recommendations. Bacteriological sampling and analysis of the replacement water may then be made by the Contractor in full accordance with AWWA C651-99. A minimum of three samples shall be taken by the Contractor at locations directed by Engineer along the length of water pipe being chlorinated and sent to a State approved private laboratory for analyses. The Contractor shall rechlorinate if the samples show presence of coliform, and the pipe section shall not be placed in service until all of the repeat samples show no presence of coliform.
- F. Furnish two copies of a Certificate of Disinfection Report to Engineer and one copy to Engineer.
- G. Contractor shall pay all costs for all testing, flushing, chlorinating, laboratory analyses, sampling, water supply and municipal charges.

18.3 AS-BUILT DRAWINGS

- A. Contractor shall be solely responsible for complying with the requirements of local permitting authorities for preparation and submittal of as-built drawings. The requirements for the preparation of as-built drawings as defined herein shall be considered the minimum requirements of Engineer, but shall in no way relive Contractor from satisfying the requirements of local permitting authorities.
- B. As work progresses, record the following on two (2) sets of Drawings:
- C. All changes and deviations from the design in location, grade, size, material, or other feature as appropriate.

- D. Any uncharted locations of utilities or other subsurface feature encountered during installation, including the characteristics of such uncharted utility or subsurface feature such as utility type, size, depth, material of construction, etc.
- E. Recording of changes shall be clearly and neatly marked in red pen or pencil. All changes shall be noted on the appropriate Drawing sheets.
- F. Make measurements from fixed, permanent points on the Project Site to accurately locate the work completed. Such measurements shall consist of at least three (3) ties showing the distance of each item relative to each of the fixed, permanent points.
- G. As-Built Drawings shall be complete and shall indicate the true measurement and location, horizontal and vertical, of all new construction. As-Built drawings shall also contain any additional information required by Engineer.

18.4 CLEAN UP

- A. Contractor shall remove all debris, residuals, and materials at the conclusion of the work.

END OF SECTION