SECTION 15000

GENERAL PIPING SYSTEM AND APPURTENANCES

PART 1 - GENERAL

1.01 DEFINITIONS

A. The CONTRACTOR shall furnish and install all piping systems shown and specified, in accordance with the requirements of the approved plans and standard specifications. Each system shall be complete with all necessary fittings, hangers, supports, anchors, seismic restraints, expansion joints, flexible connectors, valves, accessories, tracing, insulation, lining and coating, testing, excavation, backfill and encasement, to provide a functional installation.

1.02 RELATED SECTIONS

A. Section 01300 – Record Drawings and Submittals

B. Section 01600 – Materials and Equipment

C. Section 02222 – Protecting Existing Underground Utilities

D. Section 02223 – Trenching, Backfilling and Compacting

E. Section 09900 – Painting and Coating

1.03 REFERENCE STANDARDS

A. Uniform Mechanical Code

B. Uniform Plumbing Code

C. Uniform Fire Code

D. Commercial Standards: All equipment, products, and their installation shall be in accordance with the following standards, as applicable, and as indicated in each Section:

1. American Society for Testing and Materials (ASTM)
2. American National Standards Institute (ANSI)
3. American Society of Mechanical Engineers (ASME)
4. American Water Works Association (AWWA)
5. American Welding Society (AWS)
6. American Iron and Steel Institute (AISI)
7. National Fire Protection Association (NFPA)

E. The following standards have been referenced in this Section:

ANSI B16.1	Gray Iron Pipe Flanges and Flanged Fittings
ANSI B16.5	Pipe Flanges and Flanged Fittings, NPS ½ through NPS 24
ANSI/AWWA C207	Steel Pipe Flanges for Water Works Service, Sizes 4 in through 144 in
ANSI/AWS D1.1	Structural Welding Code – Steel
ASTM A 193	Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 194	Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service
ASTM A 307	Specification for Carbon Steel Bolts and Studs, 60000 PSI Tensile trength
ASTM A 325	Specification for High-Strength Bolts for Structural Steel Joints
ASTM A 563	Specification for Carbon and Alloy Steel Nuts
ASTM/AWWA C219	Bolted, Sleeve-Type Couplings for Plain-End Pipe
AWWA Manual M11	Steel Pipe – A Guide for Design and Installation

1.04 CONTRACTOR SUBMITTAL

A. The CONTRACTOR shall submit complete shop drawings and certificates, test reports, affidavits of compliance, of all piping systems for review by the DISTRICT in accordance with the standard specifications, and as indicated in the individual piping sections. The shop drawings shall include dimensions and details on pipe joints, fittings, fitting specials, harnessed joints, valves, and appurtenances, and shall include design calculations and material lists. The submittals shall include detailed layout, spool, or fabrication drawings which show all pipe spools, spacers, adapters, connectors, fittings, and pipe supports and seismic restraints necessary to accommodate the equipment and valves provided in a complete and functional system.

B. Where new pipelines connect to existing pipelines, submit individual details for each connection point of the layout, including fabrication drawings which show all pipe spools, spacers, adapters, connectors, closure pieces, fittings, and pipe supports, thrust blocks and seismic restraints necessary to accommodate the equipment and valves provided in a complete and functional system.

C. The CONTRACTOR shall submit information containing the following:

1. Manufacturer’s product data.

2. Manufacturer’s installation instructions

3. Manufacturer's certification of compliance.

1.05 QUALITY ASSURANCE

A. Inspection: All pipe shall be subject to inspection at the place of manufacture. The CONTRACTOR shall notify the DISTRICT in writing of the date for the start of each phase of pipe production and the dates for the proof of design tests. The notification shall be given at least 15 days prior to the start of the pipe manufacture. During the manufacture of the pipe, the DISTRICT shall be given access to all areas where manufacturing is in progress and shall be permitted to make all inspections necessary to confirm compliance with the standard specifications.

B. Tests: Except where otherwise indicated, all materials used in the manufacture of the pipe shall be tested in accordance with the applicable specifications and standards. Welds shall be tested as indicated. The CONTRACTOR shall perform all tests. All costs for testing shall be borne by the CONTRACTOR. Copies of all test reports shall be submitted to the DISTRICT.

1.06 MANUFACTURER'S SERVICE REPRESENTATIVE

A. Where the assistance of a manufacturer's service representative is advisable in order to obtain the specified pipe joints, supports, or special connections, the CONTRACTOR shall furnish such assistance at no additional cost to the DISTRICT.

1.07 MATERIAL DELIVERY, STORAGE, AND PROTECTION

A. All piping materials, fittings, valves, and accessories shall be delivered in a clean and undamaged condition and shall be stored off the ground to provide protection against oxidation caused by ground contact. All defective or damaged materials shall be replaced with new materials.

1.08 CLEANUP

A. After completion of the work, all remaining pipe cuttings, joining and wrapping materials, and other scattered debris, shall be removed from the site by the CONTRACTOR. The entire piping system shall be handed over to the DISTRICT in a clean and functional condition.

PART 2 - MATERIALS

2.01 GENERAL

A. All pipes, fittings, and appurtenances shall be furnished in accordance with the requirements of the approved plans and the Design Standards.

B. Pressure Rating: All piping systems shall be designed for a minimum pressure of 250 psi.

C. Alternative pipe materials including but not limited to Fusible Polyvinyl Chloride (PVC) and High Density Polyethylene (HDPE) pipe with require DISTRICT approval prior to design and construction.

2.02 PIPE FLANGES

A. Flanges: Flanges on ductile iron pipe and fittings shall conform to the Design Standards. All flanges shall be flat faced.

B. Flange coating shall be in accordance with the Design Standards.

C. Flange Nuts and Bolts: All bolts and nuts shall conform to the Design Standards. Studs and bolts shall extend through the nuts a minimum of 1/2-inch. All-thread studs shall be used on all valve flange connections, where space restrictions preclude the use of regular bolts. Provide Type 316 heavy hex bolts and nuts for above and below ground installations.

D. Flange Gaskets: Gaskets shall be in accordance with the Design Standards.

E. Insulating Flanges: Insulated flanges bolt holes shall be drilled oversize by an amount equal to two times the insulating sleeve thickness to maintain the same minimum clearance for bolts.

F. Insulating Flange Sets: Insulating flange sets shall be provided where shown on the approved drawings. Each insulating flange set shall consist of an insulating gasket, insulating sleeves and washers and a steel washer. Insulating sleeves and washers shall be one piece when flange bolt diameter is 1-1/2 inches or smaller and shall be made of acetyl resin. For bolt diameters larger than 1- 1/2 inches, insulating sleeves and washers shall be two-piece and shall be made of polyethylene or phenolic. Steel washers shall be in accordance with ASTM A325. Insulating gaskets shall be full-face.

G. Insulating Flange Manufacturers, per approved material list or approved equal:

1. Calpico, Inc.
2. Farwest
3. PSI Products, Inc., Gardena, California.

2.03 THREADED INSULATING CONNECTIONS

A. General: Threaded insulating bushings, unions, or couplings, as appropriate, shall be used for joining threaded pipes of dissimilar metals and for piping systems where corrosion control and cathodic protection are involved.

B. Materials: Threaded insulating connections shall be of nylon, Teflon, polycarbonate, polyethylene, or other nonconductive materials, and shall have ratings and properties to suit the service and loading conditions.

C. Manufacturers: Isojoint or approved equal.

2.04 PIPE THREADS

A. All pipe threads shall be in accordance with ANSI/ASME B1.20.1.

2.05 FLEXIBLE PIPE COUPLINGS FOR PLAIN END DUCTILE IRON PIPE, PVC PRESSURE PIPE, OR PVC DISTRIBUTION PIPE

A. Flexible pipe couplings for ductile iron pipe, PVC pressure pipe, or PVC distribution are not allowed.

2.06 TRANSITION COUPLINGS

A. Transition couplings for connecting different pipes having different outside diameters shall be steel: Dresser Style 62 or 162, Smith-Blair Series 413 or 415, Baker Series 212 or 220, or approved equal.

2.07 FLANGED COUPLING ADAPTERS FOR DUCTILE IRON PIPE, PVC PRESSURE PIPE, OR PVC DISTRIBUTION PIPE

A. Flanged coupling adapters for ductile iron pipe, PVC pressure pipe, or PVC distribution pipe shall be cast iron, ductile iron, or steel: Dresser Style 127 or 128, Smith-Blair Type 912 or 913, Baker Series 601 or 602, or approved equal. Flange ends shall match the flange of the connecting pipe.

2.08 FLANGED COUPLING ADAPTERS FOR EXISTING ASBESTOS CEMENT PIPE

A. Flanged coupling adapters for existing asbestos cement pipe shall be cast iron or ductile iron: Dresser Style 127 or 128, Smith-Blair Series 912, or DISTRICT approved equal. Flange ends shall match the flange of the connecting pipe. Verify in the field the actual outside diameter of the existing pipe to be connected.

2.09 LINING AND COATING FOR COUPLINGS

A. Coat interior and exterior ferrous surfaces of flexible pipe couplings, transition couplings, and flanged coupling adapters with epoxy in accordance with the standard specifications. Coating shall be holiday free on interior surfaces. Buried couplings shall be wax tap coated in accordance with Design Standards.

2.10 SERVICE SADDLES

A. Service saddle shall be in accordance with the Design Standards.

PART 3 - EXECUTION

3.01 GENERAL

A. All pipes, fittings, and appurtenances shall be installed in accordance with the requirements of these standard specifications and approved plans.

B. Where core drilling is required for pipes passing through existing concrete, core drilling locations shall be determined by radiograph of concrete construction to avoid damage to embedded raceways and rebar.

3.02 SANITATION OF PIPE INTERIOR

A. During laying operations, do not place tools, clothing, or other materials in the pipe.

B. When pipe laying is not in progress, including the noon hour, close the ends of the installed pipe with a plug to deter entry of vermin, children, dirt, storm water, or foreign material.

3.03 INSTALLING COUPLINGS

A. Clean oil, grease, scale, and dirt from pipe ends. Repair any damage or holidays in the shop applied coating before installing couplings. Clean gaskets in flexible pipe couplings, transition couplings, and flanged coupling adapters before installing.

B. Clean sleeve bolts and nuts by wire brushing before installing in follower rings. Lubricate threads of bolts and nuts with oil or graphite prior to installation. Tighten nuts uniformly and in a progressive diametrically opposite sequence, and torque with a calibrated torque wrench.

C. If couplings leak under pressure testing, loosen or remove the nuts and sleeve bolts, reset or replace the gaskets, reinstall or retighten the bolts and nuts, and retest the coupling. Couplings shall be watertight.

D. After testing, wrap sleeve bolts and nuts of buried couplings with wax tape coating in accordance with Design Standards.

3.04 INSTALL SERVICE SADDLES

A. Place the service saddle on the pipe and hand tighten the nuts while positioning the saddle in its final location. Uniformly tighten the nuts in a progressive diametrically opposite sequence and torque with a calibrated torque wrench to the saddle manufacturer's recommended values.

B. Connect a corporation stop to the saddle. Apply Teflon joint compound or tape to the male threads before installing the corporation stop. Make joints watertight.

C. Mount a tapping machine on the corporation stop to cut a hole in the pipe with a shell type cutter made specifically for PVC pipe. Do not use other devices or hand equipment to bore through the pipe wall.

D. Submit method for tapping other pipe materials to DISTRICT prior to installation.

3.05 INSTALLING FLANGED PIPING

A. Flanges shall be coated in accordance with the Design Standards.

B. Set pipe with the flange bolt holes straddling the pipe horizontal and vertical centerline. Install pipe without springing, forcing, or stressing the pipe or any adjacent connecting valves or equipment. Before bolting up, align flange faces to the design plane within 1/16-

inch per foot measured across any diameter. Align flange bolt holes within 1/8-inch maximum offset.

C. Clean bolts, nuts, washers and flange faces by wire brushing before installing gasket and adjoining flange. Inspect gasket seating surfaces, gasket, each bolt, nut, washer, and facing on which the nuts will rotate. Replace any damaged item.

D. Lubricate threads in accordance with the Design Standards. Assemble all bolts, nuts, and washers in the flange, and then tighten nuts in a progressive diametrically opposite sequence, and torque with a calibrated torque wrench. All clamping torque shall be applied to the nuts only.

E. Bolt lengths shall extend a minimum of ½" through their nuts.

F. Do not use more than one gasket between contact faces in assembling a flanged joint.

G. Place washers under all nuts. Place washers under bolt heads where the flanges have been epoxy coated. Do not damage coated surfaces during installation.

H. If flanges leak under pressure testing, loosen or remove the nuts and bolts, reset or replace the gasket, reinstall or retighten the bolts and nuts, and retest the joints. Joints shall be watertight. Replace galled, cracked, or distorted bolts and nuts.

3.06 INSTALLING BLIND FLANGES

A. At outlets not indicated to be connected to valves or to other pipes and to complete the installed pipeline hydrostatic test, provide blind flanges with bolts, nuts, washers, and gaskets.

B. Blind flanges shall be coated in accordance with the Design Standards.

3.07 INSTALLING POLYETHYLENE ENCASEMENT

A. Wrap buried couplings and adapters with polyethylene material in accordance with Design Standards.

3.08 PAINTING AND COATING

A. Coat flexible pipe couplings, transition couplings, flanged coupling adapters and joint harnesses located aboveground, or in vaults and structures, the same as the adjacent pipes and in accordance with the standard specifications. Apply finish coats in the field. Color of finish coat shall match color of the adjacent piping.

3.09 INSTALLING MARKING TAPE

A. After the pipe zone has been backfilled and compacted, place the marking tape on the compacted pipe zone material and center over the pipe. Run tape continuously along the trench and tie ends of tape together.

3.10 PRESSURE TESTING

A. Test couplings and adapters at the same time that the connecting pipelines are pressure tested in accordance with Design Standards and standard specifications.

END OF SECTION

SECTION 15010

WET TAPS AND TEMPORARY PIPING SYSTEMS

PART 1 – GENERAL

1.01 DESCRIPTION

This Section describes general requirements for wet taps, temporary piping systems, and their appurtenances. This Section is to be used as a guideline for the Contractor's design of temporary piping systems and for the Contractor's preparation of a sequence of work for wet taps and temporary piping systems.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01043 – Coordination with District's Operations

B. Section 01300 – Contractor Submittals

C. Section 01530 – Protection of Work, Property and Existing Utilities

D. Section 02050 – Demolition and Removals

E. Section 02140 – Dewatering

F. Section 02223 – Trenching, Backfilling, and Compaction

G. Section 02350 – Excavation Support Systems

H. Section 02950 – Highlining for Watermains

I. Section 15041 – Disinfection of Piping

J. Section 15042 – Hydrostatic Testing of Pressure Pipelines

1.03 PIPE TAPPING (WET TAP)

A. Pipe tap connections (wet taps) to existing pipelines, whether for mainline extension or service laterals, shall be performed by the Contractor.

B. The sequence of work and materials for wet taps shall be approved by the District. Tapping operations shall be continuously witnessed by the District.

C. The Contractor shall provide all materials, labor, and equipment to excavate, shore or brace the trench, cast thrust block, backfill, compact, and repair pavements in accordance with the Contract Documents.

1.04 TEMPORARY PIPELINES

A. Temporary pipelines, where shown on the Drawings or required by the District, shall provide temporary service to customers during construction.

B. Contractor shall prepare a highline plan submittal (conformed to the Schedule of Values) for District review and approval prior to commencement of the Work. The submittal shall depict the highline pipe limits and layout, materials, sizing, installation schedule and duration of use, and highline supply connection locations and details per Specification Section 02950 Highlining for Watermains.

C. All temporary piping, fittings, and service connections shall be furnished, installed, and maintained by the Contractor, and the Contractor shall make connections to a water source designated or approved by the District.

D. The Contractor shall be responsible for disinfecting all pipe, connections, flushing, and assisting the District in taking water samples for bacteriological testing in accordance with the Contract Documents and Specification Section 15041 Disinfection

E. Following disinfection and acceptance of the temporary pipe as a potable water system, the Contractor shall maintain continuous service through the temporary piping. Damage to the temporary piping system shall be immediately repaired.

F. Upon completion of the work, the Contractor shall remove the temporary piping and appurtenances and shall restore all surfaces to the satisfaction of the District.

PART 2 – PRODUCTS

2.01 GENERAL

A. Manufacturer's Product Data: The Contractor shall submit manufacturer's product data for all materials and products to be used in the work in accordance with Section 01300 including, but not limited to, tapping sleeves, tapping valves, jointing and gasket materials, special pieces, flexible couplings, mechanical couplings, harnessed and flanged adapters, tie rods, and all other items required to provide a complete and operable system.

B. The Contractor shall submit the proposed temporary piping layout where a temporary highline is shown or specified.

C. All components of temporary piping systems pipe furnished by the Contractor shall be of good quality, clean, and suitable for conveying potable water in the opinion of the District.

2.02 TAPPING EQUIPMENT

A. The tapping machine shall have the ability to positively flush all shavings and other residue created when installing tapped outlets of 4 inches or larger.

B. The shell cutter bell on the tapping machine shall be tapped with a 2-inch minimum outlet.

C. A ball valve shall be installed on the outlet to regulate flow.

D. A hose and filter shall be connected to the ball valve to retrieve shavings and residue generated during the tapping process.

E. A multi-toothed shell cutter is required to minimize the size of shavings generated when tapping PVC pipe.

F. The shell cutter pilot tool shall be designed to capture the coupon generated by performing the wet tap.

G. The tapping machine shall be filled with water prior to commencing the tapping procedure.

PART 3 – EXECUTION

3.01 GENERAL

A. The Contractor shall furnish tapping sleeves or tees, valves and all other materials as called for in the Contract Documents or as required for a complete and functional installation.

B. The Contractor shall provide all equipment and labor required for the excavation and installation of the connection including but not limited to dewatering equipment, temporary piping, thrust blocks, trench cover plates, trench shoring and/or bracing, backfill and site restoration.

C. The Contractor shall provide emergency standby equipment or materials to the satisfaction of the District.

3.02 WET TAPS AND CUT-IN TEE AND VALVE INSTALLATIONS

A. The Contractor shall obtain the District's written approval of the Contractor's construction schedule, sequence of work, and materials for all work to be performed by the Contractor.

B. Prior to construction, Contractor shall pothole the existing pipe at the location of the proposed connection. The District shall inspect the pothole prior to Contractor's repair of trench. Contractor shall record the following information on the construction drawings for record purposes:

1. Pipe type such as AC, PVC, ductile-iron or steel

2. Pipe outside diameter (AC, PVC, ductile iron). Cement mortar coated steel pipe will require removal of the mortar coat to determine the steel cylinder outside diameter and characteristics of reinforcing steel.

3. Pipe class and/or pressure rating

4. Elevation, grade, and alignment (based on at least two points)

5. Location of collars, pipe bells, fittings or couplings within 5 feet of the proposed connection point

6. Potential conflicts with existing utilities

C. The new pipeline shall have successfully passed pressure testing in accordance with Section 15042 and disinfection and bacteriological testing in accordance with Section 15041 prior to proceeding with connection work.

D. After the District has given approval to proceed with the connection, the Contractor shall schedule the wet tap or cut-in installation with the District.

1. Shutdowns will be scheduled at the convenience of the District. Shutdowns may be scheduled for nights or weekends if required by operational criteria of the District.

2. The Contractor shall give the District a minimum of five (5) working days notice prior to any proposed excavation or shutdown of existing mains or services. Scheduling shall be subject to District approval.

3. The District may postpone or reschedule any shutdown operation if, for any reason, the District believes that the Contractor is inadequately prepared with competent personnel, equipment, or materials to proceed with the connection.

4. If progress in completing the connection within the time specified is inadequate, the District may order necessary corrective measures. Corrective measures may consist of directing District personnel or another contractor to complete the work. All costs for corrective measures shall be borne by the Contractor.

E. The Contractor may proceed with excavation only when potholing has been completed, materials and sequence of work have been approved, materials have been delivered, wet tap or cut-in installation has been scheduled and a copy of the approved traffic control plan has been furnished to the District.

1. The Contractor shall provide lights, barricades and traffic control in accordance with the agency of jurisdiction and as deemed necessary for the excavation by the District.

2. The Contractor shall saw-cut pavement, excavate and provide and install shoring and steel plating, when necessary, one day prior to the wet tap or cut-in installation.

3. The Contractor shall dewater existing mains where cut-in installations are required in the presence of the District. Only District personnel are authorized to operate existing valves. The Contractor shall be responsible for any and all damage resulting from unauthorized operation of existing District facilities.

4. In areas where cut-ins are to be performed, the Contractor shall line the bottom of the trench with 12 to 18 inches of 3/4-inch crushed rock and construct a 12- to 16-inch deep sump for dewatering the trench.

5. Wet Taps:

a. Disinfect and install the tapping saddle and tapping valve. Clean and disinfect the tapping machine prior to attachment to the tapping valve and saddle.

b. Install concrete valve support blocks and thrust blocks.

c. Constantly monitor feed settings and motor speed of the tapping machine to ensure a successful tapping operation.

6. Cut-ins:

a. Spirally reinforced steel pipe will require special procedures prior to cutting into the pipe. Weld the existing steel reinforcing rod to the steel cylinder on both sides of the cut location so that the reinforcement remains in tension after cutting the pipe.

b. Cut and remove portions of existing mains, and disinfect and install tees, valves, couplings, thrust restraint devices, and appurtenances required to complete the closure. The Contractor shall discard pipe and appurtenances removed from service in accordance with the Contract Documents.

7. After the tapping or cut-in operations are completed and the District has given approval to proceed, the Contractor shall complete the installation as shown on the Contract Documents including, but not limited to:

a. Disinfecting and installing the pipe section(s) necessary to make the closure to the new system.

b. Installing and setting the valve gate well(s),

c. Installing thrust and anchor blocks,

d. Completing all backfill and compaction of the trench,

e. Repairing or replacing pavement as necessary in accordance with jurisdictional agency requirements.

3.03 TEMPORARY PIPELINES

A. The temporary pipe shall be installed in such a manner that it will not present a hazard to vehicle traffic or pedestrians and will not interfere with access to driveways along its route.

B. Isolation valves shall be installed at 400-foot intervals or as shown on the Drawings or ordered by the District.

C. If repairs to temporary piping are necessary, the Contractor shall make such repairs in a timely manner as directed by the District. If progress in making repairs is inadequate in the sole opinion of the District, or in the event of emergency, the District may take corrective measures, which may include the performance of repair work by District forces or another contractor. All costs for corrective measures shall be borne by the Contractor.

END OF SECTION

SECTION 15041

DISINFECTION OF PIPING

PART 1 – GENERAL

1.01 DESCRIPTION

This section describes requirements for disinfection by chlorination of potable water mains, services, pipe appurtenances and connections.

1.02 REFERENCED STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

A. AWWA B300 -Standard for Hypochlorites

B. AWWA B301 -Standard for Liquid Chlorine

C. AWWA C651 -Disinfecting Water Mains

D. Standard Methods for the Examination of Water and Wastewater, a joint publication of the American Public Health Association (APHA), the American Water Works Association (AWWA), and the Water Environment Federation (WEF)

1.03 RELATED SECTIONS

A. Section 15042 – Hydrostatic Testing of Pressure Pipelines

B. Section 15058 – PVC Pipe and Fittings

C. Section 15060 – PVC Pressure Pipe

D. Section 15062 – Ductile Iron Pipe and Fittings

E. Section 15064 – Steel Pipe and Fittings

F. Section 15057 – Copper, Brass, and Bronze Pipe, Fittings, and Appurtenances

1.04 SERVICE APPLICATION

A. All water mains and appurtenances taken out of service for inspection, repairs, or other activity that might lead to contamination shall be disinfected before they are returned to service.

B. All new water mains and temporary pipelines shall be disinfected prior to connection to the District's existing system. Disinfection against a closed valve connected to the existing water system will not be allowed.

C. All temporary appurtenances used during the disinfection process (bulkheads, fittings, gages, isolation valves, air release valves, etc.) shall be furnished by the Contractor and shall be disinfected.

D. All components incorporated into a connection to the District's existing system shall be disinfected prior to installation.

1.05 SUBMITTALS

A written disinfection and dechlorination plan, including all methods and equipment to be used, signed by a certified chlorinator shall be submitted to the District for review and approval prior to starting disinfection operations.

1.06 DELIVERY, STORAGE AND HANDLING

Chlorination and dechlorination shall be performed by competent individuals knowledgeable and experienced in the operation of the necessary application and safety equipment in accordance with applicable Federal, State and Local laws and regulations. The transport, storage and handling of these materials shall be performed in accordance with Code of Federal Regulations (CFR) 1910.120 Hazardous Waste Operations and Emergency Response, CFR 49.172 Hazardous Materials Regulations, and the General Industry Safety Orders of the California Code of Regulations, Title 8, Section 5194.

1.07 CONCURRENT DISINFECTION AND HYDROSTATIC TESTING

The specified disinfection of the pipelines may not be performed concurrently with the hydrostatic testing in accordance with Section 15042. In the event repairs are necessary, as indicated by the hydrostatic test, additional disinfection may be required by the Engineer in accordance with this specification.

1.08 CONNECTION TO EXISTING MAINS

Prior to connection to existing mains, disinfection and bacteriological testing shall be performed in accordance with this specification, and hydrostatic testing shall be performed per Section 15042. District authorization for connection to the existing system shall be given only on the basis of acceptable hydrostatic, disinfection and bacteriological test results.

PART 2 – MATERIALS

2.01 LIQUID CHLORINE (GAS)

A. Liquid chlorine contains 100-percent available chlorine and is packaged in steel containers in net weights of 150 lb. or 1 ton.

B. Liquid chlorine shall be used with appropriate gas flow chlorinators, heaters, and injectors to provide a controlled, high-concentration solution feed to the water. The chlorinators and injectors shall be the vacuum-operated type.

2.02 SODIUM HYPOCHLORITE (LIQUID)

Sodium hypochlorite is available in liquid form in glass or plastic containers, ranging in size from 1 qt. to 5 gal. The solution contains approximately 10% to 15% available chlorine.

2.03 TABLET OR GRANULAR HYPOCHLORITE

Tablet or granular hypochlorite shall not be used at any time.

PART 3 – EXECUTION

3.01 GENERAL

A. Disinfection of pipelines shall not proceed until all appurtenances and any necessary sample ports have been installed and the District inspector provides authorization.

B. Keep the water main and its appurtenances clean and dry during the installation process.

C. All piping, valves, fittings, and appurtenances which become contaminated during installation shall be cleaned, rinsed with potable water, and then sprayed or swabbed with a 5 percent sodium hypochlorite solution prior to installation.

D. Water mains under construction that become flooded by storm water, runoff, or ground water shall be cleaned by draining and flushing with metered potable water until clear water is evident. Upon completion, the entire main shall be disinfected using a method approved by the District.

3.02 METHODS

A. Continuous Feed:

1. The continuous feed method of chlorination, as defined in AWWA C651-14, is the only acceptable method of chlorination. Tablet chlorination and slug chlorination are not acceptable.

2. Chlorine used for the continuous feed method can be liquid sodium hypochlorite that is NSF 60 approved for the use in potable water, or gas chlorine using a vacuum operated chlorinator.

B. Liquid Chorine (Gas):

1. Only vacuum-operated equipment shall be used. Direct-feed chlorinators, which operate solely from gas pressure in the chlorine cylinder, shall not be permitted. The equipment shall incorporate a backflow prevention device at the point of connection to the potable water source used to fill the line being tested.

2. The chlorinating agent shall be applied at the beginning of the system to be chlorinated and shall be injected through a corporation stop, a hydrant, or other approved connection to ensure treatment of the entire system being disinfected.

3. Only a certified, licensed chlorination and testing contractor shall perform gas chlorination work. The chlorination contractor must also possess a Grade II Treatment Plant Operator Certification from the State of California if required by the Engineer.

C. Sodium Hypochlorite Solution (Liquid):

1. Sodium hypochlorite solution shall be used for cleaning and swabbing piping and appurtenances immediately prior to installation and for disinfecting all components of connections to the District's existing system.

2. Sodium hypochlorite solution may be used for the initial disinfection of newly installed water mains. The solution shall be applied at a terminus of the system to be chlorinated using an injector which can adjust the amount of solution being injected into the piping system. The solution shall be injected in the appropriate concentration to achieve the specified concentration range of chlorine throughout the entire piping system. Where pumping equipment is used in conjunction with an injector, an integral backflow prevention device shall be installed and connected to the potable water supply.

3. Water trucks, pumping equipment, piping, appurtenances and all other equipment in contact with potable water shall be disinfected prior to use.

4. Sodium hypochlorite solution may also be used to increase the total chlorine residual if the concentration from the initial chlorination of the system is found to be low. The solution shall be added to the system in sufficient amounts at appropriate locations to insure that the disinfecting solution is present at a concentration within the specified range throughout the piping system.

3.03 PREPARATION

1. An appropriate water source will be determined by the District representative based on proximity to work location and available flow. Adequacy of flow will be confirmed by water operations staff. Typically a fire hydrant or wharf head.

2. A dedicated meter and backflow will be set at the source location prior to any source connections to the water main being tested. The District will set the meter and the contractor will set and test an RP type backflow device that is the same size as the meter, or larger than the meter. This source will only be used for water main testing and no construction purposes for the duration of water main testing.

3. A 2.5" construction meter is only suitable for up to 12" diameter water main. Larger pipe will require at least a 4" meter/backflow.

4. Clean water hose will be provided by the contractor to convey water from the water source to the water main. This hose should be at least 2.5" in diameter, NSF 61 approved for potable water use (cloth fire hose is not acceptable), and the hose should be disinfected and flushed. Care should be taken to ensure the backflow assembly is clean prior to introducing water to the new main.

5. The main being tested should not be connected hydraulically to the existing District water system except for the backflow protected source. Physical separations or test plates must be used at all future tie-in points. The presence of a physical separation or test plate will be confirmed by the inspector. Testing against a closed valve is not acceptable.

6. Sample points will be selected by the inspector. The same sample points should be used for chlorine disinfection testing as well as bacteriological samples. Sets of samples shall be collected every 1,200 ft, plus one set from the end of the line, and at least one from each branch greater than one full pipe length. Samples should not be drawn from hydrants if possible.

7. A District provided form will be used by the inspector to document a diagram of the water main being tested, location and type of all designated sample points, date and field result of chlorine confirmation tests, and date and field results of all bacteriological samples taken.

3.04 PRESSURE TESTING

1. Pressure testing will be performed in accordance with Section 15042 Hydrostatic Testing Pressure Water Mains.

3.05 PROCEDURE FOR DISINFECTING WATER MAINS AND APPURTENANCES

1. Chlorine will be introduced downstream of the RP backflow device. This could be the #4 test port on the backflow.

2. The water main will be filled with chlorinated water dosed at 25-150 mg/L of free chlorine residual. Care shall be taken to push the water to all dead ends of the new main and through all services.

3. The inspector will confirm that 25-150 mg/L of free chlorine is present at all designated sample points on the main. This will be accomplished using a Hach high chlorine titration kit.

4. The District inspector will witness the contractor operate all isolation valves on the water main segment being tested. All valves will be closed then completely reopened. Valves will remain completely open for the remainder of the test.

5. The water main will be isolated with static pressure until the following day. The source hose should stay connected if possible.

6. At 24 hours after the chlorine dosed and tested, the inspector will test each designated sample point to ensure the water main has at least 10 mg/L free chlorine residual at all points.

7. If 10 mg/L is present at all designated points, the chlorine can be flushed to commence bacteriological testing. If 10 mg/L is not present at all designated points, the water main must be chlorinated again.

3.06 PROCEDURE FOR DISINFECTING TIE-INS AND CONNECTIONS

A. Connections equal to or less than 18 feet: Pipes, fittings, valves and all other components incorporated into connections with the existing water system shall be spray disinfected or swabbed with a 1 to 5 percent liquid chlorine solution in accordance with AWWA C651-14 and as specified herein. Upon connection to the main, the line shall be flushed as directed by the District.

B. Connections greater than 18 feet: If the total length of the connection exceeds 18 feet, then the pipe required for the connection shall be "predisinfected" in accordance with AWWA C651 prior to installation. The pipe shall be set up above-ground, disinfected, and samples taken for bacteriological testing as described in this Section. The ends of the piping must be sealed with water-tight caps during the period of bacteriological testing. The "predisinfected" pipe can be used in connection work after satisfactory bacteriological test results are received.

3.07 DISCHARGE OF CHLORINATED WATER

A. Indiscriminate onsite disposal or discharge to sewer systems, storm drains, drainage courses or surface waters is prohibited. It shall be the responsibility of the Contractor to file a Notice of Intent and obtain a General Waste Discharge Requirements Permit for Discharges of Hydrostatic Test Water and Potable Water to Surface Waters, Storm Drains or Other Conveyance Systems, San Diego Region (Hydrostatic Test Permit) for any discharge of hydrostatic test water or other potable water. The Contractor shall be solely responsible to evaluate, obtain and comply with the provisions of the Hydrostatic Test Permit, including any monitoring and reporting as may be required. The Contractor shall comply with all requirements of the State Water Resources Control Board and the San Diego Regional Water Quality Control Board. The Contractor shall provide copies of all reports and monitoring information to the District. A District representative shall be present to witness the reporting.

B. Failure to comply with the Hydrostatic Test Permit is a violation of federal and state law. The Contractor hereby agrees to indemnify and hold harmless the District, its Board members, officers, agents, employees and authorized volunteers from and against any and all claims, demands, losses or liabilities of any kind or nature which District, its Board members, officers, agents, employees and authorized volunteers may sustain or incur for noncompliance with the Hydrostatic Test Permit arising out of or in connection with the Project.

C. The environment to which the chlorinated water is to be discharged shall be reviewed by the Contractor and the Engineer. Where it is deemed necessary, federal, state and local regulatory agencies should be contacted to determine special provisions for the disposal of chlorinated water. Any indication that the discharge of chlorinated water may cause damage to the environment shall require the neutralizing of the chlorine residual by means of a reducing agent in accordance with AWWA C651 and the requirements of this specification.

D. In locations where chlorine neutralization is required, the reducing agent shall be applied to the water as it exits the piping system. The Contractor shall monitor the chlorine residual during the discharge operations. Total residual chlorine limits in these locations,

and for the discharge of chlorinated water from the testing of pipelines to surface waters of the San Diego Region are as follows:

Total Residual Chlorine Effluent Limitations	
30-Day Average	0.002 mg/l
Average Daily Maximum	0.008 mg/l
Instantaneous Maximum	0.02 mg/l

E. The various methods of dechlorination available can remove residual chlorine to concentrations below standard analytical methods of detection, 0.02 ppm, which will assure compliance with the effluent limit. The Contractor will perform all necessary tests to ensure that the total residual chlorine effluent limitations listed above are met.

F. In locations where no hazard to the environment is evident based on the joint examination described above, the chlorinated water may be broadcast for dust control on the surface of the immediate site. Care shall be exercised in broadcasting the water to prevent runoff.

3.08 BACTERIOLOGICAL TESTING

Contractor shall be responsible for paying for and performing all laboratory testing by an independent qualified laboratory approved by the District per Specification Section 01410 Testing Laboratory Services.

1. Two consecutively passing sets of bacteriological samples are required for the water main to be accepted for tie-in to the DISTRICT water system. Samples will be analyzed for coliform (presence/absence) and heterotrophic plate count (HPC). Passing samples shall be absent for coliform and have an HPC of less than 500 colony forming units (CFU) or less than 500 most probable number (MPN). If deemed applicable based on project size and conditions, it is recommended that samples be tested for acceptable aesthetic quality (e.g., pH, alkalinity, specific conductance, turbidity).

2. During flushing, the District inspector will use a chlorine residual analyzer to confirm that all highly concentrated chlorine has been flushed from the main. The chlorine residual should be no more than 4 mg/L prior to bacteriological sampling.

3. The water main will be thoroughly flushed then shut off for a 16 hour period. During this period, the main should remain under static pressure with a valve on the source off (a backflow device valve). The inspector will read the construction meter. No water is allowed to pass through this meter prior to the arrival of the inspector for the bacteriological samples the following day.

4. After at least 16 hours have passed, the District inspector will confirm no water has passed through the meter. Bacteriological samples will be taken at each designated point. Two samples from each sample point will be taken a minimum of 15 minutes apart with the sample taps left running between samples, in accordance with “Bacteriological Tests, Option B”. The source water will only be

turned on to provide pressure for samples if needed. Flushing of the water main is not permitting on the day samples are being drawn.

5. The water source will be turned on after sampling is complete to provide continuous positive pressure on the tested main. The main must remain connected to the metered and backflow protected source and pressurized until all samples have been accepted by the District and the tie-in work starts. The main will be depressurized only by District Water Operations staff on the date of the scheduled tie-in.

6. Once bacteriological samples have been taken, the contractor cannot depressurize or otherwise tamper with the tested water main. Any unauthorized depressurization or tampering witness by District staff will require bacteriological testing to start again. After sample results are sent to the inspector from the lab, proceed based on the following table:

Total Coliform Bacteria	E. Coli Bacteria	HPC (CFU or MPN)	Follow-up Actions
Absent (all samples)	-	< 500 (all samples)	Water Main can be accepted for tie-in
		=/> 500	Flush and repeat testing at elevated HPC sites. Repeat disinfection Optional.
PRESENT (1st Round </= 25% samples)	Absent	Regardless	Flush and repeat testing of all sample sites. Repeat disinfection Optional.
PRESENT (>25% samples)	Absent	Regardless	Flush and repeat testing of all sample sites. Repeat disinfection REQUIRED.
PRESENT (>1st Round)	Absent	Regardless	Flush and repeat testing of all sample sites. Repeat disinfection REQUIRED.
PRESENT	PRESENT (any sample)	Regardless	Flush and repeat testing of all sample sites. Repeat disinfection REQUIRED.

3.09 TIE-IN

1. The final tie-in of the tested water main will occur no sooner than five calendar days after the passing bacteriological results, and not later than 14 calendar days after passing bacteriological results. If job progress is dependent on an immediate shutdown and tie-in, District inspectors and Operations staff will work together to complete the work in less than five days.

END OF SECTION

SECTION 15042

HYDROSTATIC TESTING OF PRESSURE PIPELINES

PART 1 - GENERAL

1.01 DESCRIPTION

This section describes the requirements and procedures for pressure and leakage testing of pressure distribution mains.

1.02 RELATED SECTIONS

A. Section 15041 – Disinfection of Piping

1.03 CONNECTION TO EXISTING MAINS

The test shall be made before connection of the new line to the existing District pipes and mains (excepting hot taps).

1.04 TESTER

District may require testing to be performed by a District-approved testing company who will be required to provide the District Representative with certified testing results. Tester will have a gage and meter that is calibrated annually.

1.05 REQUIREMENTS PRIOR TO TESTING

A. Before testing, the pipe trench shall be backfilled with a minimum of 2-1/2 feet of material, or center loaded to hold the pipe in place while testing.

B. All concrete anchor blocks shall be allowed to cure a sufficient time to develop a minimum strength of 2,000 psi before testing unless otherwise approved by the District Representative.

C. Steel pipelines shall not be tested before the mortar lining and coating on the entire pipe length to be tested have attained an age of twenty-four (24) hours. Cement-mortar lined pipe shall not be filled with water until a minimum period of twenty-four (24) hours has elapsed after the last joint in any section has been made.

PART 2 - MATERIALS

2.01 WATER

A. Use only potable water for the hydrostatic pressure test. Make up water for testing shall be potable water.

B. The same water used for chlorination of other sections of the pipeline may not be used to fill the line for hydrostatic pressure or leakage testing.

2.02 TEST BULKHEADS

A. Design and fabricate test bulkheads per Section VIII of the ASME Boiler and Pressure Vessel Code. Materials shall comply with Part UCS of said code.

1. The bulkhead design pressure shall be at least 2.0 times the specified test pressure for the section of pipe containing the bulkhead.

2. Limit the stresses in the bulkhead at the design pressure to 70 percent of yield strength of the bulkhead material.

3. Include air-release and water drainage connections.

2.03 TEST OUTLETS AND TEMPORARY VALVES AND PIPING

A. Provide additional outlets and temporary valves for releasing air or apply the test where automatic air valves or other outlets are available in the pipeline. Construct the outlets in the same manner as for a permanent outlet and seal with a blind flange, pipe cap, or plug and apply coating equal to that of the adjacent pipe after use.

B. Provide a reduced pressure backflow prevention assembly if the source of potable water is from a public waterline.

C. Provide temporary piping to convey and dispose of the test fluid used in the pipeline. Disconnect and remove temporary piping after successful completion of testing.

D. Locate and install test bulkheads, temporary valves and connections to existing pipelines and other appurtenances in a manner to provide air gap separation between existing potable water pipelines and the pipeline being tested.

2.04 TEST EQUIPMENT

Provide pressure gages, pipes, pumps, meters, and other equipment necessary to perform the hydrostatic pressure test.

PART 3 - EXECUTION

3.01 GENERAL

A. Existing facilities will be operated by or under the direction of the District's Representative only.

B. Disinfect the pipeline to be pressure tested before pressure testing when it is connected to a potable water pipeline. Otherwise, perform the required disinfection after pressure testing.

C. All labor, materials, tools, and equipment for testing shall be furnished by the contractor.

D. The pipeline shall be subjected to a field hydrostatic test pressure of 50 psi in excess of the class rating of the pipe being tested for a period of four hours. At the District’s sole

discretion, a test pressure corresponding to 50 psi above the operating pressure (based on the hydraulic grade line of the pipeline) may be used with prior District approval.

E. The test pressure shall not exceed the rated pressure of valves when the boundary of the test section includes closed, resilient-seat gate valves or rubber-seat butterfly valves. Testing against closed valves will NOT be allowed. Valves should not be operated in either direction at differential pressure exceeding the rated valve working pressure.

F. Hydrants in a test section shall be tested with only the main valve of the hydrant closed.

G. Noticeable leaks shall cause the test to be terminated until the leak is repaired and the test is rescheduled.

H. The test shall further be conducted with valves open, and the open ends of pipes, valves, and fittings suitably closed. Valves shall be operated during the test period.

3.02 LENGTH OF TEST SECTION

Test the pipeline in sections. The length of the test section in any one test shall not exceed 2,500 feet, the distance between closed valves, or as directed by the District's Representative.

3.03 FIELD TEST PROCEDURE

A. The pipeline should be filled at a rate such that the average velocity of flow is less than 1 feet per second. At no time shall the maximum velocity of flow exceed 2 fps during filling. The following table relates the filling velocity to an equivalent volume flow rate.

Nominal Size (inches)	Flow Rate*(gpm)
6	85
8	150
10	240
12	340
16	600
18	750
24	1,300

* Filling rate equivalent to pipeline filling velocity of 1 fps for pipe flowing full.

B. All air shall be purged from the pipeline at each service lateral, air valve, blowoff, and hydrant before checking for leaks or performing pressure or acceptance tests on the system. To accomplish this, if air valves or hydrants or other outlets are not available, taps shall be made at the high points to expel the air, and these taps shall be tightly plugged afterwards.

C. After the pipeline has been filled and allowed to sit a minimum of 24 hours (48 hours for mortar-lined pipelines), the pressure in the pipeline shall then be pumped up to the specified test pressure. If a large quantity of water is required to increase the pressure during testing, entrapped air, leakage at joints, or a broken pipe can be suspected. Tests should be discontinued until the source or trouble is identified and corrected.

D. When the test pressure has been reached, the pumping shall be discontinued until pressure in the line has dropped 30 psi, at which time the pressure shall again be pumped up to the specified test pressure. This procedure shall be repeated until four hours have elapsed from the time the specified test pressure was first applied. At the end of the four-hour period, the pressure shall be pumped up to the test pressure for the leakage test.

E. No pressure drop due to leakage is allowed. Any variations in pressure not accounted for by ambient temperature fluctuation or gauge accuracy tolerances shall be considered a failed test.

F. Any noticeable leak shall be stopped and all defective pipe, fittings, valves, and other accessories discovered in consequence of the test shall be removed and replaced by the Contractor. The defective material shall be replaced with sound material, and the test shall be repeated until passing results are achieved.

3.04 BULKHEAD AND TEST FACILITY REMOVAL

After a satisfactory test, drain the water; remove test bulkheads, temporary valves and piping, and other test facilities; connect to existing facilities; and restore the pipe coatings.

END OF SECTION

SECTION 15057

COPPER, BRASS, AND BRONZE PIPE, FITTINGS, AND APPURTENANCES

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials and installation of copper, brass, and bronze pipe, fittings and appurtenances.

1.02 APPROVED MANUFACTURERS

A. All materials shall be the appropriate model number specified in the District Specifications as manufactured by the companies listed herein, or approved equal.

B. Copper Tubing:

1. Per Approved Materials List or approved equal.

C. Service Saddle:

1. Per Approved Materials List or approved equal.

D. Corporation Stop:

1. Per Approved Materials List or approved equal.

E. Angle Meter Stop:

1. Per Approved Materials List or approved equal.

F. Customer Valve:

1. Per Approved Materials List or approved equal.

G. Insulating Pipe Bushings, Unions, or Couplings:

1. Per Approved Materials List or approved equal.

1.03 SERVICE SADDLES

A. Strap-type (single and double) bronze service saddles shall only be installed on asbestos-cement or ductile iron pipe.

B. All service saddles installed on C900 PVC pipe shall be a two or three-piece casting designed for use with the specific outside diameter of the pipe.

PART 2 - MATERIALS

2.01 DESCRIPTION

All materials shall be manufactured domestically unless written approval is granted by the District.

2.02 COPPER

A. Copper tubing shall conform to the requirements of ASTM B88 for seamless copper water tube. Copper tubing shall be true, smooth and clean on both inside and outside and free from any cracks, seams, or other defects. It shall be truly cylindrical, of the full specified outside and inside diameters, and of uniform thickness of metal. All copper tubing shall be Type K.

B. Hard copper shall be used for 1-1/2 inch and larger services. Soft copper may be used for 1-inch services.

C. Fittings shall be copper conforming to ASTM B75 and ANSI B16.22, with compression or grip joint connections.

2.03 BRASS PIPE, NIPPLES, AND FITTINGS

A. Short threaded nipples, brass pipe and fittings shall conform to ASTM B43, regular wall thickness. Threads shall conform to ANSI B1.20.1, NPT.

2.04 BRONZE APPURTENANCES

A. All items specified herein shall be manufactured of bronze conforming to ASTM B62, "Composition Bronze or Ounce Metal Castings."

B. All service saddle bodies shall be manufactured of bronze and shall be tapped for an iron pipe thread. The seal with the pipe shall be effected with either a rubber gasket or an O-ring.

1. All service saddles shall be of the double-strap type for asbestos-cement or ductile iron pipe.

2. All service saddles for C900 PVC pipe shall be cast in two sections for pipe up to and including 8 inches in diameter. Service saddles for use on 10 and 12-inch diameter C900 PVC pipe may be cast in two or three sections. Each saddle shall accurately fit the contour of the pipe O.D. without causing distortion of the pipe. The sections shall be securely held in place with stainless steel or silicon bronze screws or bolts. Casting sections may be hinged and secured with 316 stainless steel pins. The casting sections shall be tapped to receive the screws or bolts. All bolts shall be tightened using a torque wrench as recommended by the manufacturer.

C. Corporation stops shall be manufactured of bronze. The inlet fitting shall be male iron pipe thread when used with saddle and the outlet connection shall be a compression type or iron-pipe thread.

D. Angle meter stops shall be manufactured of bronze. The inlet connection shall be a compression type or iron-pipe thread and the outlet fitting shall be a meter flange or meter coupling. The inlet and outlet shall form an angle of 90 degrees on a vertical plane through the centerline of the meter stop. A rectangular lug and lock wing shall be provided on the top of the fitting to operate the shutoff mechanism. Two-inch angle meter stops shall be with "slotted" holes for 1-1/2 inch or 2-inch meters.

E. Customer Service valves shall be manufactured of bronze with lever-type turn handle. The inlet connection shall be a meter flange or a meter coupling and the outlet female iron pipe.

2.05 FLANGES, GASKETS, BOLTS, AND NUTS

A. Connect to flanged valves and fittings with bronze flanges conforming to ANSI B16.24, Class 125 or Class 150, to match the connecting flange.

B. Gaskets for flanged-end-fittings shall be made of synthetic rubber binder and shall be full-face, 1/8-inch-thick per Approved Materials List or approved equal.

C. When both aboveground adjoining flanges are bronze, use bronze bolts and nuts. Bolts shall conform to ASTM F468, Grade C65100 or C63000. Nuts shall conform to ASTM F467, Grade C65100 or C63000.

D. When only one of the aboveground adjoining flanges is bronze, use Type 316 stainless-steel bolts and nuts conforming to ASTM A193, Grade B8M for bolts and ASTM A194, Grade 8M for nuts.

E. Connect to buried ferrous flanges with flange insulation kits. Bolts used in flange insulation kits shall conform to ASTM B193, Grade B7. Nuts shall comply with ASTM A194, Grade 2H. If the adjoining buried flange is bronze, use bronze bolts and nuts as described above, without a flange insulation kit.

F. Provide one (1) washer for each nut. Each washer shall be of the same material as the nut.

PART 3 - EXECUTION

3.01 COPPER TUBING AND FITTINGS

A. Cut tubing square and fully remove burrs both inside and outside. Do not miter joints for elbows or notch straight runs of pipe for trees.

B. Bends in soft copper tubing shall be long sweep. Shape bends with shaping tools. Form bends without flattening, buckling, or thinning the tubing wall at any point.

C. Brazing procedures shall be in accordance with Articles XII and XIII, Section IX, of the ASME Boiler and Pressure Vessel Code. Silver solder shall be used. Solderers shall comply with ANSI B31.3, paragraph 328.

D. Buried piping shall be installed with some slack to provide flexibility in the event of a load due to settlement, expansion or contraction. A minimum cover of 36 inches below

the finished street grade shall be adhered to. The tubing is to be bedded and covered with sand or select material as determined by the District Representative.

E. All domestic service laterals shall be 1-inch minimum size copper tubing. End connections shall be compression type.

F. All 2-inch size services shall be installed with straight lengths of hard copper water tube Type K.

3.02 SERVICE SADDLE

A. The service saddle shall be no close than 18 inches to a valve, coupling, joint, or fitting unless it is at the end of the main. The installation of a service saddle on any machined section of ACP will not be permitted.

B. The surface of the pipe shall be filed to remove all loose material and to provide a hard, clean surface before placing the service saddle.

C. The service saddle shall be tightened firmly to ensure a tight seal; however, care shall be used to prevent damage or distortion of either the corporation stop or service saddle by over tightening. A torque wrench shall be used per manufacturer's recommendation to avoid damage.

D. The tap into the pipe shall be made in accordance with the pipe manufacturer's recommendation.

3.03 INSTALLING FLANGE BOLTS AND NUTS

A. Lubricate bolt threads with graphite and oil prior to installation.

B. Set flanged pipe with the flange bolt holes straddling the pipe horizontal and vertical centerlines.

3.04 INSULATING BUSHING AND UNIONS

Pipe or fittings made of nonferrous metal shall be isolated from ferrous metals by nylon insulating pipe bushings, unions, or couplings.

END OF SECTION

SECTION 15058

PVC PIPE AND FITTINGS (SCHEDULE SERIES)

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials and installation of polyvinyl chloride (PVC) pipe, conduit, and fittings with iron pipe size outside diameters and solvent welded or threaded joints for miscellaneous applications. Size range is ½-inch to 12-inch.

1.02 RELATED SECTIONS

A. Section 01300 – Record Drawings and Submittals

B. Section 15041 – Disinfection of Piping

C. Section 15042 – Hydrostatic Testing of Pressure Pipelines

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 01300.

B. Submit manufacturer's catalog data and descriptive literature for PVC conduit, pipe, fittings, solvent, and miscellaneous materials. Show dimensions and materials of construction by specification reference and grade.

C. Provide NSF/ANSI Standard 61 certification for materials used in potable water systems.

1.04 QUALITY ASSURANCE

All materials delivered to the job site shall be new, free from defects, and marked to identify the material, class, and other appropriate data such as thickness for piping. Materials shall be subject to inspection prior to acceptance.

PART 2 - MATERIALS

2.01 PVC CONDUIT

A. PVC conduit shall be Schedule 40 conforming to NEMA TC-2, Type EC-40 with long radius elbows and solvent welded joints.

2.02 PVC PIPE

A. PVC pipe shall be Schedule 80, Type I, Grade I (Class 12454-B), conforming to ASTM D1784 and D1785. PVC pipe used in for potable water applications shall be listed by the National Science Foundation (NSF).

2.03 NIPPLES

A. Short nipples shall be the same as the PVC pipe.

2.04 FITTINGS

A. Fittings shall be Schedule 80 conforming to ASTM D2466 for socket-type.

2.05 JOINTS

A. Pipe and fitting joints shall be solvent welded except where threaded joints are required.

B. Solvent cement for socket joints shall comply with ASTM D2564.

PART 3 - EXECUTION

3.01 GENERAL

A. Do not install PVC pipe when the temperature is below 40 degrees or above 90 degrees F.

B. Store pipe and fittings indoors in their original packaging, or outdoors and protected from direct sunlight exposure.

C. Store solvent cement indoors or, if outdoors, shade from direct sunlight exposure. Do not use solvent cements which have exceeded the shelf life marked on the storage container.

D. Before installation, check pipe and fittings for cuts, scratches, gouges, buckling, kinking, or splitting on pipe ends. Remove any pipe section containing defects by cutting out the damaged section as a complete cylinder.

E. Do not drag pipe over the ground, drop it into the ground, or drop objects on it.

3.02 SOLVENT WELDED JOINTS

A. Prior to solvent welding, remove fittings and couplings from their cartons and expose them to the air for at least one hour to the same temperature conditions as the pipe.

B. Cut pipe ends square and remove all burrs, chips, and filings before joining pipe or fittings. Bevel solvent welded pipe ends as recommended by the pipe manufacturer.

C. Wipe away loose dirt and moisture from the inside and outside of the pipe end and the inside of the fitting before applying solvent primer and cement. Do not apply solvent primer to wet surfaces. Apply primer and cements in accordance with manufacturer’s recommendations.

D. Make up solvent welded joints per ASTM D2855.

E. Allow at least 8 hours of drying time before moving solvent welded joints or subjecting the joints to any internal or external loads or pressures.

3.03 INSTALLING BURIED PIPE

A. Use imported sand conforming to Section 02223 in the pipe base and pipe zone.

B. Grade the bottom of the trench uniformly to the line and grade to which the pipe is to be laid. Place pipe base and pipe zone material conforming to Section 02223.

C. Remove foreign matter and dirt from inside of pipe and keep clean during and after pipe laying.

D. Do not backfill the pipe trench until the solvent welded joints have set. Support the pipe uniformly and continuously over its entire length on firm, stable bedding. Do not use blocking to change pipe grade or to support pipe in the trench.

3.04 WARNING/IDENTIFICATION TAPE

A. Install detectable warning/identification tape above PVC pipe in public right-of-way or District easements. See Section 15080.

3.05 PRESSURE TESTING

A. Test miscellaneous piping at the same time that the connecting pipelines are pressure tested. See Section 15042. Repair any leaks in the piping and retest.

3.06 DISINFECTION

A. See Section 15041.

END OF SECTION

SECTION 15060

POLYVINYL CHLORIDE (PVC) PIPE

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials and installation procedures for polyvinyl chloride (PVC) pressure pipe.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 02140 – Dewatering

B. Section 02223 – Trenching, Backfilling and Compaction

C. Section 03300 – Cast-In-Place Concrete

D. Section 09867 – Polyethylene Encasement

E. Section 09868 – Cold Applied Wax Tape Coating

F. Section 15041 – Disinfection of Piping

G. Section 15042 – Hydrostatic Testing of Pressure Pipelines

H. Section 15062 – Ductile Iron Pipe and Fittings

1.03 REFERENCE STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

A. AWWA C900 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100mm Through 300mm), for Water Transmission and Distribution

B. AWWA C905 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In. (350mm Through 1,200mm), for Water Transmission and Distribution

C. AWWA M23 – PVC Pipe - Design and Installation

D. Uni-Bell – Handbook of PVC Pipe Design and Construction

1.04 CONTRACTOR SUBMITTALS

A. Submit shop drawings in accordance with Section 01300.

B. Provide affidavit of compliance meeting all requirements of AWWA C900 or C905, as applicable.

C. Provide National Sanitation Foundation (NSF) 61 certification where pipe will be used in potable water service.

D. Submit manufacturer's catalog data and descriptive literature for high deflection couplings, repair couplings, tracer wire, marking tape, and miscellaneous piping materials.

1.05 QUALITY ASSURANCE

A. The manufacturer of each shipment of pipe shall be required to supply a statement certifying that each lot or load of pipe has been subjected to the tests specified for PVC pipe, and has been found to meet all the requirements of AWWA C900 and/or C905 as applicable.

B. PVC pipe and couplings shall bear indelible identification markings as required by AWWA C900 and C905. In addition, all pipe shall bear a “home” mark on the spigot end to indicate proper penetration when the joint is made.

C. Pipe that shows evidence of exposure to sunlight, age, surface deterioration, or other physical damage shall be rejected. The decision of the District shall be final as to the acceptability of the pipe to be installed.

D. Where new pipelines are to be connected to existing pipelines, the Contractor shall field verify the location, elevation, pipe material, pipe outside diameter, and any other characteristics of the existing pipe before proceeding with pipe installation.

1.06 DELIVERY, STORAGE AND HANDLING

A. PVC pipe shall be stored in suppliers' yards and on the job site in accordance with AWWA M23 and the manufacturer's recommendations. Store PVC pipe in the field by supporting the pipe uniformly in accordance with AWWA M23. Pipe shall not be stacked higher than 4 feet or with weight on the bell ends.

B. Cover stored PVC pipe with an opaque material to protect it from the sun's ultraviolet radiation. PVC pipe that has been subjected to excess ultraviolet radiation as identified by color fading or chalking shall not be used. The determination as to the acceptability of PVC pipe shall rest solely with the District Engineer.

C. PVC pipe that has been contaminated in any way with petroleum products (on the inside or outside of the pipe) shall not be used.

PART 2 - MATERIALS

2.01 PVC PIPE

A. Pipe shall be polyvinyl chloride (PVC) conforming to AWWA C900 or C905 with material cell classification 12454-B per ASTM D 1784. Pipe shall have an integral bell end with elastomeric gasket and a spigot end.

B. PVC pipe in diameters 4-inch through 12-inch shall comply with the requirements of AWWA C900, dimension ratio (DR) 14.

C. PVC pipe in diameters 14-inch through 36-inch shall comply with the requirements of AWWA C905, dimension ratio (DR) 18.

D. Provide pipe in standard 20-foot laying lengths. Random lengths will not be permitted.

E. PVC Pipe manufacturer shall be per the Approved Materials List or approved equal.

2.02 HIGH DEFLECTION COUPLINGS

A. Provide polyvinyl chloride (PVC) couplings with twin elastomeric gaskets which allow for 2½-degree deflection at each bell for a maximum of 5-degree total deflection per coupling. If specified on the plans, couplings shall be restrained.

B. Couplings for cast iron outside diameter pipe sizes shall meet the requirements of AWWA C900.

C. Couplings for iron pipe size (IPS) outside diameter pipe shall meet ASTM D3139.

D. High Deflection Couplings manufacturer shall be per the Approved Materials List or approved equal.

2.03 CLOSURE/REPAIR COUPLINGS

A. Provide polyvinyl chloride (PVC) couplings with twin elastomeric gaskets which are designed to connect plain ends of straight pipe. Couplings shall meet the material requirements of high deflection couplings specified herein.

B. Do not deflect pipe in these couplings.

C. Closure/Repair Couplings manufacturer shall be per the Approved Materials List or approved equal.

2.04 FITTINGS

A. Ductile-iron fittings shall meet the requirement of Section 15062.

B. Fittings shall have mechanical joints compatible for use with cast iron outside diameter PVC pipe.

C. Fittings manufacturer shall be per the Approved Materials List or approved equal.

2.05 OUTLETS

A. For outlets 2 inches and smaller with working pressures 200 psi or less, attach a service saddle and corporation stop to the pipe. Provide service saddles with full width, cast bronze bodies conforming to ASTM B62, O-ring gaskets, and iron pipe threads. Provide Type 316 stainless steel double band straps with four bolts or a single wide strap with four bolts. All stainless steel shall be fully passivated for enhanced corrosion resistance. Saddles shall be manufactured for installation on cast iron equivalent outside diameter PVC pipe conforming to AWWA C900 or C905.

B. Service saddles shall be per the Approved Materials List or approved equal.

C. For outlet diameters 3 inches and larger, use a ductile iron tee with a flanged outlet.

2.06 RESTRAINED JOINTS

A. Mechanical Joint Restraint.

1. The restraining mechanism for mechanical joints shall consist of a follower gland having a seal gasket and individually actuated wedges that increase their resistance to pullout as pressure or external forces increase. The system manufacturer shall provide all the components (follower ring, wedges, and gaskets) for the restraining device.

2. The device shall be capable of full mechanical joint deflection during assembly and the flexibility of the joint shall be maintained after burial.

3. The joint restraint ring and its wedging components shall be constructed of ductile iron conforming to ASTM A 536, Grade 60-42-10. The wedges shall be ductile iron, heat-treated to a minimum hardness of 370 BHN. Dimensions of the gland shall be such that it can be used with mechanical joint bells conforming to AWWA C111 and AWWA C153. The design shall use torque limiting twist-off nuts to provide actuation of the restraining wedges.

B. Restraint for PVC Pipe.

1. Joint restraint for C900 PVC pipe and fitting systems shall be effected by an internal self-restraining system. Such a system shall be rated by the manufacturer to pressures that meet or exceed the rating of the C900 PVC pipe being restrained (e.g. DR 18 is rated for service at 235 psi). No degradation of the pipe's performance is allowed. Use a system such as RieberLok or approved equivalent.

2. Gasket material shall be SBR or approved equal.

3. Pipe shall be manufactured according to ANSI/AWWA C900 specifications and shall originally be fitted with a Rieber gasket or approved equal.

4. Installation shall be in accordance with ANSI/AWWA C605 and the restraint manufacturers recommendations.

C. Minimum rated pressure shall be equal to that of the pipe on which the fittings will be installed.

D. Restraint fittings shall be per the Approved Materials List or approved equal.

2.07 TRACER WIRE

A. Use AWG No. 8 stranded copper wire with high molecular weight polyethylene (HMW/PE) insulation specifically designed for direct burial in corrosive soil or water. Polyethylene insulation shall conform to ASTM D1248, Type 3, Class C, Grade 5. Refer to the Approved Materials List for manufacturer.

2.08 MARKING TAPE

A. Use marking tape consisting of one layer of aluminum foil laminated between two colored layers of inert plastic film. The lamination bond should be strong enough that the layers cannot be separated by hand. Tape shall be a minimum of 5 mils thick and 6 inches wide. Elongation shall be a minimum of 600 percent. Tape shall bear a continuous, printed message every 16 to 36 inches warning of the installation buried below. Tape shall be per the Approved Materials List, or approved equal.

PART 3 - EXECUTION

3.01 DELIVERY AND TEMPORARY STORAGE

A. Support the pipe uniformly during transport and storage. Avoid scratching the pipe surface. Do not stack higher than 4 feet nor stack with weight on bells. Cover to protect from sunlight.

B. Do not install pipe that is gouged or scratched forming a clear depression.

C. Do not install pipe that has been contaminated with a petroleum product (inside or outside).

D. Do not install any pipe that shows evidence of exposure to sunlight, age, surface deterioration, or other physical damage. The decision of the District's Representative shall be final as to the acceptability of the pipe to be installed.

3.02 HANDLING OF PIPE

A. Lift pipes with mechanical equipment using wide belt slings. Do not use cable slings or chains. Do not move pipe by inserting any devices or pieces of equipment into the pipe barrel.

3.03 SANITATION OF PIPE INTERIOR

A. During laying operations, do not place tools or any other materials in the pipe.

B. When pipelaying is not in progress, including the noon hour, close the ends of the installed pipe with plugs to prevent entry of vermin or persons.

3.04 INSTALLING PIPE IN TRENCH

A. See Section 02200 and 02223 for earthwork requirements.

B. Inspect each pipe and fitting before lowering into the trench. Clean ends of pipe thoroughly. Remove foreign matter and dirt from inside of pipe and keep clean during and after laying.

C. Handle pipe in a manner to avoid any damage to the pipe. Do not drag pipe over the ground, drop it onto the ground, or drop objects on it. Do not drop or allow pipe to fall into trenches.

D. Laying tolerances for the installed pipe shall not vary greater than 0.3-foot horizontally, or greater than 0.1-foot vertically from the alignment and elevations shown on the Drawings.

E. Grade the bottom of the trench to the line and grade to which the pipe is to be laid, with allowance for pipe thickness. Remove hard spots that would prevent a uniform thickness of pipe base material (imported sand). Before laying each section of the pipe, check the grade with a straightedge and correct any irregularities found. The trench bottom shall form a continuous and uniform bearing and support for the pipe at every point between bell holes, except that the grade may be disturbed for the removal of pipe handling slings.

F. At the location of each joint, dig bell holes in the bottom of the trench and at the sides to permit visual inspection of the entire joint and to prevent the pipe from being supported by the bell end or fitting.

G. Keep the trench in a dewatered condition during pipelaying.

H. When pipelaying is not in progress, including the noon hours, close the open ends of pipe. Do not permit trench water, animals, or foreign material to enter the pipe.

3.05 DEWATERING

A. Dewatering of trench excavations shall be performed in accordance with Section 02140. If flooding of the trench does occur, the Contractor shall immediately dewater and restore the trench. Damaged or altered pipelines, appurtenances, or trench materials shall be repaired or replaced as directed by the District Engineer.

3.06 PIPE INSTALLATION

A. When the work requires and the size of the pipe allows entry of personnel into the pipe, the Contractor shall comply with all Federal and State regulations for confined space entry. Work inside pipelines shall not be undertaken until all the tests and safety provisions of the Code of Federal Regulations 1910.146, and the General Industry Safety Orders of the California Code of Regulations, Title 8, Section 5159 for confined space entry have been performed and the area is verified as safe to enter. The Contractor shall furnish and install all pipe, specials, fittings, closure pieces, valves, supports, bolts, nuts, gaskets, jointing materials, and all other appurtenances as shown on the Approved Plans and as required to provide a complete and workable installation. Install pipe in the trench

as follows: A. Inspect each section of pipe prior to lowering the pipe into the trench. Thoroughly clean the ends of the pipe. Remove foreign matter and dirt from inside of the pipe and keep clean during and after installation.

B. Install pipe according to the manufacturer's approved order of installation to the proper lines and grades in accordance with the Approved Plans and as follows:

1. Install pipe uphill if the grade exceeds ten percent (10%).

2. Installation tolerances for the pipe shall not vary more than 50mm (2”) horizontally or 25mm (1”) vertically from the alignment and elevations shown on the Approved Plans.

3. Install the pipe such that the identification markings on each pipe section are continuously aligned for the total length of the pipeline alignment. Orient the strip marking upward to the 12 o’clock position (top) of the trench opening.

C. The pipe shall have firm bearing along its full length, and bell holes shall be provided t each joint to permit visual inspection of the joint and prevent the pipe from being supported by the bell end or coupling.

D. The beveled end of the pipe shall be removed prior to insertion into a mechanical joint fitting.

E. Field cutting and milling shall be performed in accordance with the manufacturer’s written instructions to equal the quality of shop-fabricated ends.

F. Pipe Assembly:

1. Push-On Type: Assemble the pipe joint using a lubricant selected from the Approved Materials List. Insert the spigot end into the bell or coupling to the proper insertion mark. Check that the elastomeric ring has not left the groove during assembly by passing a feeler gauge around the completed joint. Drive spigot ends of the pipe into bell ends in accordance with the manufacturer’s recommendations. Stabbing shall not be permitted.

2. Mechanical-Joint Type: Assembly of mechanical joint fittings shall be in accordance with the manufacturer’s recommendations regarding installation.

G. PVC pipe shall not be bent, nor shall PVC pipe be deflected at pipe connections other than deflection couplings. Install deflection couplings selected from the Approved Materials List for horizontal and vertical changes in direction not greater than 5*, and for installation of pipe through curves. Pipe sections of differing lengths may be used as follows to facilitate the installation of pipelines through curves:

1. Allowable lengths of pipe sections through curves are 6.10m (20’), 3.05m (10’), or 1.52m (5’) only. 2. No more than two 1.52m (5') pipe sections may be used in succession without being separated by a 6.10m (20’) or 3.05m (10') section. Pipe layout through curves is subject to approval by the District Engineer. In no case shall the minimum radius be less than 23.16m (76').

3.07 INSTALLING FLANGE ADAPTERS

A. Clean bolts, nuts and flange faces by wire brushing before installing gasket and adjoining flange. Coat bolt shafts with waterproof gear grease or primer for wax tape coating prior to insertion in flange bolt holes. Do not apply grease or primer to threads. Lubricate threads of bolts and nuts with oil or graphite prior to installation. Assemble all bolts and nuts in the flange, then uniformly tighten bolts and nuts in a progressive diametrically opposite sequence, and torque with a calibrated torque wrench. All clamping torque shall be applied to the nuts only.

B. If flanges leak under pressure testing, loosen or remove the nuts and bolts, reset or replace the gasket, reinstall or retighten the bolts and nuts, and retest the joints. Joints shall be watertight. Replace galled, cracked, or distorted bolts and nuts.

3.08 INSTALLING SERVICE SADDLES

A. Place the service saddle on the pipe and hand tighten the nuts while positioning the saddle in its final location. Uniformly tighten the nuts in a progressive diametrically opposite sequence and torque with a calibrated torque wrench to the saddle manufacturer’s recommended values.

B. Connect a corporation stop to the saddle. Apply Teflon joint compound or tape to the male threads before installing the corporation stop. Make joints watertight.

C. Mount a tapping machine on the corporation stop to cut a hole in the pipe with a shell type cutter made specifically for PVC pipe. Do not use other devices or hand equipment to bore through the pipe wall.

3.09 INSTALLING POLYETHYLENE ENCASEMENT

Wrap buried metallic components including service saddles, fittings and valves with a three-part, cold applied wax tape coating system per Section 09868 and polyethylene encasement per Section 09867. Complete the wrap prior to placing concrete anchors, supports, or thrust blocks. Repair polyethylene material damaged during construction prior to backfilling.

3.10 INSTALLATION AND TESTING OF TRACER WIRE

A. Prior to backfill, install tracer wire on top of pipe and secure with 2-inch wide plastic adhesive tape at maximum 10-foot intervals. Run tracer wire continuously along pipe and terminate in adjacent valve boxes for buried assemblies or buried valves. Where buried splices occur, use an electrical splicing kit consisting of a split bolt connector, mold, and a two-part encapsulating epoxy resin such as Scotchcast, or approved equal.

B. Provide 24 inches of coiled wire at access points for attachment of pipe locating equipment. Each installed run of pipe shall be capable of being located using the tracer wire. Protect wire insulation from damage during installation and backfilling. Wires with cut or damaged insulation are not acceptable and replacement of the entire wire which has been damaged will be required at the Contractor's expense.

C. After all utilities have been installed and backfilled, the wire shall be tested for continuity by the Contractor using an approved tone testing device. District staff shall witness the continuity testing. Wires not passing the continuity test shall be replaced at the Contractor's expense.

3.11 INSTALLING MARKING TAPE

A. After the pipe zone and the first 12 inches in the trench zone have been backfilled and compacted, place the marking tape on the compacted backfill and center the tape over the pipe. Run the tape continuously along the trench and tie the end of the tape to the preceding tape segment. Wrap the marking tape around valve box extension pipes and continue along the pipe.

3.12 PRESSURE TESTING

A. See District Standard Specifications Section 15042 Hydrostatic Testing of Pressure Pipelines.

3.13 DISINFECTION

A. See District Standard Specifications Section 15041 Disinfection of Piping.

END OF SECTION

SECTION 15062

DUCTILE IRON PIPE AND FITTINGS

PART 1 - GENERAL

1.01 DESCRIPTION

This section covers materials and installation of ductile iron pipe and fittings for distribution and transmission pipelines and appurtenances.

1.02 RELATED SECTIONS

A. Section 09867 – Polyethylene Sheet or Tube Encasement

B. Section 09868 – Cold Applied Wax Tape Coating

C. Rincon del Diablo Municipal Water District, Standard Specifications

1.03 REFERENCE STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

A. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs

B. ASTM C150 - Standard Specification for Portland Cement

C. ASTM A536 - Standard Specifications for Ductile Iron Castings

D. AWWA C104 - Cement Mortar Lining for Ductile Pipe and Fittings for Water mains

E. AWWA C105 - Polyethylene Encasement for Ductile Iron Pipe

F. AWWA C110 - Ductile Iron Fittings

G. AWWA C111 - Rubber-Gasket Joints for Ductile Iron Pipe and Fittings

H. AWWA C115 - Flanged Ductile Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges

I. AWWA C150 - Thickness Design of Ductile Iron Pipe

J. AWWA C151 - Ductile Pipe, Centrifugally Cast

K. AWWA C153 - Ductile Iron Compact Fittings

L. AWWA C217 - Cold-Applied Petroleum Wax Tape Coatings

M. AWWA C600 - Installation of Ductile Iron Water Mains

N. AWWA C602 - Cement-Mortar Lining of Water Pipelines

O. AWWA C606 - Grooved and Shouldered Type Joints

1.04 CONTRACTOR SUBMITTALS

A. Submit shop drawings in accordance with Section 01300.

B. Provide an affidavit of compliance with standards referenced in this Specification.

C. Submit manufacturer's literature on ductile iron pipe and fittings including dimensions, thickness, weight, coating, lining, and a statement of inspection and compliance with the acceptance tests of AWWA C151 and C110, respectively.

D. Submit manufacturer's literature on ductile iron pipe fittings conforming to AWWA C153 including dimensions, thickness, weight, coating and lining. Submit certificate of compliance with AWWA C153. Include legible engineering analysis sealed by a registered professional engineer or test results confirming the hydrostatic design in accordance with Section 53-5.3 of AWWA C153 for each size and configuration of fitting to be supplied. Submit results of foundry tests required by AWWA C153 including chemical analysis per Section 53-13.

E. Submit dimensions of push-on joints and other joints which do not conform to rubber gasket joints in accordance with AWWA C111.

F. Submit tabulated layout schedule and drawing location and dimensions of pipe and fittings including:

1. Pipe station and top of pipe elevation at each change of grade and alignment.

2. Elements of curves and bends, both in horizontal and vertical alignment, including elements of the resultant true angular deflection in cases of combined curvature.

3. The limits of each reach of pipe thickness class and of restrained joints.

4. The limits of each reach of concrete encasement or encasement in casing.

5. Locations and details of bulkheads for field hydrostatic testing of the pipeline.

6. Locations of closures for length adjustment and for construction convenience.

7. Locations of manholes and other points of access for placement of mortar lining at field joints and removal of test bulkheads.

8. Locations of valves and other mechanical equipment.

G. Submit joint details.

H. Submit manufacturer's literature on restrained joint systems and calculations and/or test data proving that the proposed restrained joint arrangement can transmit the required thrust.

I. Submit copy of manufacturer's quality control check of pipe material and production.

J. Submit certificate that cement complies with ASTM C150, designating type.

K. Submit test report on physical properties of rubber compound used in the gaskets.

L. Submit manufacturer's catalog data and descriptive literature on marking tape.

1.05 INSPECTION AND FIELD VERIFICATION

A. The Engineer may inspect materials, productions, and testing of pipes, fitting, and special pieces at manufacturer's plant.

B. Where new pipelines are to be connected to existing waterlines, the Contractor shall verify in the field the location, elevation, pipe material, pipe outside diameter, and any other characteristics of the existing waterline before proceeding with the installation. This field verification shall be performed in the presence of the Engineer.

PART 2 - MATERIALS

2.01 DUCTILE IRON PIPE

A. Pipe shall be ductile iron pipe manufactured in accordance with the ANSI/AWWA C151/A21.51. Provide pipe in nominal 18-foot or 20-foot laying lengths.

B. Plainly mark each length of straight pipe to identify the design pressure class or thickness class, the wall thickness, and date of manufacture. Mark the spigot end of plain end pipe to clearly show the required depth of insertion into the bell.

2.02 PIPE WALL THICKNESS

A. Pipe wall thickness shall be designed in accordance with ANSI/AWWA C150/21.50 and shall be based on laying conditions and internal pressures as indicated on the Drawings. The minimum pressure class shall be Class 350 for 24-inch and smaller pipe diameters and Class 250 for larger pipe diameters.

B. Minimum wall thickness for pipe having threaded flanges shall be Special Thickness Class 53 per AWWA C151.

C. Minimum wall thickness for pipe having grooved end joints shall conform to AWWA C606.

2.03 TYPE OF PIPE JOINTS

A. Joints in aboveground piping or piping located in vaults and structures shall be flanged or mechanical clamp-type couplings. Use flange adapters only if shown on the Drawings.

B. Joints in buried piping shall be push-on or mechanical joint per AWWA C111 except where flanged joints are required to connect to valves, meters and other equipment or as shown on the Drawings. Push-on joints shall be per the Approved Materials List or District approved equal.

C. Where specified on the Drawings, restrained push-on joint for buried pipe shall be per the Approved Materials List or District approved equal.

D. Mechanical joint restraining glands shall be of the type specified elsewhere in this Section.

E. Provide plain end pipe where flexible pipe couplings are to be used.

2.04 DUCTILE IRON FITTINGS

A. For 3-inch to 24-inch, provide ductile iron push-on or mechanical joint fittings conforming to AWWA C110 with a rated working pressure of 350 psi.

B. Provide ductile iron push-on or mechanical joint fittings conforming to AWWA C110 with a rated working pressure of 250 psi for 30-inch to 48-inch, and 200 psi for 54-inch through 64-inch.

C. In lieu of fittings conforming to AWWA C110, provide ductile iron compact fittings conforming to AWWA C153 with a minimum rated working pressure of 350 psi. Provide fittings constructed of Grade 70-50-05 ductile iron having a minimum weight equal to the weight tabulated in AWWA C153. Mechanical joint bells shall conform to AWWA C111. Mechanical joint glands shall be Grade 70-50-05 ductile iron and cast in one continuous ring. Fittings with repaired defects are not acceptable and will be rejected.

D. For mechanical joint fittings with glands, use tee-head or non-hex head bolts and hex head nuts for joint makeup and gasket seating. Bolts and nuts shall be zinc coated carbon steel.

E. For grooved or shouldered end fittings, use ductile iron fittings conforming to AWWA C606. The minimum thickness of pipe to be used with grooved or shouldered ends shall conform to AWWA C606.

F. Material for fittings with welded on bosses shall have a Charpy notch impact value of minimum 10 ft-lbs under the conditions defined in AWWA C151. Test completed welds by the liquid penetrant method per ASTM E 165.

G. Ductile Iron Fittings shall be per the Approved Materials List or approved equal.

2.05 FLANGES

A. Provide flat faced ductile iron flanges with serrated facings conforming to AWWA C110 and ANSI B16.42 Class 150.

B. For flanged fittings with working pressures greater than 250 psi, use ductile iron fittings conforming to ANSI B16.42 Class 300.

C. Ductile iron blind flanges shall be of pressure rating and drilling to match those of the mating fitting, valve, or flange. Blind flange thickness shall not be less than those specified for flanges in AWWA C115.

D. Threaded flanges shall be flat faced, solid back, ductile iron per AWWA C115.

E. Flanged pipe shall be either cast or threaded. Flanged pipe shall be shop fabricated, not field fabricated. Prior to assembly of the threaded flange onto the pipe, apply a thread compound to the threads to provide a leak-free connection. There shall be zero leakage through the threads at a hydrostatic test pressure of 250 psi without the use of the gasket. Flanges shall be machined flat and perpendicular to the pipe barrel. Flanges shall be backfaced parallel to the face of flange. Bolt holes of flanges shall straddle the horizontal and vertical centerline of the pipe.

F. All machined faces of flanges shall be coated with a temporary rust-inhibitive coating until final coating or the installation is completed.

2.06 LINING AND COATING

A. Line the interior of pipe and fittings with cement mortar with a seal coat per AWWA C104. Provide double thickness lining and use cement conforming to ASTM C150, Type II.

B. Coat the exterior of buried pipe and fittings with an asphalt material per AWWA C151. Apply coating in shop.

C. Epoxy coat the interior and exterior of pipe and fittings in vaults or above-grade per Section 09900, System No. 5. Apply coatings in shop. Coatings shall be holiday free.

2.07 BOLTS, NUTS AND GASKETS FOR FLANGES

A. Provide heavy hex, carbon steel bolts and nuts for buried flanges to be wrapped with polyethylene materials, where located aboveground, or in vaults and structures. Bolts and nuts shall conform to ASTM A307 Grade B and ASTM A563 Grade A, respectively.

B. Provide washers for each bolt head and nut. Washers shall be of the same material as the bolts and nuts.

C. Gaskets shall be asbestos-free, drop-in ring type, 1/16-inch or 1/8-inch thick, and shall be acrylic or aramid fiber bound with nitrile. Gaskets shall be suitable for a water pressure of 500 psi at a temperature of 400 degrees F.

D. Gaskets shall be per the Approved Materials List or District approved equal.

2.08 SERVICE SADDLE OUTLETS

A. For outlets 2 inches and smaller with working pressures 200 psi or less, drill the pipe and attach a service saddle to the pipe. Provide service saddles with full width, cast bronze bodies conforming to ASTM B62, O-ring gaskets, and iron pipe threads. Provide Type 304 stainless steel double band straps with four bolts or a single wide strap with four

bolts. All stainless steel shall be fully passivated for enhanced corrosion resistance. Service saddles shall be per the Approved Materials List or District approved equal.

B. For outlets 3 inches and larger or with working pressures greater than 200 psi and less than 300 psi, use a ductile iron tee with a flanged outlet. For 2-inch and smaller outlets, install a ductile iron reducing flange with iron pipe threads and an insulating bushing on the outlet.

2.09 MECHANICAL CLAMP-TYPE COUPLINGS AND FLANGE ADAPTERS

A. Mechanical clamp-type couplings and flange adapters for grooved or shouldered end pipe shall be malleable iron, ASTM A47 Grade 32510; or ductile iron, ASTM A536 Grade 65-45-12. Bolts shall conform to ASTM A183, 110,000 psi tensile strength. Gaskets shall be halogenated butyl rubber or EPDM conforming to ASTM D2000.

B. Couplings for pipe 24 inches and smaller shall conform to AWWA C606 for rigid, radius cut grooved joints in ductile iron pipe. Couplings shall per the Approved Materials List or approved equal.

C. Couplings for pipe, larger than 24 inches, shall conform to AWWA C606 for shouldered end pipe. Couplings shall be per the Approved Materials List or approved equal.

D. Grooved end flange adapters for piping having an operating pressure of 150 psi and less shall have dimensions conforming to ANSI B16.42 Class 150 and shall be per the Approved Materials List or approved equal.

2.10 MECHANICAL JOINT RESTRAINT

A. The restraining mechanism for mechanical joints shall consist of a follower gland having a seal gasket and individually actuated wedges that increase their resistance to pullout as pressure or external forces increase. The system manufacturer shall provide all the components (follower ring, wedges, and gaskets) for the restraining device.

B. The device shall be capable of full mechanical joint deflection during assembly and the flexibility of the joint shall be maintained after burial.

C. The joint restraint ring and its wedging components shall be constructed of ductile iron conforming to ASTM A 536, Grade 60-42-10. The wedges shall be ductile iron, heat-treated to a minimum hardness of 370 BHN. Dimensions of the gland shall be such that it can be used with mechanical joint bells conforming to AWWA C111 and AWWA C153. The design shall use torque limiting twist-off nuts to provide actuation of the restraining wedges.

D. Minimum rated pressure shall be 350 psi for sizes 16 inches and smaller and 250 psi in sizes 18 inches and larger.

E. Mechanical joint restraint shall be per the Approved Materials List or approved equal.

2.11 DUCTILE IRON PIPE WELDMENTS

A. All welding to ductile iron pipe, such as for bosses or joint restraint shall be done at the place of manufacture of the pipe. Perform welding by skilled welders who have experience in the method and materials to be used. Welders shall be qualified under the standard qualification procedures of the ASME Boiler and Pressure Vessel Code, Section IX, Welding Qualifications.

B. Welds shall be of uniform composition, neat, smooth, full strength, and ductile. Completely grind out porosity and cracks, trapped welding flux, and other defects in the welds in such a manner that will permit proper and complete repair by welding.

C. Completed welds shall be inspected at the place of manufacture by the liquid penetrant method. Conform to the requirements specified in ASTM E 165, Method A, Type I or Type II. The materials used shall be water washable and nonflammable.

2.12 CEMENT MORTAR

A. Cement mortar for buttering and pointing the inside joints shall consist of one part cement to 1-1/2 parts sand by damp loose volume. The quantity of mixing water shall be no more than necessary for handling and placing. Cement shall conform to ASTM C150, Type II. Sand shall conform to ASTM C144 for masonry sand.

2.13 MARKING TAPE

A. Marking tape shall consist of one layer of aluminum foil laminated between two colored layers of inert plastic film. The lamination bond shall be strong enough to withstand separation by hand. Tape shall be a minimum of 5 mils thick and 6 inches wide. Tape shall bear a continuous, printed message every 16 to 36 inches warning of the installation buried below. Tape shall be per the Approved Materials List or approved equal.

PART 3 - EXECUTION

3.01 PRODUCT MARKING

A. Plainly mark each length of straight pipe to identify the ductile iron wall thickness and date of manufacturer. Mark the spigot end of restrained joint pipe to show clearly the required depth of insertion into the bell.

3.02 DELIVERY AND TEMPORARY STORAGE

A. Limit onsite pipe storage to a maximum of one week. Place the pipe alongside the trench and secure it from rolling. Support the pipe on wooden blocks, sandbags, mounds of sand, or other suitable supports. Do not roll or drop the pipe on the ground or allow the pipe to fall from the pipe trailer trucks.

B. Avoid cracking of the cement mortar lining. If necessary, use plastic sheet bulkheads to close pipe ends and keep lining moist.

C. Do not install pipe or fittings with damaged linings. Patch damaged areas in the field with material similar to the original. Where damage cannot be repaired in the field, replace the defective pipe or fittings.

3.03 HANDLING OF PIPE

Lift pipes with mechanical equipment using wide belt slings. Do not use cable slings or chains. Do not move pipe by inserting any devices or pieces of equipment into the pipe barrel.

3.04 SANITATION OF PIPE INTERIOR

A. During laying operations, do not place tools, clothing, or other materials in the pipe.

B. When pipelaying is not in progress, including the noon hour, close the ends of the installed pipe with a plug to deter entry by vermin or children.

3.05 POLYETHYLENE ENCASEMENT OF PIPING, FITTINGS, AND VALVES

A. See Section 09867

3.06 INSTALLING PIPE IN TRENCH

A. See ANSI/AWWA C600-Installation of Ductile Iron Water Mains and their Appurtenances, for trench requirements.

B. Inspect each pipe and fitting before lowering into the trench. The Engineer will inspect all pipe prior to installation for damage to the interior protective coatings. Patch damaged areas in the field with material similar to the original. Clean ends of pipe thoroughly. Remove foreign matter and dirt from the inside of pipe and keep clean during and after laying.

C. Handle pipe in a manner to avoid any damage to the pipe. Do not drag pipe over the ground, drop it onto the ground, or drop object on it. Do not drop or dump pipe into trenches.

D. Laying tolerances for the installed pipe shall not vary greater than 0.3-foot horizontally, or greater than 0.1 foot vertically from the alignment and elevations shown on the Approved Plans.

E. Grade the bottom of the trench to the line and grade to which the pipe is to be laid, with allowance for pipe thickness. Remove hard spots that would prevent a uniform thickness of pipe base material (imported sand). Before laying each section of the pipe, check the grade with a straightedge and correct any irregularities found. The trench bottom shall form a continuous and uniform bearing and support for the pipe at every point between the bell holes, except that the grade may be disturbed for the removal of pipe handling slings.

F. At the location of each joint, dig bell holes in the bottom of the trench and at the sides to permit visual inspection of the entire joint and to prevent the pipe from being supported by the bell end or fitting.

G. Keep the trench in a dewatered condition during pipelaying.

H. When the pipelaying is not in progress, including the noon hours close the open ends of pipe. Do not permit trench water, animals, or foreign material to enter the pipe.

I. For pipes 24 inches in diameter and larger, the amount of pipe to be laid and assembled in a trench shall be limited to a distance of approximately 320 feet. No additional pipe will be allowed to be installed in the trench until the other related operations of pipeline construction are completed. Other operations include, but are not limited to, bond wires, backfilling and compacting, completion of interior joints, and inspection of the pipe interior. The interior of the pipeline is considered a confined or enclosed space having a limited means of egress which is subject to the accumulation of toxic or flammable contaminants or has an oxygen deficient atmosphere.

3.07 ASSEMBLING PUSH-ON PIPE JOINTS

A. The spigot and integral bell shall be dirt free and slide together without displacing the rubber ring gasket. Lay the pipe section with the integral bell facing the direction of laying.

B. Clean the groove of the bell of all foreign materials. Insert the gasket into the groove of the bell prior to installation. Observe the correct direction of the shaped gasket. Feel that the gasket is completely and evenly seated in the groove.

C. Lubricate the exposed gasket surface and the beveled spigot up to the full insertion length with the lubricant supplied by the pipe manufacturer. If the lubricated pipe end touches dirt, clean the pipe end and reapply lubricant.

D. Insert the spigot into the bell and apply slow, continuous force until insertion to the mark on the spigot end is achieved.

E. Check that the rubber ring gasket has not left the groove during assembly by passing a feeler gage around the completed joint.

F. Assemble restrained joints per manufacturer's instructions.

3.08 INSTALLING BURIED FITTINGS

A. The Engineer will inspect all fittings prior to installation for damage to the interior protective coatings. Patch damaged areas in the field with material similar to the original.

B. For mechanical joint fittings, clean the bell socket and the plain end of the pipe of all foreign material and dirt. Place the gland on the pipe spigot with the lip extension toward the plain end. Lubricate the pipe spigot and gasket. Use the same lubricant as supplied by the pipe manufacturer. Install the gasket on the pipe spigot with the narrow edge of the gasket toward the plain end. Install the pipe into the bell socket and press the gasket firmly into the gasket recess. Keep the joint straight during assembly. Push the gland towards the socket and center it around the pipe with the gland lip against the gasket. Insert bolts and hand tighten nuts. Make joint deflection after assembly but before tightening bolts. Uniformly tighten bolts and nuts in a progressively diametrically

opposite sequence, and torque nuts to 75- to 90-foot pounds with a calibrated torque wrench.

C. For push-on and restrained push-on fittings, clean the bell ends of the fitting of all foreign material and dirt. Insert the gasket in the groove of the bell and make sure the gasket faces the correct direction. Feel that the gasket is completely and evenly seated in the groove. When pipe is cut in the field, bevel the plain end prior to installation. Lubricate the exposed gasket surface and the beveled pipe spigot with the same lubricant supplied by the pipe manufacturer. Insert the spigot into the bell and apply slow, continuous force while keeping the joint straight. Make joint deflection after the joint is assembled. Remove all slack between the pipe and the fitting after installing restrained joint fittings.

3.09 JOINT DEFLECTIONS FOR BURIED PIPE

A. When necessary to deflect pipe from a straight line in either the horizontal or vertical plane, do not exceed the following joint deflection angles for unrestrained buried pipe or fittings. The angles shown are for each joint and are maximum deflections.

Nominal Pipe Size (inches)	Mechanical Joint (inches)	Push-On Joint (degrees)
4 through 12	5	4
14 through 16	4	3
18 through 30	3	2-1/2
36 through 48	2	2

B. Do not exceed 80 percent of the manufacturer's recommended maximum deflection.

3.10 INSTALLING PIPE IN VAULTS

A. Install pipe in vaults without springing, forcing, or stressing the pipe or any adjacent connecting valves or equipment. Provide temporary supports and place the assembled piping at the correct grade and position in the vault.

B. Provide pipe supports as shown on the Drawings.

3.11 INSTALLING FLANGED JOINTS

A. Clean bolts, nuts and flange faces by wire brushing before installing gasket and adjoining flange. Coat bolt shafts with waterproof gear grease or primer for wax tape coating prior to insertion in flange bolt holes. Do not apply grease or primer to threads. Lubricate threads of bolts or nuts with oil or graphite prior to installation. Assemble all bolts and nuts in the flange, and then uniformly tighten bolts and nuts in a progressive diametrically opposite sequence, and torque with a calibrated torque wrench. All clamping torque shall be applied to the nuts only.

B. If flanges leak under pressure testing, loosen or remove the nuts and bolts, reset or replace the gasket, reinstall or retighten the bolts and nuts, and retest the joints. Joints shall be watertight. Replace galled, cracked, or distorted bolts and nuts.

C. After testing, coat exposed surfaces of bolts and nuts to be buried with primer for wax tape coating per Section 09868.

D. Wrap flanges which connect to buried valves or other buried equipment with sheet polyethylene per Section 09867. Extend the polyethylene material over the flanges and bolts, and secure it around the adjacent pipe circumference with plastic adhesive tape.

E. When joining ductile iron flanges to steel flanges, remove the raised face on the steel flange.

3.12 INSTALLING SERVICE SADDLES

A. Drill a hole through the pipe wall equal to the nominal pipe size of the saddle. Remove all burrs and rough edges by grinding. Patch any damage to the cement mortar lining.

B. Place the service saddle on the pipe and hand tighten the nuts while positioning the saddle in its final location. Uniformly tighten the nuts in a progressive diametrically opposite sequence with a calibrated torque wrench to saddle manufacturer's recommended values.

C. Connect a corporation stop to the saddle per Standard Drawings. Apply Teflon joint compound and tape the male threads before installing the corporation stop. Make joints watertight.

D. Wrap service saddle including body, straps, bolts, nuts, and adjacent surfaces of the pipe with wax tape coating per Section 09868. Wrap completed wax tape coating system with polyethylene sheet.

3.13 INSTALLING MECHANICAL CLAMP-TYPE COUPLINGS FOR FLANGE ADAPTERS

A. Install mechanical clamp-type couplings and flange adapters on grooved or shouldered end pipe and fittings in accordance with the manufacturer's recommendations and the following.

B. Clean oil, grease, and dirt from the grooved or shouldered end pipe and fittings. Repair any damage or holidays in the shop applied coating before installing coupling or adapter. Apply the coupling manufacturer's gasket lubricant to the gasket exterior including lips, pipe ends, and housing interiors.

C. Lubricate threads of bolts and nuts with oil or graphite prior to installation. Uniformly tighten bolts and nuts alternately and evenly until coupling segments are seated. Use torques as recommended by the coupling manufacturer.

3.14 POINTING INSIDE JOINT RECESSES FOR PIPES 24 INCHES IN DIAMETER AND GREATER

A. Backfill the trench before pointing the inside joint recesses with cement mortar. Joints shall be pointed immediately after backfilling and at no time shall the completion of the pointing be further than 320 feet behind the pipe laying.

B. Working inside the pipe, remove foreign substances from joint recesses and pack with cement mortar. Finish the surface with a steel trowel to match adjoining pipe.

C. Remove excess mortar and other construction debris from the pipe interior. Sweep pipe clean of all foreign substances.

3.15 INSTALLING MARKING TAPE

A. After the pipe zone and the first 12 inches in the trench zone have been backfilled and compacted, place the marking tape on the compacted backfill and center the tape over the pipe. Run the tape continuously along the trench and tie the end of the tape to the preceding tape segment. Wrap the marking tape around valve box extension pipes and continue along the pipe.

3.16 PRESSURE TESTING

A. See District Standard Specifications Section 15042 Hydrostatic Testing of Pressure Pipelines.

3.17 DISINFECTION

A. See District Standard Specifications Section 15041 Disinfection of Piping.

END OF SECTION

SECTION 15064

STEEL PIPE AND FITTINGS

PART 1 - GENERAL

1.01 DESCRIPTION

This section covers materials and installation of steel pipe and fittings for distribution and transmission pipelines and appurtenances.

1.02 RELATED SECTIONS

A. Section 01300 – Shop Drawings and Submittals

B. Section 01410 – Testing Laboratory Services

C. Section 09811 – Fusion Bonded Epoxy Lining and Coating

D. Section 09900 – Painting and Coating

1.03 REFERENCE STANDARDS

Except as otherwise indicated in this Section, the Supplier shall comply with the following reference standards and specifications:

A. AWWA C200 - Steel Water Pipe - 6 In. and Larger

B. AWWA C205 - Cement Mortar Protective Lining and Coating for Steel Water Pipe - 4 In. and Larger - Shop Applied

C. AWWA C206 - Field Welding of Steel Water Pipe

D. AWWA C207 - Steel Pipe Flanges for Waterworks Service - Sizes 4 In. through 144 In

E. AWWA C208 - Dimensions for Fabricated Steel Water Pipe Fittings

F. Standard Specifications for Public Works Construction (SSPWC), latest edition

1.04 WARRANTY

A. The supplier shall warranty the material for a period of 12 months (from acceptance by District) against material/fabrication defects.

1.05 CONTRACTOR SUBMITTALS

Submittals shall be in accordance with Section 01300. Submittals shall include, as a minimum, the following information:

A. Layout drawings showing stations and elevations of pipe horizontal alignment and profile, connections, outlets or fittings.

B. Material of construction with ASTM reference and grade.

C. Design and dimensions of all joints including flanges, couplings, butt straps, hand holes, and bulkheads.

D. Design and dimensions of fittings and specials.

E. Data on linings and/or coatings including types and thicknesses.

F. Submit certificate that cement complies with ASTM C150, designating type.

G. Submit certified copies of mill test reports on each heat from which steel is rolled.

H. Prior to shipment of pipe, submit certified test reports that the pipe was manufactured and tested in accordance with the AWWA standards specified herein.

I. Submit welder and welding operator qualifications, welding procedure specifications, procedure qualification records including all destructive and non-destructive test results and welding bead profiles as required.

J. Submit fabricator's written Quality Assurance Control Program prior or with shop drawings. Manufacturers without a written, approved Quality Assurance Control Program will not be accepted for this project and shop drawings will not be reviewed or approved without the manufacturer’s complete Quality Assurance Control Program. Submit manufacturer’s quality control program results in one complete binder including all inspection reports, conducted tests, certified mill test reports, weld test coupon reports, welder qualification records, hydrostatic testing reports, shop testing reports, final fabrication checklist for each special, and affidavit of compliance. The quality control program results shall document all phases of the fabrication process.

K. Submit qualifications for field welders. Field welders shall be certified under Section IX, Part A of the ASME Boiler and Pressure Vessel Code or in accordance with AWWA C206, Section 4. Certifications shall be dated within three (3) years of the job to be performed.

L. Submit qualifications for Certified Welding Inspector(s) for field welding with the following minimum endorsements: AWS D1.1 Structural Welding – Steel or API 1104 Welding of Pipelines and Related Facilities.

1.06 INSPECTION AND FIELD VERIFICATION

A. All work hereunder shall be subject to continuous inspection by a Special Inspector approved by the District. Field welding shall be inspected by a Certified Welding Inspector. Special Inspection shall be performed in accordance with the latest edition of the Uniform Building Code. The Special Inspector shall work under the direct supervision of the Contractor. All costs of such inspection shall be borne by the Contractor and shall be included in the price bid for completion of the work.

B. Where new pipelines are to be connected to existing waterlines, the Contractor shall verify in the field the location, elevation, pipe material, pipe outside diameter, and any other characteristics of the existing pipe before proceeding with fabrication of pipe or

special fittings. This field verification shall be performed in the presence of the District or its representative.

C. The District reserves the right to inspect materials, productions, and testing of pipes, fitting, and special pieces at the manufacturer's plant. The Contractor shall provide 10 days advance notice of the start of fabrication.

PART 2 - MATERIALS

2.01 STEEL PIPE

A. Steel pipe shall conform to AWWA C200.

B. The steel cylinder thickness for pipe that is 12 inches in nominal diameter or less shall be designed for a 300 psi working pressure and 36,000 psi minimum yield strength conforming to requirements of ASTM A36 or 10 gauge minimum.

C. The steel cylinder thickness for pipe greater than 12 inches in nominal diameter shall be designed for a 300 psi working pressure and 36,000 psi minimum yield strength conforming to requirements of ASTM A36 or ¼-inch minimum.

2.02 ALIGNMENT

A. For horizontal and vertical curve alignment, use straight or beveled pipe of normal or one half normal lengths pulled partially on one side of the joint or use pipes with a welded mitered bend of up to 10 degrees next to the bell end. Design pipes with a bend in excess of 10 degrees as a special. Do not use angular deflections at butt strap joints.

1. Deflection by Pulled Joints:

   a. For welded joints, do not pull joint to exceed the minimum overlap of the assembled bell and spigot lap joint or more than 1/2-inch on the outside of the curve. The minimum overlap of the assembled joint shall be 1 inch or 3 times the pipe wall thickness, whichever is greater, per AWWA C206. Maintain a minimum 1/4-inch space between the spigot end and the rolled end of the bell.

2. Deflection by Beveled Joints: For welded joints only, use pipe sections having beveled bell ends for curves and angles in the alignment which cannot be accomplished using the maximum allowable deflection by pulled joints. Beveled pipe sections used in curved alignment shall be of standard length except when shorter sections are required to fit the radius of curvature in which case all sections shall be of equal length. Do not bevel spigot ends. The beveled end of a pipe shall not have a deflection from a plane perpendicular to the pipe axis exceeding 5 degrees. Form the bell end perpendicular to the plane of the beveled end so there is no loss of lap joint tolerance. Do not pull beveled joints.

3. Deflection by Mitered Bends: Use pipe sections with welded mitered bends of up to 10 degrees next to the bell end for curves and angles which cannot be accomplished using the maximum allowable deflections by pulled or beveled joints. Pipe sections with mitered bends used in curved alignment shall be of

standard length except when shorter sections are required to fit the radius of curvature in which case all sections shall be of equal length.

2.03 FITTINGS FOR STEEL PIPE

A. Fittings shall conform to the dimensions of AWWA C208 and shall be made of segmentally welded sections of hydrostatically tested pipe (same material and thickness), with ends compatible for type of joints shown. The minimum radius of elbows shall be 2.5 times the pipe diameter and the maximum miter angle on each section of elbow shall not exceed 11.25 degrees. Fittings shall be equal in pressure design strength and shall have the same lining and coating as the abutting steel pipe.

2.04 JOINTS FOR STEEL PIPE

A. Pipe joints for buried pipe shall be welded bell and spigot joint or welded butt-strap.

B. Use flanged joints for attaching pipe to valves, other appurtenances, or as shown on the Drawings. Use slip-on or ring type welded to the interior and exterior circumference of the pipe section.

C. Flanges shall be in accordance with AWWA C207 Class E for working pressures of 150 psi or less, or Class F for working pressures greater than 150 psi to 300 psi. Flanges shall be flat faced.

D. Flange faces shall be shop coated with a soluble rust-preventative compound. Gaskets shall be full-face, 1/8-inch thick, cloth-inserted rubber. Bolts on buried flanges shall be Type 316 stainless steel with coal tar epoxy applied after installation.

E. Welded Joints: Use expanded bell with matching spigot to penetrate a minimum of 2 inches into the bell. Joints shall be welded on the exterior for pipe diameters 18 inches and smaller, and on the exterior and interior for 24-inch and larger pipe diameters.

F. Butt straps shall be furnished in one or two sections, requiring one or two longitudinal welds in addition to the circumferential fillet welds. Butt straps for pipe diameters 18 inches and larger shall have two handholes.

G. Use grooved joints where shown on the Drawings to join plain end pipe with mechanical clamp-type couplings. Couplings for grooved end pipe shall be ductile iron, ASTM A536, Grade 65-45-12. Bolts shall conform to ASTM A183, 110,000 psi tensile strength. Gaskets shall be EPDM (ethylene propylene diene monomer) conforming to ASTM D2000. Couplings shall conform to AWWA C606 for flexible, square cut grooved joints in steel pipe.

2.05 CEMENT MORTAR LINING

Cement mortar lining of pipe and fittings shall conform to the following:

A. Cement shall conform to ASTM C150 Type II.

B. Except as otherwise provided in AWWA C205, the interior of all steel pipe, fittings and specials, shall be cleaned and lined in the shop with cement mortar lining applied

centrifugally in conformance with AWWA C205. Every precaution shall be taken to prevent damage to the lining. If lining is damaged or found faulty at the construction site, the damage or unsatisfactory portions shall be replaced with lining conforming to these specifications.

C. Linings shall be continuous to the end of the pipe except where field welding on the interior of the joint will occur. Hold back the interior lining 1/2-inch where interior welding will occur. Ends of the lining shall be square and uniform. Feathered or uneven edges will not be permitted.

D. Defective linings as identified in AWWA C205 shall be removed from the pipe wall and shall be replaced to the full thickness required. Defective linings shall be cut back to a square shoulder in order to avoid feather-edged joints.

2.06 CEMENT MORTAR COATING

Cement coating of pipe and fittings shall conform to the following:

A. Cement for exterior mortar coating shall conform to ASTM C150 Type V.

B. All buried pipe shall receive a 3/4-inch thick reinforced cement mortar coating.

C. Hold back mortar coatings sufficiently to allow field welding of pipe joints. Mortar coating shall be half-thickness for one bolt length behind the back of flange.

D. The coating shall be reinforced with spirally wound, 14-gauge steel wire spaced at 1-1/2 inch centers positioned approximately at the center of the mortar coating. In lieu of a spirally wound wire, a 14-gauge wire mesh with 2-inch square opening may be used. The mesh shall be fastened with welded wire clips or strips of metal so as to hold the wire approximately at the center of the mortar coating. Splices shall be lapped four inches and the free ends tied or looped to ensure continuity.

E. Exterior field welded pipe joints shall be encased in grout reinforced with 14-gauge wire mesh with 2-inch square opening fastened securely with at least 3/8-inch offset from the exterior surface of the pipe. The joint shall be formed with heavy-duty diapers or grout bands. Grout shall be non-shrink grout sufficiently fluid to permit it to be poured down one side of the pipe and allowed to flow up the other side. The grout shall be poured in such a manner that all exposed portions of the pipe joint shall be completely protected with cement mortar.

2.07 PAINT COATING

A. Coat the interior and exterior of pipe and fittings in accordance with Section 09900, System No. 5. Hold back the coating two inches from where field welding will occur.

2.08 FUSION BONDED EPOXY COATING

A. Apply fusion bonded epoxy coatings to the interior and exterior of pipe and fittings in accordance with Section 09811. Hold back the coating two inches from where field welding will occur.

PART 3 - EXECUTION

3.01 TESTING OF PIPE AND SPECIALS

A. General: After completion of fabrication and welding in the shop, and prior to the application of any lining or coating, test each component according to the following requirements.

B. Shop Test Requirements

1. Perform tests of production welds in accordance with AWWA C200 for each heat of steel used. A guided-bend test specimen shall be considered as having passed only if no crack or other open defect exceeding 1/8-inch measured in any direction is present in the weld metal or heat affected zone of the base material after the bending. A tension test specimen shall be considered as having passed only if failure occurs in the base metal at a stress in excess of the minimum specified tensile strength. There shall be at least one set of welding tests as described in AWWA C200, Section 3.3.5 for each 1,000 linear feet of spiral seam weld in addition to tests specified in Section 3.3.6 of the same standard.

2. Test each straight pipe section in the shop by the hydrostatic test method.

3. Inspect all welds in the expanded portion of the pipe bell in accordance with the magnetic particle test.

4. Test back-gouge and completed weld of all manual process groove welds by the liquid penetrant method. Test completed fillet welds by the liquid penetrant method.

5. Any production weld or manual process weld that appears to be of poor quality as determined by the District's Representative shall be subjected to 100 percent radiographic testing. One hundred percent ultrasonic testing may be used in lieu of 100 percent radiographic testing.

6. After shop fabrication, retest each pipe section with a mitered bend or reducer. Test the mitered or butt joints by the liquid penetrant method or by 100 percent radiographic testing.

7. After shop fabrication, retest each pipe section with an attached outlet. Test the collar or wrapper with the soap and compressed air method. Test the outlet by the liquid penetrant method.

8. Test each slip-on or ring type flange welded to the pipe by the liquid penetrant method or with the soap and compressed air method.

C. Test Methods

1. Shop Hydrostatic Test: Vent air from the pipe section before the test pressure is applied. Hold the test pressure on each section for a sufficient length of time to permit inspection of all joints.

2. Use the following hydrostatic test pressure for testing straight pipe sections:

$$P = \frac{2ST}{D}$$

Where: P = Hydrostatic test pressure, PSI
S = Stress, PSI, use 75% of the minimum yield point of the steel
T = Wall thickness of the steel pipe section to be tested in inches
D = Actual outside diameter of the steel pipe section to be tested in inches

3. When subjected to the above hydrostatic test pressure, the pipe shall show no leaks, distortion, or other defects. Repair any leaks or other defects which develop during the hydrostatic test by chipping out and rewelding, after which the repaired section shall again be tested until it shows no leaks or other defects.

4. Test Bulkheads: Furnish and attach suitable dished heads and blind flanges for making the hydrostatic tests, and after completion of the tests, remove the heads and properly restore the ends of the sections.

5. Radiographic Test: Make the radiographs in accordance with the requirements of the ASME Boiler and Pressure Vessel Code, Section VIII, Pressure Vessels. Repair defects in the welds disclosed by the radiographs. Submit all radiographs and the notation of areas for repair to the District's Representative for review.

6. Ultrasonic Test: Make the ultrasonic tests in accordance with the requirements of the ASME Boiler and Pressure Vessel Code, Section VIII, Pressure Vessels. Repair defects in the welds disclosed by ultrasonic testing. Prepare a report of the ultrasonic testing and submit to the District's Representative for review.

7. Soap and Compressed Air Test: Use compressed air at maximum 40-psi pressure into the joint, and while the joint is under pressure, swab every portion of every welded seam forming a part of the joint with a heavy soap solution or a commercial bubble-producing leak test fluid. Examine for leakage. Repair any defects disclosed by the test by chipping out, rewelding the chipped section, and retesting. Drill and tap the necessary test holes, and plug weld the holes after testing.

8. Liquid Penetrant Test: Conform to the requirements specified in ASTM E165, Method B. The materials used shall be either water washable or nonflammable. Products: "Spotcheck" by the Magnaflux Corporation or "Met-L-Check Flaw-Findr" by the Met-L-Check Company. Chip out all defects, reweld, and retest the section affected until it shows no leaks or other defects.

9. Magnetic Particle Test: Magnetic particle test shall conform to the requirements specified in ASTM E709, using the dry powder technique. Chip out all defects, reweld, and retest the section affected until it shows no leaks or other defects.

3.02 SHIPPING AND STORAGE

A. The manufacturer shall supply pipe complete with sufficient struts and cross bracing to maintain the pipe in a round condition and to limit its deflection during storage, transport, and installation. The Contractor and manufacturer shall determine the dimensions, spacing, and configuration of stulls in order to resist transport and storage loads without failure of the stulls or damage to linings and coatings.

B. Handle pipe with wide belt slings. Chains, cables or other equipment likely to damage the pipe or coating shall not be used.

C. Steel pipe and fittings shall be shipped and stored in strict accordance with the manufacturer's instructions.

3.03 INSTALLATION OF STEEL PIPE

The Contractor shall provide and install all required piping and accessories in accordance with the contract documents and manufacturer’s recommendations. Pipe installation as specified in this section supplements AWWA M11. Only approved certified Welders shall weld joints.

A. Piping runs shown on the drawings shall be followed as closely as possible. Proposed deviations shall be submitted in accordance with Section 01300.

B. Inspect each pipe and fitting before lowering into the trench. Inspect the interior and exterior protective coatings. Patch damaged areas in the field with material similar to the original. Remove foreign matter and dirt from inside the pipe and keep it clean during and after laying.

C. Handle pipe in a manner to avoid any damage to the pipe. Do not roll or drop the pipe into trenches under any circumstances.

D. Before laying each section of pipe, check the grade and correct any irregularities found. Grade the bottom of the trench and place a bedding layer of select material under pipe in accordance with the Standard Drawings. The trench bottom and bedding shall provide uniform bearing and support for the pipe.

E. At the location of each joint, dig bell holes in the bottom of the trench and at the sides to permit completion and visual inspection of the entire joint.

F. Field welding shall be performed in accordance with AWWA C206 and inspected by a Certified Welding Inspector. Field welds shall be tested using the liquid penetrant method.

G. Interior and exterior joint surfaces shall be completed in accordance with the lining and coating requirements of the referenced standards.

H. Maintain the trench in a dewatered condition during pipe laying.

I. When the pipe laying is not in progress, close the open ends of the pipe. Do not permit trench water, animals, or foreign objects to enter the pipe.

3.04 PRESSURE TESTING

A. See District Standard Specifications Section 15042 Hydrostatic Testing of Pressure Pipelines.

3.05 DISINFECTION

A. See District Standard Specifications Section 15041 Disinfection of Piping.

END OF SECTION

SECTION 15070

HIGH DENSITY POLYETHYLENE (HDPE) PIPE

PART 1 – GENERAL

1.01 DESCRIPTION

A. The Work under this section includes providing all labor, materials, tools, and equipment necessary for furnishing and installing high density polyethylene (HDPE) pressure pipe, including fittings, in accordance with these specifications and in conformity with the lines and grades shown on the drawings.

B. Type: HDPE pressure pipe shall comply fully with AWWA C906 and ASTM D3350. HDPE pipe shall have Ductile Iron Pipe Size (DIPS) nominal diameter, unless noted otherwise. HDPE pipe joints shall be fused, except where explicitly detailed otherwise on the plans.

1.02 RELATED SECTIONS

A. Section 01300 – Record Drawings and Submittals

B. Section 15041 – Disinfection of Piping

C. Section 15042 – Hydrostatic Testing of Pressure Pipelines

D. Section 15062 – Ductile Iron Pipe and Fittings

E. Section 15057 – Copper, Brass, and Bronze Pipe, Fittings, and Appurtenances

1.03 REFERENCED STANDARDS

A. HDPE pressure pipe shall comply with the requirements of the latest editions of the following standards:

AWWA M55	Manual of Practice – PE Pipe Design and Installation
AWWA C906	Polyethylene (PE) Pressure Pipe and Fittings, 4 in. Through 63 in. For Water Distribution
ASTM D2774	Standard Practice for Underground Installation of Thermoplastic Pressure Piping
ASTM D3035	Standard Specification for Polyethylene (PE) Plastic Pipe (DR- PR) Based on Controlled Outside Diameter
ASTM D3261	Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing

ASTM D3350	Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
ASTM F714	Standard Specification for Polyethylene (PE) Plastic Pipe (SDR- PR) Based on Outside Diameter
ASTM F2164	Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure
ASTM F2206	Standard Specification for Fabricated Fittings of Butt-Fused Polyethylene (PE) Plastic Pipe, Fittings, Sheet Stock, Plate Stock, or Block Stock
ASTM F2620	Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings
ASTM F3124	Standard Practice for Data Recording the Procedure Used to Produce Heat Butt Fusion Joints

1.04 QUALITY ASSURANCE

A. All requirements, tests and inspections called for therein shall apply, together with additional requirements specified herein. The District reserves the right to witness all factory tests.

B. HDPE Fusion Technician Qualifications:

1. The Technician performing fusion bonding of HDPE pipe joints shall be employed or trained by the fusion equipment supplier.

2. The Technician shall have the following minimum experience:

a. Performed fusion bonding on at least three previous projects.
b. Performed fusion bonding on at least 20,000 feet of 12-inch (or larger) HDPE pipe.

C. HDPE Fusion Measurements:

1. Record fusion machine heater plate surface temperature and hydraulic cylinder interface pressures during butt fusion joining operations. Measurements shall be permanently recorded utilizing a McElroy Datalogger or approved equal.

2. Submit recorded data of fusion machine within two (2) days following the completion of butt joints. Failure to submit this information may be cause for rejection of the joint.

D. HDPE Fabricated Fittings:

1. The fitting fabricator shall have at least three (3) years experience in the fabrication of pressure-rated HDPE fittings of similar size and complexity as this project.

2. The Fabrication Shop Supervisor must have at least one (1) year experience of shop supervision and three (3) years of experience fabricating HDPE fittings.

3. The technician fabricating the HDPE fabricated fittings shall have the following minimum experience:

   a. Two (2) years of experience fabricating HDPE fittings.
   b. Fabricated at least forty (40) fittings that are DR17 or thicker and 18-inch diameter or larger.

1.05 SUBMITTALS

A. The Contractor shall provide the following submittals, as a minimum, in accordance with Technical Specification Section 01300:

1. Product Data: Pipe material indicating manufacturer, pressure rating and compliance with AWWA C906.

2. Manufacturer’s fittings fabrication and butt fusion procedure including cool down time and datalogger equipment.

3. Data sheet listing and describing proposed butt fusion joint machine(s).

4. Qualifications of fusion machine technician. Qualifications of piping installation crew.

5. Written certification from the HDPE pipe fusion equipment supplier that the fusion technician has received training in the proper use of the fusion equipment and the manufacturer's recommended fusion equipment.

6. Fusion Data (heater plate temperature, hydraulic cylinder interface pressures, time/duration, etc.) shall be submitted to the District within two days following the completion of any joint.

7. Shop drawings and cutsheets providing information on fittings, including dimensions, certification of compliance with standards and pressure rating.

8. Information on pipe accessories, including but not limited to special adaptors for connections to steel and ductile iron fittings.

9. HDPE pressure pipe manufacturer shall furnish an affidavit of compliance that all delivered materials comply with the requirements of these specifications.

10. Specifications and data sheets for flange adapters, including hardware and flange back-up rings. Information shall include manufacturer's written installation

directions including alignment and bolt tightening recommendations.

11. Line Lay Drawings: Submit line laying drawings showing layout of pipeline incorporating accommodating expansion and contraction for temperature fluctuations of at-grade installation. Drawings shall also show thrust blocks, anchor blocks and layout of barricades.

12. Thermal calculations showing expansion and contraction of installed at-grade HDPE pipeline layout shown in the Line Layout Drawings is capable of accommodating temperature fluctuations as follows:

    a. Low Temperature: 60-degrees Fahrenheit
    b. High Temperature: 85-degrees Fahrenheit
    c. Temperature Differential: 25-degrees Fahrenheit

    An industry-accepted rate of expansion and contraction in pipeline length is 1 inch/10 degrees/100 feet of pipe. This is a performance specification for the installation of at-grade HDPE pipeline. Thermal calculations shall be prepared by a CA licensed civil engineer demonstrating the Line Lay drawings accommodate calculated thermal expansion and contraction of installed at-grade HDPE pipeline.

13. Proposed Testing plan.

1.06 QUALITY OF WORKMANSHIP

A. The pipe and fittings shall be homogenous throughout and free from visible cracks, holes, foreign inclusions or other injurious defects. The pipe shall be as uniform as commercially practical in color, opacity, density and other physical properties.

PART 2 – PRODUCTS

2.01 HIGH DENSITY POLYETHYLENE (HDPE) PIPE

A. Material: All material shall be manufactured from a PE 4710 resin listed with the Plastic Pipe Institute (PPI) as TR-4. The resin material shall meet the specifications of ASTM D 3350 with a minimum cell classification of 445474C. The polyethylene compound shall be suitably protected against degradation by ultraviolet light by means of carbon black of not less than 2 percent. HDPE pipe and fittings shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. The pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids, or other injurious defects. Pipe shall have a manufacturing standard of ASTM D3035 and be manufactured by an ISO 9001 certified manufacturer.

B. Pipe Size: HDPE pipe shall have a nominal diameter as indicated with outside dimension (OD) correlating to standard ductile iron pipe size (DIPS) as specified in AWWA C906. Pipe size shall be manufactured to the dimensional requirements listed in ASTM F714. Pipe shall meet AWWA C906 and shall be listed as meeting NSF-61.

C. Dimension Ratio: HDPE pipe shall have dimension ratio (DR) as indicated.

D. Color and Identification: Pipe, fittings, and appurtenances shall be provided in accordance with the following color schedule:

DESIGNATION (SERVICE)	PIPE WALL COLOR	PIPE IDENTIFICATION
Water	Black	Blue striped
Fittings	Black	Not striped

2.02 JOINTS

A. General

1. HDPE pipe-to-pipe joints and pipe-to-fitting joints shall be butt-fused, except where indicated otherwise or specified herein.

2. HDPE pipe to flange joints on steel piping shall be integral flange with ductile iron flange back-up ring as indicated.

3. Friction or pressure couplings are not acceptable and will not be allowed.

B. Butt Fusion Joints:

1. Butt fusion joints and fusion techniques shall meet all requirements of ASTM D2657 and D3261.

C. Flanged Joints:

1. Flanged joints shall consist of HDPE flange adapters and flange back-up ring, unless otherwise shown on the Contract Drawings.

2. Full face flat ring gaskets of 1/8-inch black reinforced rubber conforming to ANSI B-16.21 shall be installed between the flange adapter and opposing flange. Gaskets shall be full-faced with bolt holes and be held in position by the through-bolts.

3. Flange back-up rings shall be ductile iron.

4. Flange back-up rings shall be compatible with AWWA C115 flanges and bolting.

5. Flanged back-up rings pressure ratings shall meet or exceed the pressure class of the pipe.

6. Bolts, studs, nuts and washers for flanged joints shall be low-carbon steel conforming to ASTM A307 and AWWA C110 and C115. Coat threads with ant-seize lubricant.

2.03 FITTINGS

A. HDPE fittings shall be made from material meeting the same requirements as the pipe.

HDPE fittings shall be molded, turned or otherwise fabricated by the manufacturer of the pipe. All fittings shall be marked with size, dimension ratio (DR), and appropriate ASTM specification number. All fabricated fittings shall meet the requirements of AWWA C906 and ASTM F2206.

1. All fittings shall have taper bored ends to meet adjoining pipe wall thickness.

2. Fittings shall be shop fabricated. Fittings shall not be field fabricated.

3. All fittings shall be pressure tested to the full working pressure of the pipe for five seconds or alternative back-bend test as provided for in AWWA C906.

B. Butt Fusion Fittings: Butt fusion fittings shall be in accordance with ASTM D3261 and shall be manufactured by injection molding, a combination of extrusion and machining, or fabricated from HDPE pipe conforming to this specification. All fittings shall be pressure rated to provide a working pressure rating no less than that of the pipe. Fabricated fittings shall be manufactured using a McElroy Datalogger to record fusion pressure and temperature. A graphic representation of the temperature and pressure data for all fusion joints made producing fittings shall be maintained as part of the quality control. The fitting shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids, or other injurious defects.

C. Flange Adapters: Flange Adapters shall be made of HDPE material with a minimum material designation code of PE 4710 and with a minimum Cell Classification as noted in 2.01A. Adapters shall be pressure rated to provide a working pressure rating no less than that of the pipe.

1. Flange adapters shall be of sufficient length to fit in the fusion machine for joining adapter to pipe.

2. Flange adapters shall have an integral flange to fit with a back-up ring.

2.04 FUSION EQUIPMENT REQUIREMENTS

A. Butt fusion equipment must be in satisfactory working order and the hydraulic system must be leak free. Heater plates shall be free from scrapes, gouges, and have a consistent clean coated surface. The pressure gage and thermometer should be checked for accuracy. When requested by the District, records showing a maintenance service/inspection within 3 months prior to use for this project shall be provided.

2.05 MANUFACTURERS

A. HDPE pipe shall be the product of one of the following manufacturers:

1. JM Eagle

2. Performance Pipe

3. Or Approved Equal

B. HDPE fittings shall be the product of one of the following manufacturers:

1. ISCO Industries

2. IPF

3. Or Approved Equal

PART 3 – EXECUTION

3.01 GENERAL

A. General: HDPE piping shall be installed in conformance with AWWA M55, the manufacturer's recommendations, comply with the alignment and profile as indicated, and in conformance with approved Line Lay drawings. Installation of HDPE piping shall conform with the performance specification of Part 3.1.H regarding thermal expansion and contraction of HDPE piping with respect to allowable ambient temperature range.

B. Shipping and Storage: HDPE pressure pipe shall be shipped and stored by supporting the pipe uniformly. The transportation carriers shall use appropriate methods and intermittent checks to ensure the pipe is properly supported, stacked and restrained during transportation such that the pipe is not nicked, gouged, or physically damaged. The transportation carrier shall provide tarpaulins to cover any pipe subject to exposure to diesel exhaust or smoke. During loading, transportation, and unloading, every precaution should be taken to prevent damage to the pipe. Pipe shall be stored on clean, level ground to prevent undue scratching or gouging. If the pipe must be stacked for storage, such stacking shall be done in accordance with the pipe manufacturer's recommendations. Pipe shall be covered to protect it from sunlight, while permitting adequate air circulation above and around the pipe. Pipe shall be stored in the unit packages provided by the manufacturer. The open ends of all sections of joined and/or installed pipe (not in service) shall be plugged to prevent animals or foreign material from entering the pipeline. All sealing surfaces of mating components (i.e. flange faces) shall be kept free from dirt or debris at all times.

C. Installation Manual: The manufacturer shall supply an installation manual to the District which outlines guidelines for handling, joining, installing, and testing of polyethylene pipeline. These guidelines shall be used as reference material for the District in his determination of the required procedures.

D. Pipe Handling: The pipe shall be handled in such a manner that it is not pulled over sharp objects or cut by chokers or lifting equipment. Fused segments of the pipe shall be handled to avoid damage to the pipe. Chains or cable type chokers must be avoided when lifting fused sections of pipe. Nylon slings are preferred. Spreader bars are recommended when lifting long fused sections. Sections of pipe with cuts and gouges exceeding 10 percent of the pipe wall thickness or kinked sections shall be removed and the ends rejoined. Additionally, the first 10 feet of pipe installed during pullback will be cut out and inspected for excess gouging.

E. Joining: Joints between plain ends of polyethylene pipe shall be made by butt fusion when

possible. The pipe manufacturer's fusion procedures shall be followed at all times as well as the recommendations of the fusion machine manufacturer. The wall thicknesses of the adjoining pipes and fittings shall have the same DR at the point of fusion.

1. Butt Fusion: Sections of HDPE pipe should be joined into continuous lengths on the jobsite above ground. The joining method shall be the butt fusion method outlined in ASTM F2620 and shall be performed in strict accordance with the pipe manufacturer's recommendations. The butt fusion equipment used in the joining procedures should be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements of 400 degrees Fahrenheit, alignment, and an interfacial fusion pressure of 75 PSI. The butt fusion joining will produce joint weld strength equal to or greater than the tensile strength of the pipe itself. All field welds shall be made with fusion equipment equipped with a McElroy Data Logger. Temperature, fusion pressure and a graphic representation of the fusion cycle shall be part of the quality control records.

   At the beginning of each week that butt fusions are to be made, the Contractor shall perform a "bend-back test" in accordance with AWWA M55. The first fusion of the week shall be a trial fusion. The trial fusion shall be allowed to cool completely, then fusion test straps shall be cut out. The test strap shall be 12-inches or 30 times the wall thickness in length (minimum) and one inch, or 1.5 times the wall thickness in width (minimum). Bend the test strap until the ends of the strap touch. If the fusion fails at the joint, a new trail fusion shall be made, cooled completely and tested. Butt fusion of pipe to be installed shall not commence until a trial fusion has passed the bent strap test.

2. Mechanical: Bolted joining may be used where the butt fusion method cannot be used. Bolted joints shall be flanged as specified in Part 2.2.C.

F. Fusion Beads: Butt-fused welds will result in a weld bead on the inside and outside surface of the fused joint. Fusion beads may remain on the pipe joint and do not need to be removed.

G. Pipe Laying: Install at-grade HDPE pipeline in conformance with approved Line Lay drawings.

3.02 QUALITY AND WORKMANSHIP

A. General: Contractor shall be responsible for employing a rigorous quality control procedure for field welding butt fusion joints quality control and documentation. All field welding shall be accomplished with District-Approved Equipment. Documentation of each field weld shall be submitted to the District for record within two days of weld completion.

B. Data Collector and Recording Device: Review Manufacturer’s data collection to verify proper fusion procedures were followed during fabrication of fittings. The Data Collector shall be as specified in Part 2.3.B.

C. Weld Quality Control Documentation: Contractor shall produce and submit field weld butt fusion reports within two days of welding activity. Report shall provide the following information, at a minimum:

1. Date, time, and ambient temperature

2. Joint Number that correlates to Project pipeline stationing

3. Employee Identification that is unique to Project-approved HDPE Fusion Technician

4. Equipment Identification and specifications including piston area

5. Pipe Data including material, size, Dimension Ratio

6. Interfacial Pressures in pounds per square inch (psi) including Heat, Soak, Fuse, and Cool

7. Recommended Gauge Pressures in pounds per square inch (psi) including Heat Soak, Fuse, and Cool

8. Recorded Data including Drag pressure, weld temperature

9. Graphs of pressure and temperature over time. Provide one graph for the first five minutes of weld procedure and a summary plot of the entire weld and cooldown process.

3.03 DAMAGED PIPE

A. Pipe sections with gouges or cuts deeper than ten percent (10%) of the wall thickness shall be cut out, removed and replaced by the Contractor at no additional cost to the District. Undamaged pipe portions may be rejoined using butt-fusion joining methods.

3.04 PRESSURE TESTING AND FLUSHING OF HDPE PRESSURE PIPE

A. Flushing, testing and disinfection shall be performed per the Greenbook specifications to satisfaction of the District.

END OF SECTION

SECTION 15074

BLOWOFF ASSEMBLIES

PART 1 – GENERAL

1.01 DESCRIPTION

This section includes materials, testing, and installation of blowoff assemblies.

1.02 SERVICE APPLICATION

A. Blowoff assemblies shall be installed on potable water mains.

B. Blowoff assemblies shall be sized and located as shown on the Approved Plans and/or Standard Drawings. In general, blowoff assemblies will be installed at the ends and at low points of pipelines as shown below:

1. 2" blowoff assemblies will be required on pipelines 12” and smaller or for temporary use or as otherwise directed by the District Engineer.

2. 4" blowoff assemblies will be required on pipeline sizes 14" through 18” or as shown on the Drawings.

3. 6” blowoff assembly will be required on pipeline sizes larger than 18” or as shown on the Drawings.

4. Blowoff assemblies less than 2” will not be allowed.

PART 2 – MATERIALS

2.01 GENERAL

A. Materials for blowoff assemblies shall conform to the requirements of the District’s Standard Drawings, Approved Materials List, and other applicable Sections of the specifications.

2.02 CONCRETE

A. Concrete used for thrust or anchor blocks shall be in accordance with Section 03300.

2.03 WARNING/IDENTIFICATION TAPE

A. Detectable pipe marking tape shall be installed for blowoff piping. Marking tape shall conform to the requirements of Section 15062.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Blowoff assemblies shall be installed at locations shown on the Approved Plans or as directed by the District Engineer in accordance with the Standard Drawings.

B. Blowoff assemblies shall be connected to water mains no closer than 24" to a bell, coupling, joint or fitting.

C. Locations of blowoff assembly meter boxes shall be in accordance with the Standard Drawings.

3.02 CONCRETE

A. Concrete thrust and anchor blocks shall be installed in accordance with Section 03300 and the Standard Drawings. Refer to Section 03300 for the minimum concrete curing time required.

3.03 WARNING/IDENTIFICATION TAPE

A. Warning/Identification tape shall be installed in accordance with Section 15062.

3.04 DISINFECTION OF BLOWOFF ASSEMBLIES

A. Blowoff assemblies shall be disinfected in accordance with Section 15041 in conjunction with disinfecting the main to which it is connected. Blowoff assembly valves shall be operated and the assembly shall be flushed to completely disinfect all internal parts.

3.05 HYDROSTATIC TESTING

A. Blowoff assemblies shall be hydrostatically tested in accordance with Section 15042 in conjunction with hydrostatically testing the pipeline to which it is connected.

3.06 FIELD PAINTING AND COATING

A. Blowoff assembly appurtenances shall be field-painted in accordance with District Specifications and the Approved Materials List.

END OF SECTION

SECTION 15080

MISCELLANEOUS PIPING SPECIALTIES

PART 1 - GENERAL

1.01 DESCRIPTION

This Section includes miscellaneous piping materials, fittings, valves, and installation as required for a complete and properly functioning system. Testing shall be in accordance with the associated facilities.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01300 – Record Drawings and Submittals

B. Section 09867 – Polyethylene Sheet or Tube Encasement

C. Section 09868 – Cold Applied Wax Tape Coating

D. Section 15041 – Disinfection of Piping

E. Section 15042 – Hydrostatic Testing of Pressure Pipelines

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 01300.

B. Submit manufacturer's catalog data, descriptive literature and assembly drawings. Show dimensions, materials of construction by specification reference and grade, linings and coatings.

C. Certification that exterior coatings meet holiday and dry film thickness requirements specified in this Section.

1.04 QUALITY ASSURRANCE

A. All materials and equipment furnished under this Section shall be from a manufacturer who has been regularly engaged in their design and manufacture for a period of at least 5 years. If an alternate product manufacturer is proposed, the Contractor shall demonstrate to the satisfaction of the Engineer that the quality is equal to the materials and equipment made by those manufacturers specifically named herein.

B. The Contractor shall test all products as required herein and by the reference specifications. The Contractor shall be responsible for the costs of additional inspection and retesting by the District resulting from noncompliance.

C. All materials delivered to the job site shall be new, free from defects, and marked to identify the material, class, and other appropriate data such as thickness for piping.

Acceptance of materials shall be subject to quality testing in addition to inspection of the completed product.

PART 2 - MATERIALS

2.01 DUCTILE IRON PIPE

A. See Section 15062.

2.02 PIPE THREADS

A. Pipe threads shall conform to ANSI/ASME B1.20.1.

2.03 GROOVED JOINT COUPLINGS

A. Couplings for cut groove ductile iron pipe joints shall be Victaulic (Style 31) or approved equal Housing shall be ductile iron, ASTM A536, grade 65-45-12 ductile iron. Coatings shall be fusion bonded epoxy 12 to 15 mil dry film thickness. Nuts and bolts shall be Type 316 stainless steel. Couplings shall conform to AWWA C606.

2.04 CORPORATION STOPS - BRONZE, 2 INCHES AND SMALLER

A. For working pressures from zero to 300 psi, per Approved Materials List or approved equal.

B. Stops shall be bronze (ASTM B 62) with inlet male iron pipe threads and outlet with quick joint for copper water tube. Quick joint shall consist of a threaded nut, external nut stop, stainless steel gripper ring, and gasket. Gripper rings can only be used once. If the threaded nut of the quick joint is loosen after assembly and the copper water tube removed from the corporation stop, a new gripper ring shall be used in the reinstallation of the copper water tube and the corporation stop. Compression or pack joints will not be allowed.

2.05 BALL VALVES - BRONZE, 2 INCHES AND SMALLER

A. For 1-inch and 2-inch valves with working pressures from zero to 300 psi, use per Approved Materials List or approved equal. Valves shall be bronze (ASTM B 62) with both ends female iron pipe threads and full port. Provide brass handles, per Approved Materials List or approved equal.

B. For 1/2-inch valves with working pressures from zero to 600 psi, per Approved Materials List or approved equal. Valves shall have threaded ends, two piece bronze body, standard port, bronze trim, chrome plated ball, and blowout proof stem. Use a lever handle for non-buried installations and a tee handle for buried installations.

2.06 ANGLE VALVES - BRONZE, 2 INCHES AND SMALLER

A. For working pressures from zero to 300 psi, use per Approved Materials List or approved equal. Valves shall be bronze (ASTM B 62), union bonnet, angle design, 300 psi WOG rated with both ends female iron pipe threads.

2.07 ANGLE VALVES - BRONZE HYDRANT HEAD

A. For working pressures from zero to 300 psi, per Approved Materials List or approved equal. Valves shall be bronze (ASTM B 62) with 4-inch inlet female iron pipe threads and 2-1/2-inch outlet male national standard hose threads with cap and chain.

2.08 INSULATING BUSHINGS

A. For working pressures from zero to 200 psi, use soft nylon insulating bushings to avoid galvanic or electrolytic deterioration wherever dissimilar metals are connected. Bushings shall be as manufactured per Approved Materials List or approved equal.

2.09 INSULATING COUPLINGS

A. For working pressures from zero to 300 psi, use insulating couplings to avoid galvanic or electrolytic corrosion wherever dissimilar metals are connected. Couplings shall be steel; lined with an inert, non-conductive, linen impregnated laminate material; both ends female iron pipe threads; and rated to 300 psi working pressure at 225°F. Exterior surface of coupling is uncoated, bare steel. Couplings shall be per Approved Materials List or approved equal.

2.10 SERVICE SADDLES - BRONZE, 2 INCHES AND SMALLER

A. Provide service saddles for asbestos cement pipe, ductile iron pipe, and PVC pressure pipe with working pressures 200 psi or less that are specifically designed to fit the type, size, and class of pipe.

B. Provide service saddles with full width, cast bronze bodies conforming to ASTM B62, O-ring gaskets, and iron pipe threads. Provide Type 304 stainless steel double band straps or a single wide strap. All stainless steel shall be fully passivated for enhanced corrosion resistance. Use tapping machines and cutting tools that have been specifically designed for the type of pipe to be drilled.

C. Service saddles for working pressures of 200 psi or less shall be per Approved Materials List or approved equal.

2.11 TAPPING SLEEVES

A. Perform wet taps on existing asbestos cement pipe, ductile iron pipe, and PVC pressure pipe with working pressures 150 psi or less. Provide tapping sleeves that have been specifically designed to fit the type, size and class of pipe of the installation.

B. Tapping sleeves shall be of Type 304 stainless steel construction with two half sleeves and flanged outlet. Sleeve halves shall be bolted together with stainless steel bolts and nuts. Gaskets shall completely surround the pipe to be tapped and be the same length as the sleeves. Gaskets shall be SBR conforming to ASTM D 2000. Flanged outlet shall be flat faced conforming to ANSI B16.5, Class 150. Use tapping machines and cutting tools that have been specifically designed for the type of pipe to be tapped.

C. Tapping sleeves for use on pipe with working pressures 150 psi or less shall be per Approved Materials List or approved equal.

2.12 WELD-ON OUTLETS

A. Perform dry taps on existing welded steel pipe unless wet taps are specifically noted on the Drawings. Prior to making the tap, submit to the District's Representative a letter outlining the procedures to be followed.

B. Use a manufactured steel wrapper plate, outlet pipe, and flange. Cement mortar line the outlet pipe prior to the installation and cement mortar coat the wrapper and outlet pipe after welding to the existing steel pipe. Provide weld-on outlets that conform to the applicable requirements of Section 15062 or Section 15064.

2.13 LINK SEALS

A. Contractor shall furnish and install complete link seal assemblies of size and location as shown on the drawings. Link seal assemblies shall be as follows:

1. Wall opening sizes (i.e. cored hole) shall be selected according to the manufacturer’s recommendations based on most recent manufacturer catalog.

2. Each individual link shall be clearly and permanently shown with the name of the manufacturer and model number.

B. Link seals shall be modular, mechanical type consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and the wall opening. The elastomeric element shall have the following properties as designated by ASTM: EPDM = ASTM D2000 M3 BA510

C. Link seals shall be seal tight to 20 psig.

D. Link seals shall have Type 316 stainless steel hardware.

E. References to installation guidelines shall be to the latest published edition of manufacturer’s selection guide for the service intended.

F. Approved Manufacturer’s:

1. Per Approved Materials List Approved equal

2.14 DETECTABLE PIPE MARKING TAPE

A. Detectable pipe marking tape shall conform to the requirements of Section 15060, 15062 or 15064.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation shall be in accordance with manufacturer's recommendations. Tightening of nuts, bolts, screws, flanges shall be accomplished so that zero leakage is obtained.

B. Clean threaded joints with a wire brush. Apply Teflon joint compound or Teflon tape to pipe threads before installing screwed valves.

C. Lubricate bolt threads with oil or graphite prior to installation.

D. Tighten nuts uniformly and progressively.

E. After testing, coat exposed surfaces of bolts and nuts to be buried with primer for wax tape coating per Section 09868.

F. Wrap buried ferrous fittings and appurtenances with polyethylene material per Section 09867.

3.02 PRESSURE TESTING

A. Test miscellaneous piping specialties at the same time that the connecting pipelines are pressure tested. See Section 15042. Repair leaks in piping and retest.

3.03 DISINFECTION

A. See Section 15041.

END OF SECTION

SECTION 15100

RESILIENT WEDGE GATE VALVES

PART 1 – GENERAL

1.01 DESCRIPTION

A. This section includes materials, testing, and installation of manually operated resilient wedge gate valves (RWGV).

1.02 REFERENCE STANDARDS

A. The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

AWWA C210	Liquid Epoxy Coating Systems for the interior and exterior of steel water pipelines
AWWA C213	Fusion Bonded Epoxy Coating for the interior and exterior of steel water pipelines
AWWA C509	Resilient Seated Gate Valves for water supply service
AWWA C515	Reduced Wall, Resilient Wedge Gate Valves for water supply service
AWWA C550	Protective Epoxy Interior Coatings for valves and hydrants
SSPC	Steel Structure Painting Council

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Section 09867 – Polyethylene Sheet or Tube Encasement

B. Section 09868 – Cold Applied Wax Tape Coating

1.04 SERVICE APPLICATION

A. Resilient wedge gate valves shall be installed on potable water mains and appurtenances in accordance with the Approved Plans and the Standard Drawings.

B. Resilient wedge gate valves shall be used for open/closed operations, throttling service and frequent operation after long periods of inactivity.

C. In general, resilient wedge gate valves shall be used when valves are required on pipelines and appurtenances 4” through 12”.

D. Valves for pipelines sized 14" and larger generally require the use of butterfly valves in accordance with Section 15103.

1.05 SUBMITTALS

The following items shall be submitted for review and approval by the Engineer prior to ordering or delivery of resilient wedge gate valves:

A. An affidavit from the valve manufacture stating that valves have successfully passed hydrostatic tests in accordance with AWWA C509 and manufacturer's own coatings tests.

B. The valve manufacturer's catalog data showing the size to be used, valve dimensions, pressure rating and materials of construction.

C. Manufacturer's catalog data and proof of NSF certification for the lining materials to be used.

1.06 DELIVERY, STORAGE AND HANDLING

A. Valves shall be delivered and stored in accordance with AWWA C550. The port openings shall be covered with plastic, cardboard or wood while in transit and during storage in the field. These covers shall remain in place until valves are ready to be installed. Valves shall not be stored in contact with bare ground. Valves shall not be stacked.

1.07 SIZING OF VALVES

A. Valves shall be the same size as the line in which they are installed unless otherwise noted on the Approved Plans.

1.08 VALVE ENDS

A. Valve ends shall be flange by flange.

1.09 VALVE TESTING

A. Resilient wedge gate valves shall be hydrostatically tested and valve coatings shall be holiday detected prior to shipment. Valves delivered to the site prior to successful hydrostatic and holiday testing shall be subject to rejection.

1.10 POLYETHYLENE WRAP

A. Buried valves shall be encased in polyethylene wrap in accordance with Section 09867.

PART 2 – MATERIALS

2.01 RESILIENT WEDGE GATE VALVES

A. Resilient wedge gate valves and appurtenant components and materials shall be selected from the Approved Materials List.

B. Valves shall be ductile-iron in accordance with AWWA C509 and C515 except as modified herein.

C. Each valve shall have a smooth, unobstructed waterway free from any sediment pockets.

D. Valves shall be leak-tight at their rated pressure.

E. Valves shall have a non-rising low-zinc bronze or stainless steel stem, opened by turning left (counterclockwise).

F. Stem seals shall be the O-ring type incorporating a minimum of two rings as required by AWWA C509.

G. Low-friction torque-reduction thrust washers or bearings shall be provided on the stem collar.

H. Wedge (gate) shall be fully encapsulated with a bonded-in-place Nitrile elastomer covering. Minimum thickness of the rubber seating area shall be ¼" (6.35 mm).

I. Valves for buried applications shall be provided with a 2" (50 mm) square operating nut, and valves located above ground or in structures shall be equipped with a hand wheel in accordance with AWWA C509 unless otherwise indicated on the Approved Plans.

J. Valve interior and exterior surfaces (except for the encapsulated disc) shall be coated as described below.

K. All bolts and nuts shall be Type 316 stainless steel.

2.02 RESILIENT WEDGE GATE VALVES (TAPPING)

A. Valves shall have a rated working pressure of not less than 150 psi.

B. Valves shall have a resilient wedge disc, non-rising stem and conform to AWWA C509.

C. Valve ends shall be ANSI B16.1 flange end with centering ring on the tapping sleeve side and mechanical joint conforming to AWWA C111 on the outlet side.

D. Provide Type 304 or 316 stainless steel body bolts conforming to ASTM F593.

E. The Contractor shall have responsibility for full compatibility of tapping valves with tapping sleeves.

F. Valves shall be hydrostatically tested in the field prior to tapping.

G. Valves shall be per the Approved Material's list, or approved equal.

2.03 EPOXY LINING AND COATING

Epoxy linings and coatings for valves shall be provided in accordance with AWWA C210, C213 and C550, with the following modifications:

A. Epoxy lining and coating of valve surfaces shall be performed by the manufacturer in a facility with qualified personnel, where the environment can be controlled. Epoxy lining and coating of valves in the field is prohibited.

B. Repairs made to manufactures applied coatings shall be performed in a facility with qualified personnel, where the environment can be controlled. The facility shall be approved by the valve manufacturer.

C. Surface preparation shall be as detailed in SSPC-SP5, White-Metal Blast Cleaning.

D. Liquid epoxy lining and coating materials shall be listed in the NSF Listing for Drinking Water Additives, Standard 61, certified for use in contact with potable water.

E. The minimum dry film thickness for epoxy linings shall be 8 mils (0.203 mm). Liquid epoxy lining shall be applied in two (2) coats in accordance AWWA C210.

F. Powder epoxy coating materials shall contain one hundred percent (100%) solids in accordance with AWWA C213.

2.04 GATE WELLS AND EXTENSION STEMS

A. Gate wells and extension stems for buried valves shall be in accordance with the District's Standard Drawings and Standard Specifications.

2.05 CONCRETE

A. Concrete used for anchor or thrust blocks shall be in accordance with Section 03300.

2.06 POLYETHYLENE WRAP

A. See Section 09867.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install valves with the bolt holes straddling the vertical centerline of pipe and the operating nut in the vertical position unless otherwise noted on the Approved Plans.

B. Valves shall be installed in accordance with the manufacturer's recommendations and the applicable section of these specifications for the piping material and joint type being used.

3.02 POLYETHYLENE WRAP

A. Installation of polyethylene wrap for buried valves shall be in accordance with Section 09867.

3.03 CONCRETE

A. Concrete thrust, anchor, and support blocks shall be installed in accordance with Section 03300 and the Standard Drawings. The concrete shall be placed so that valves and valve operators will be accessible for repairs or replacement. Refer to Section 03300 for the minimum concrete curing time required prior to pressure testing the pipeline.

3.04 GATE WELLS AND EXTENSION STEMS

A. Gate wells and extension stems for buried valves shall be installed in accordance with the Standard Drawings.

3.05 DISINFECTION OF VALVES

A. Disinfection and flushing of valves shall be performed in accordance with Section 15041 during disinfection of the pipeline on which the valves are installed. The valves shall be operated during the disinfection period to completely disinfect all internal parts.

3.06 HYDROSTATIC TESTING

A. Valves shall be hydrostatically tested in conjunction with the pipeline in which they are installed in accordance with Section 15042.

END OF SECTION

SECTION 15103

BUTTERFLY VALVES

PART 1 – GENERAL

1.01 DESCRIPTION

The Contractor shall provide all butterfly valves, actuators, and appurtenances, as shown in the Drawings and specified herein, in accordance with the requirements of the Contract Documents. The Contractor shall be responsible for coordinating all required components, including valve and actuator (manual or motorized) for a complete and functional valve installation.

1.02 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Except as otherwise indicated in this Section of the Specifications, the Contractor shall comply with the latest adopted edition of the Standard Specifications for Public Works Construction (SSPWC).

B. Except as otherwise indicated, the current editions of the following standards apply to the Work of this section:

ANSI/ASME B16.1	Cast Iron Pipe Flanges and Flanged Fittings
ANSI/ASME B16.5	Pipe Flanges and Flanged Fittings, NPS ½ through 24
ANSI/ASME B16.47	Large Diameter Steel Flanges
ASME B16.34	Valves, Flanged Threaded and Welding End
ASME B16.10	Face to Face and End to End Dimensions of Values
ANSI/AWWA C504	Rubber-Seated Butterfly Valves
ANSI/AWWA C540	Power Actuating Devices for Valves and Slide Gates
ASTM A126	Gray Iron Castings for Valves, Flanges and Pipe Fittings
ASTM A216	Steel Castings, Carbon, Suitable for Fusion Welding, for High Temperature Service
ASTM A351	Steel Castings Austenitic, Austenitic-Ferric (Duplex), for Pressure-Containing Parts
ASTM A515	Pressure Vessel Plates, Carbon Steel, for Intermediate and Higher Temperature Service
ASTM A536	Ductile Iron Castings
ASTM A743	Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion-Resistant for General Application
MSS-SP-25	Standard Marking System for Valves, Fittings, Flanges and Unions
MSS-SP-6	Standard Finishes for Contact Faces of Pipe Flanges and Connecting-End Flanges of Valves and Fittings
API 598	Valve Inspection and Testing
API 6D	Specification for Pipeline Valves
API 607	Fire Test for Soft-Seated Quarter Turn Valves
API 609	Butterfly Valves: Double-Flanged, Lug and Wafer Type
ISO 5752	Metal Valves for Use in Flanged Pipe Systems - Face-to-face and Centre-to-Face Dimensions

AWWA C210	Liquid Epoxy Coating Systems for the interior and exterior of steel water pipelines
AWWA C509	Resilient Seated Gate Valves for water supply service
AWWA C515	Reduced Wall, Resilient Wedge Gate Valves for water supply service
AWWA C550	Protective Epoxy Interior Coatings for valves and hydrants
SSPC	Steel Structure Painting Council

1.03 SUBMITTALS

A. The Contractor shall furnish submittals in accordance with Section 01300.

1.04 FACTORY TESTING

A. Valves shall be facility tested in compliance with AWWA C504.

B. Proof-of-design tests reports shall be submitted in compliance with AWWA C504.

PART 2 – MATERIALS

2.01 BUTTERFLY VALVES (AWWA)

A. General: Butterfly valves shall conform to ANSI/AWWA C504 - Rubber-Seated Butterfly Valves, subject to the following requirements. Buried, Class 150B butterfly valves shall also comply with the Standard Specification for Public Works Construction (SSPWC) Regional Supplement Amendment Section 212-5.2 unless indicated otherwise. Buried Class 250 butterfly valves shall comply with the SSPWC Regional Supplement Amendment Section 207-26.4.1 unless indicated otherwise. Valves shall be of the size and class indicated. Flanged valves shall have Class 250 flanges, complying with ASME/ANSI B16.1, and shall be short-bodied except as otherwise noted. Shaft seals shall be designed for use with standard split-V type packing, or other acceptable seal. The interior passage of butterfly valves shall not have any obstructions or stops. The seats shall be positively mounted in the body of the valve; cartridge-type seats which rely on a high coefficient of friction for retention shall not be acceptable.

B. Epoxy lining and coating:

1. Epoxy linings and coatings for valves shall be provided in accordance with AWWA C210, C213 and C550, with the following modifications:

   a. Epoxy lining and coating of valve surfaces shall be performed by the manufacturer in a facility with qualified personnel, where the environment can be controlled. Epoxy lining and coating of valves in the field is prohibited.
   b. Repairs made to manufactures applied coatings shall be performed in a facility with qualified personnel, where the environment can be controlled. The facility shall be approved by the valve manufacturer.

c. Surface preparation shall be as detailed in SSPC-SP5, White-Metal Blast Cleaning.

d. Liquid epoxy lining and coating materials shall be listed in the NSF Listing for Drinking Water Additives, Standard 61, certified for use in contact with potable water.

e. The minimum dry film thickness for epoxy linings shall be 8 mils (0.203 mm). Liquid epoxy lining shall be applied in two (2) coats in accordance AWWA C210.

f. Powder epoxy coating materials shall contain one hundred percent (100%) solids in accordance with AWWA C213.

C. Manual Operators:

1. Operators shall conform to ANSI/AWWA C540, subject to the following requirements. Unless otherwise indicated, all manually-operated butterfly valves shall be equipped with a hand wheel (exposed) or two-inch (2") square operating nut, 316 stainless steel with couplings extension stem wall and guide brackets and position indicator (buried or submerged). Valve key extensions shall be installed on all buried butterfly valves unless indicated otherwise in accordance with District Standards.

2. Valves, twelve-inches (12") and larger, as well as all submerged and buried valves, shall be equipped with worm-gear operators, lubricated and sealed to prevent entry of dirt or water into the housing. Screw-type (traveling nut) operators will not be permitted for valves twelve-inches (12") in diameter and larger. Operators shall require a minimum of 40 turns to rotate the disc from fully open to fully closed position.

D. Butterfly valves shall be manufactured per the Approved Materials List or approved equal.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install valves with the bolt holes straddling the vertical centerline of pipe and the operating nut in the vertical position unless otherwise noted on the Approved Plans.

B. Valves shall be installed in accordance with the manufacturer's recommendations and the applicable section of these specifications for the piping material and joint type being used.

C. All exposed butterfly valves shall be installed with a means of removing the complete valve assembly without dismantling the valve or operator.

END OF SECTION

SECTION 15109

FIRE HYDRANTS

PART 1 – GENERAL

1.01 DESCRIPTION

This section includes the materials for and installation of fire hydrant assemblies.

1.02 REFERENCE STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

AWWA C210	Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water pipelines
AWWA C213	Fusion Bonded Epoxy Coating for the Interior and Exterior of Steel Water pipelines
AWWA C503	Wet-Barrel Fire Hydrants
AWWA C550	Protective Epoxy Interior Coatings For Valves and Hydrants

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Rincon del Diablo MWD (District) Standard Drawings and Approved Materials List

B. Section 03300 – Cast-In-Place Concrete

C. Section 15041 – Disinfection of Pipe

D. Section 15042 – Hydrostatic Testing of Pressure Pipe

E. Section 15062 – Ductile Iron Pipe and Fittings

1.04 SYSTEM DESCRIPTION

A. Hydrant outlet sizes and configuration shall be as shown on the Approved Plans or as directed by the fire department of jurisdiction.

B. Hydrants shall generally have the following number and size of outlets as directed by the fire department of jurisdiction:

1. Residential: One 2 1/2" outlet and one 4" outlet

2. Commercial: Two 2 1/2" outlets and one 4" outlet.

3. Industrial: One 2 1/2" outlet and two 4" outlets.

1.05 SERVICE APPLICATION

A. Wet-barrel hydrants shall generally be used for pressures up to 200 PSI. System pressures up to and including 150 PSI require standard wet-barrel hydrants, and pressures up to 200 PSI require high-pressure wet-barrel hydrants in accordance with the Approved Materials List.

B. Dry-barrel hydrants shall generally be used for pressure ranges in excess of 200 PSI, up to 250 PSI as specifically shown on the approved drawings.

1.06 DELIVERY, STORAGE AND HANDLING

A. Fire hydrants shall be delivered and stored in accordance with AWWA C210, AWWA C213, and AWWA C550. The port openings shall be covered with plastic, cardboard or wood while in transit and during storage in the field. These covers shall remain in place until the valve is ready to be installed. Fire hydrants shall not be stored in contact with bare ground. Fire hydrants shall not be stacked.

1.07 MASONRY RETAINING WALLS

A. If the aboveground portion of the assembly is located within a cut slope or embankment fill, a masonry retaining wall shall be constructed on three sides around the assembly per District Standards. The face of wall shall be a minimum of one foot beyond the dimensional values of the concrete pad to be poured for the assembly as shown on the District Standard Drawings. Use tan colored slump block and grout each cell solid. The concrete pad to be poured around the assembly shall extend to the face of the three walls and also to the adjacent sidewalk or curb. The District's Representative will decide whether the requirements of this paragraph are being followed by the Contractor. If in the opinion of the District's Representative modifications or changes are necessary, the work shall be performed as directed.

PART 2 – MATERIALS

2.01 HYDRANTS

A. Fire hydrants and appurtenances shall be selected from the Approved Materials List.

B. Wet-barrel fire hydrants shall comply with AWWA C503 and these specifications unless otherwise indicated on the Standard Drawings.

C. The interior of ductile-iron hydrants shall be fusion-epoxy lined per AWWA C550.

D. All outlets shall be provided with National Standard Fire-Hose Threads. Outlets shall be equipped with plastic caps with plastic chains.

E. Wet-barrel fire hydrant flanges and appurtenant bury ells and spools shall incorporate a six-hole bolt pattern.

2.02 BOLTS AND NUTS

A. Hydrant flange bolts and nuts shall be selected from the Approved Materials List.

2.03 CONCRETE

A. Concrete used for splash pads, thrust or anchor blocks shall be in accordance with Section 03300.

2.04 WARNING/IDENTIFICATION TAPE

A. Use marking tape consisting of one layer of aluminum foil laminated between two colored layers of inert plastic film. The lamination bond should be strong enough that the layers cannot be separated by hand. Tape shall be a minimum of 5 mils thick and 6 inches wide. Elongation shall be a minimum of 600-percent. Tape shall bear a continuous, printed message every 16 to 36 inches warning of the installation buried below. Tape shall be selected from the Approved Materials List.

2.05 FIELD PAINTING AND COATING

A. Field painting and coating shall not be permitted. Painting and coating shall be done at the manufacturer.

PART 3 – EXECUTION

3.01 GENERAL

A. Fire hydrant assemblies shall be installed at locations shown on the Approved Plans or as directed by the fire department of jurisdiction in accordance with the District Standard Drawings.

B. The location and port orientation of the Fire Hydrant shall be in accordance with the Standard Drawings and as required by the Fire Department.

C. Fire hydrant flange bolts shall be set with nuts on top. Torque nuts uniformly and progressively in accordance with the manufacturer’s recommendations.

D. Depending on location, fire hydrant assemblies may require protection posts or concrete retaining walls. When required by the District Engineer, or when shown on the Approved Plans, protection posts or retaining walls shall be installed in accordance with the District Standard Drawings.

3.02 CONCRETE

A. Concrete thrust and anchor blocks shall be installed in accordance with Section 03300 and the District Standard Drawings. Refer to Section 03300 for the minimum concrete curing time required.

3.03 WARNING/IDENTIFICATION TAPE

A. After the pipe zone and the first 12 inches in the trench zone have been backfilled and compacted, place the marking tape on the compacted backfill and center over the pipe. Run tape continuously along the trench and tie ends of tape together. Wrap marking tape around valve box extension pipes and continue along pipe.

3.04 DISINFECTION OF FIRE HYDRANT

A. The fire hydrant assembly shall be disinfected in accordance with Section 15041, as part of the process of disinfecting the main pipeline. The assembly valves shall be operated and the assembly flushed to completely disinfect all internal parts.

3.05 HYDROSTATIC TESTING

A. Fire hydrant assemblies shall be hydrostatically tested in accordance with Section 15042 in conjunction with the pipeline to which it is connected.

3.06 PAINTING AND COATING

A. Field painting and coating shall not be permitted. Painting and coating shall be done at the manufacturer. Hydrants connected to potable water pipelines shall be colored yellow, and hydrants connected to reclaimed water pipelines shall be colored purple.

END OF SECTION

SECTION 15112

BACKFLOW PREVENTION ASSEMBLIES

PART 1 – GENERAL

1.01 DESCRIPTION

This section includes materials, installation, and testing of backflow preventer assemblies and detector check assemblies. Assemblies shall be installed at the locations as shown on the Drawings or as established in the field by the District's Representative. The District will perform the initial test of the completed assembly to certify the installation. Future maintenance and annual certification of the assembly shall be the responsibility of the Customer.

1.02 RELATED SECTIONS

A. Section 01300 – Record Drawings and Submittals

B. Section 02223 – Trenching, Backfilling, and Compacting

C. Section 03000 – Hydrostatic Testing of Pressure Pipelines

D. Section 09900 – Painting and Coating

E. Section 15042 – Hydrostatic Testing of Pressure Pipelines

F. Section 15041 – Disinfection of Piping

1.03 SUBMITTALS

A. Submit submittals packages in accordance with Section 01300.

B. Submit manufacture's catalog data, descriptive literature, and assembly drawings. Show dimensions, materials of construction by specification reference and grade, linings, and coatings.

C. Submit manufacturer's certificate of compliance with AWWA C511 for reduced pressure principle backflow preventers.

1.04 MASONRY RETAINING WALLS

A. If the aboveground portion of the assembly is located within a cut slope or embankment fill, a masonry retaining wall shall be constructed on three sides around the assembly. Construct the concrete foundation and retaining wall similar to the requirements that San Diego Gas and Electric uses for their facilities. The face of wall shall be a minimum of one foot beyond the dimensional values of the concrete pad to be poured for the assembly as shown on the Drawings. Use tan colored slump block and grout each cell solid. The concrete pad to be poured around the assembly shall extend to the face of the three walls and also to the adjacent sidewalk or curb. The District's Representative will decide whether the requirements of this paragraph are being followed by the Contractor. If in the

opinion of the District's Representative modifications or changes are necessary, the work shall be performed as directed.

1.05 PRIVATE PUMPING FACILITIES

A. The addition of a backflow prevention assembly to any given size water service assembly will reduce the available water service pressure. A larger size water service and backflow prevention assembly may be required to provide adequate water service pressure. The District will not provide pumping facilities to increase water service pressure. Private pumping facilities shall be independent and located downstream of backflow prevention assemblies

1.06 THERMAL EXPANSION

A. The addition of a backflow prevention assembly to a water service will constitute a closed system. The District will not provide thermal expansion facilities for this condition. Provide sufficient facilities for thermal expansion and check for proper operation of existing thermal or pressure relief devices.

PART 2 – MATERIALS

2.01 MANUFACTURERS

A. Provide backflow prevention assemblies of the described type that are on the "List of Approved Backflow Prevention Assemblies" as issued by the State of California, Department of Health Services. A copy of the list is available from the District's Backflow Department.

2.02 BACKFLOW PREVENTERS

A. General: Backflow preventers shall be the same size as and never smaller than the upstream water service assembly. Where normal minimum water service pressure is less than 80 psi; the District may require the next larger assembly size.

B. Backflow preventers of the reduced pressure principle type shall conform to the material specifications of the state approved manufacturers. See the instructions in paragraph 2.1 for obtaining the "List of Approved Backflow Assemblies".

C. Backflow preventers, 2 inches and smaller, shall be of the conventional in-line design for installation in a horizontal position. See the instructions in paragraph 2.1 for obtaining the "List of Approved Backflow Assemblies".

D. Backflow preventers, 2-1/2 inches through 10 inches, shall be of the conventional in-line design for installation in a horizontal position. Provide adjustable pipe supports to augment the installation to prevent flange damage. See the instructions in paragraph 2.1 for obtaining the "List of Approved Backflow Assemblies".

2.03 DETECTORS CHECKS

A. General: Detector shall be sized according to the demands of the fire protection system. Provide double check detector checks for Class 1, 2, 3, and 4 fire protection systems. Provide reduced pressure detector checks for Class 5 and greater fire protection systems.

B. Double check detector checks shall conform to AWWA C510 with a minimum rated working pressure of 175 psi for operation on cold water pipelines. Provide two independently acting, spring loaded check valves; two resilient seated gate valves with outside stem and yoke; four full ported, bronze ball valve test cocks; and a low flow by-pass line with registration meter and double check valve assembly in series. Assemble the by-pass meter and double check valves to the main line assembly as an integral unit. The meter shall be a totalizing type with registration in cubic feet. Main check valves shall be constructed for servicing without removing the assembly from the line. Construct main line valve bodies and covers of ductile iron conforming to ASTM A 536 Grade 65-45-12 with bronze trim conforming to ASTM B 584 Alloy C83600. Construct by-pass line components of bronze or brass.

1. Double check detector checks, 4 inches through 8 inches, shall be of the compact design (“N” series) for inlet flow in a vertical up direction and outlet flow in a vertical down direction. Provide valve setters with the appropriate end connections to augment the installation. Double check detector checks shall be District approved.

2. In lieu of the compact design, double check detector checks, 4 inches through 10 inches, shall be of the conventional in-line design for installation in a horizontal position. Provide adjustable pipe supports to augment the installation. Double check detector checks shall be District approved.

C. Reduced pressure detector checks, 4 inches through 10 inches, shall be similar to backflow preventers of the reduced pressure type described in paragraph 2.02, B. Provide a by-pass line with registration meter and a bronze reduced pressure backflow preventer assembly in series. The by-pass reduced pressure backflow preventer shall operate identically to the main line assembly and open to detect initial flow. The meter shall be a totalizing type with registration in cubic feet. Reduced pressure detector checks shall be of the conventional in-line design for installation in a horizontal position. Provide adjustable pipe supports to or granular hypochlorite shall not be used at any time. augment the installation to prevent flange damage. Detector checks shall be Cla-ValModel RD7L, Febco Model 826YD, or District approved equal.

D. Where required by the fire department, provide an exposed inlet connection on the downstream side of the detector check. Replace the ductile iron bend with a ductile iron flanged tee. Install a flange with a 4-inch threaded outlet on the run. Thread a 4-inch brass nipple into the flange and install a swing check valve and a two-way, 90 degree, angle inlet connection. The 4-inch swing check valve shall be of brass construction with spring loaded check and have threaded ends. The inlet connection shall be a two-way, 90 degree angle outlet of cast brass construction with 4-inch by 2-1/2-inch size. Provide either single or double clapper style as specified by the fire department and pin lug swivels. Cast on the top of the connection the words “AUTO SPKR” or “STANDPIPE” as directed by the fire department. Provide brass plug with chain for each inlet swivel.

The swing check valve and inlet connection shall be as manufactured by Potter-Roemer,Inc. or District approved equal.

2.04 LINING AND COATING OF ASSEMBLIES

A. Coat interior and exterior ferrous surfaces of the backflow preventers and detector checks with fusion-bonded epoxy per Section 09961. Do not coat bronze, rubber, or stainless steel items.

2.05 VALVE END CONNECTIONS

A. Valves, 2 inches and smaller, shall have screwed ends. Valves, 2-1/2 inches and larger, shall have flanged ends.

B. Screwed ends shall conform to ANSI B1.20.1,NPT.

C. Flanged ends shall conform to ANSI B16.1, Class 125.

2.06 PACKING, O-RINGS, AND GASKETS

A. Unless otherwise stated; packing, O-rings, and gaskets shall be one of the following non-asbestos materials.

1. A. Teflon.

2. B. Kevlar aramid fiber.

3. Acrylic or aramid fiber bound by nitrile. Provide Garlock “Blurgard”, Klinger “Klingersil C440”, or District approved equal.

4. Buna-N (Nitrile).

2.07 BOLTS, NUTS AND GASKETS FOR FLANGES

A. See Section 15050.

2.08 VALVE SETTERS

A. Provide valve setters to augment the installation of the compact design (“N” series) detector checks. Valve setters shall be constructed with integral support arms between the elbows to transfer thrust downstream. Construct valve setters of ductile iron conforming to ASTM A 536 Grade 65-45-12. Coat interior and exterior surfaces of the ductile iron with fusion-bonded epoxy per Section 09961. End connections shall be a combination of flanged ends and mechanical joints as shown on the Drawings. Flanged ends shall conform to ANS B16.1 Class 125. Valve setters shall be District approved.

2.09 ADJUSTABLE PIPE SUPPORTS

A. Provide adjustable pipe support of welded steel construction with fusion-bonded epoxy coating. Locate the pipe supports under flanges or valve bodes as shown. Provide 2-

inchgalvanized steel pipe, cut to length, and place between the collar and base. Provide Material Resources "Standon Pipe Support Model S-89," or District approved equal.

2.10 POLYETHYLENE ENCASEMENT

A. See Section 09954.

2.11 GUARD POSTS

A. See Section 05121. Provide guard posts around the assembly when directed by the District's Representative to protect the installation.

2.12 ENCLOSURE

A. Provide an enclosure over and around the assembly when directed by the District's Representative to protect installation.

PART 3 – EXECUTION

3.01 INSPECTION BEFORE INSTALLATION

A. Operate the shutoff valves and test cock on the assemblies from closed to fully open, then close again before installing. Check for broken, cracked, or missing parts; malfunctioning stems; and faulty operation.

3.02 INSTALLATION

A. See Section 02223 for earthwork requirements. Use imported sand in the pipe base and pipe zone.

B. Install piping and riser section per the instructions contained in the appropriate for the material used.

C. Piping from the main to the backflow prevention assembly shall be placed level or on a continuous upward grade to avoid pocketing air. No outlets will be allowed in the piping between the main and the assembly. Trench backfilling shall not commence until the District's Representative has inspected this section of piping and is satisfied with the installation.

D. Install backflow prevention assemblies in a horizontal position, aboveground, and at the dimensions shown on the Drawings. Locate the assemblies where shown or as established in the field by the District's Representative. The District shall be the final authority as to location, installation, size, and type of backflow prevention assembly required.

E. Clean threaded joints by wire brushing or swabbing. Apply Teflon joint compound or Teflon tape to pipe threads before installing screwed valves. Joints shall be watertight.

F. Install flanged joints per the installation instructions in Section 15050.

3.03 INSTALLING POLYETHYLENE ENCASEMENT

A. After applying primer for wax tape coating to all buried bolts and nuts, wrap ferrous pipe risers including base bends and valve setters with polyethylene material per Section 09954. Complete the wrap prior to placing concrete anchor blocks or concrete trust blocks on base bends or valve setters. Repair polyethylene material damaged during construction.

3.04 PLACING CONCRETE

A. Place concrete anchor blocks around the elbow of the pipe riser or valve setter. Where a thrust block is required, place concrete against the base bends and undisturbed ground. Place concrete back to back between the base bends. Allow concrete to set and be hard enough to be self-supporting. Place and compact trench backfill up to the subgrade of the concrete pad on grade. Pour a concrete pad on grade around the pipe risers. Concrete shall be Class C per Section 03000.

3.05 SETTING GUARD POSTS

A. Position guard posts to protect the backflow prevention assembly. Locate posts as directed by the District's Representative. Excavate a hole 16 inches in diameter by 3-1/2 feet deep for each post. Set posts plumb, fill holes with concrete to 2 inches above finish grade, and crown to slope away from post. Posts shall be embedded a minimum of 3 feet in

3.06 INSTALLING THE ENCLOSURE

A. Set enclosure over the assembly and center in place as directed by the District's Representative. Use driller in or adhesive stainless steel anchors to attach the enclosure to the concrete pad.

3.07 PAINTING AND COATING

A. Paint aboveground surfaces of the pipe risers, elbows or bends, and adjustable pipe supports per Section 09900, System No. 20. Color of finish coat shall be OSHA Blue. Do not paint backflow prevention assemblies.

B. Paint aboveground surfaces of the guard posts per Section 09900, System No.20. Color of finish coat shall be OSHA Yellow.

3.08 PRESSURE TESTING

A. Pressure testing will be performed in accordance with Section 15042 Hydrostatic Testing Pressure Water Mains. Test backflow prevention assemblies at the same time that the connecting pipelines are pressure tested. Repair leaks in the backflow prevention assemblies and joints of the interconnecting piping and retest.

3.09 INITIAL TESTING

A. Upon completion of the installation and inspection by the District's Representative, an initial test will be performed by certified personnel of the District's Backflow

Department. The initial test will be conducted to certify the adequacy and operational compliance of the assembly with both state and District regulations. Backflow prevention assemblies will not be placed into service until the District has tested and certified the installation.

3.10 DISINFECTION

A. See Section 15041 for chlorination requirements.

END OF SECTION

SECTION 15122

FLEXIBLE PIPE COUPLINGS & JOINTS

PART 1 - GENERAL

1.01 DESCRIPTION

This Section includes materials, installation, and testing of flexible pipe couplings for steel pipe, PVC pipe and ductile iron pipe.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01300 – Record Drawings and Submittals

B. Section 09867 – Polyethylene Sheet or Tube Encasement

C. Section 09868 – Cold Applied Wax Tape Coating

D. Section 15041 – Disinfection of Piping

E. Section 15042 – Hydrostatic Pressure Testing of Piping

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 01300.

B. Submit manufacturer's catalog data, descriptive literature, and assembly drawings. Show manufacturer's model or figure number for each type of coupling or joint for each type of pipe material for which couplings are used.

C. Submit manufacturer's recommended torques to which the coupling bolts shall be tightened.

D. Show dimensions, materials of construction by specification reference and grade, linings, and coatings.

E. Show number, size and material of construction for rods and lugs for each joint harness.

PART 2 - MATERIALS

2.01 STEEL FLEXIBLE PIPE COUPLINGS

A. Steel couplings shall have middle rings made of steel conforming to ASTM A36, A53 (Type E or S), or A512 having a minimum yield strength of 30,000 psi. Follower rings shall be malleable iron (ASTM A47, Grade 32510), ductile iron (ASTM A536) or steel (ASTM A108, Grade 1018, or ASTM A510, Grades 1018 or 1021). Minimum middle ring length shall be 5 inches for pipe sizes 3/4-inch through 4-1/2 inches; 7 inches for pipe sizes 5 inches through 24 inches; and 10 inches for pipe sizes larger than 24 inches.

B. Sleeve bolts shall have a minimum yield strength of 40,000 psi, an ultimate strength of 60,000 psi, and shall conform to AWWA C111.

C. Steel follower rings shall be cast, forged, or hot rolled in one piece. Rings fabricated from two or more shapes shall not be used.

D. Wall thickness of sleeve shall be at least that specified for the size of pipe in which the coupling is to be used.

E. Gaskets shall be Buna-N.

2.02 CAST IRON FLEXIBLE PIPE COUPLINGS

A. Cast iron couplings shall have sleeves made of gray iron conforming to ASTM A126, Class B; cast iron conforming to ASTM A48, Class 30 (minimum) or ductile iron conforming to ASTM A536. Follower rings shall be made of malleable iron (ASTM A47, Grade 32510) or ductile iron (ASTM A536).

B. Sleeve bolts shall have a minimum yield strength of 40,000 psi, an ultimate strength of 60,000 psi and shall conform to AWWA C111.

C. Gaskets shall be Buna-N.

2.03 FLEXIBLE PIPE COUPLINGS FOR PLAIN END STEEL PIPE

A. Flexible pipe couplings for steel pipe shall be steel: Approved Materials List or approved equal.

2.04 FLEXIBLE PIPE COUPLINGS FOR PLAIN END DUCTILE IRON OR PVC PIPE

A. Flexible pipe couplings for ductile iron or PVC pipe shall be cast iron or ductile iron: Approved Materials List or approved equal.

2.05 TRANSITION COUPLINGS

A. Transition couplings for connecting different pipe materials having different outside diameters shall be steel: Approved Materials List or approved equal.

2.06 FLANGED COUPLING ADAPTERS FOR STEEL PIPE

A. Flanged coupling adapters for steel pipe shall be steel: Approved Materials List or approved equal. Flange ends shall match the flange of the connecting pipe.

2.07 FLANGED COUPLING ADAPTERS FOR DUCTILE IRON OR PVC PIPE

A. Flanged coupling adapters for ductile iron pipe or PVC pipe shall be cast iron, ductile iron, or steel: Approved Materials List or approved equal. Flange ends shall match the flange of the connecting pipe.

2.08 FLANGED COUPLING ADAPTERS FOR EXISTING ASBESTOS CEMENT PIPE

A. Flanged coupling adapters for existing asbestos cement pipe shall be cast iron or ductile iron: Approved Materials List or approved equal.

B. Flange ends shall match the flange of the connecting pipe. The Contractor shall field verify the actual outside diameter of the existing pipe to be connected.

2.09 DISMANTLING JOINTS

Dismantling joints shall be of the restrained flanged adaptor type allowing for longitudinal adjustment. Non-restrained, seal only flanged adaptors will not be acceptable.

A. The dismantling joint shall be pressure rated to 250 psi. Flanges shall be Class 150 in accordance with ANSI B16.42.

B. The flanged spool and end ring and body shall be ductile iron. All nuts, bolts and tie rods shall be Type 316 stainless steel.

C. Gasket material shall be Buna-N.

2.10 FLEXIBLE EXPANSION JOINTS

A. Flexible expansion joints shall be installed in the locations indicated on the drawings and shall be manufactured of ductile iron conforming to the material requirements of ASTM A536 and ANSI/AWWA C153/A21.53. Foundry certification of material shall be readily available upon request.

B. Each flexible expansion joint shall be pressure tested prior to shipment against its own restraint to a minimum of 350 psi (250 psi for flexible expansion joints 2 inch and 30 inches diameter and larger.) A minimum 2:1 safety factor, determined from the published pressure rating, shall apply. Factory Mutual Approval for the 3 inch through 12 inch sizes is required.

C. Each flexible expansion joint shall consist of an expansion joint designed and cast as an integral part of a ball and socket type flexible joint, having a minimum per ball deflection of: 20º, 2” - 12”; 15º, 14” - 36”; 12º, 42”-48” and 4-inches minimum expansion. Additional expansion sleeves shall be available and easily added or removed at the factory or in the field. Both standardized mechanical joint and flange end connections shall be available.

D. All internal surfaces (wetted parts) shall be lined with a minimum of 15 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C213. Sealing gaskets shall be constructed of EPDM. The coating shall meet ANSI/NSF-61.

E. Exterior surfaces shall be coated with a minimum of 6 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C116/A21.16.

F. Appropriately sized polyethylene sleeves, meeting ANSI/AWWA C105/A21.5, shall be included for direct buried applications.

G. Manufacturer's certification of compliance to the above standards and requirements shall be readily available upon request. The purchaser (or District) shall reserve the right to inspect the manufacturer's facility for compliance. All flexible expansion joints shall be per Approved Materials List or approved equal.

2.11 LINING AND COATING FOR COUPLINGS

A. Coat the interior and exterior ferrous surfaces of couplings, flange adapters, and dismantling joints with fusion-bonded epoxy per Section 09811. The coating shall be holiday free on interior surfaces.

2.12 JOINT HARNESSES

A. Provide joint harnesses for flexible pipe couplings located in vaults and structures where the piping is not restrained or anchored. Joint harnesses of this design shall be limited to a maximum nominal pipe diameter of 8 inches and applies only to steel pipe.

B. Steel ring plates shall conform to ASTM A36; ASTM A283, Grade B, C or D; or ASTM A285, Grade C. Ring plates shall be as shown on the Drawings.

C. Bolt or stud material shall be high-strength alloy steel conforming to ASTM A193, Grade B7. Nuts shall conform to ASTM A194, Grade 2H.

D. Provide washers for each nut. Washers shall be of the same material as the nuts.

2.13 BOLTS, NUTS AND GASKETS FOR FLANGES

A. Provide heavy hex, carbon steel bolts and nuts for flanges located above-ground, in vaults and structures, and for buried flanges to be wrapped with polyethylene material. Bolts and nuts shall conform to ASTM A307 Grade B and ASTM A563 Grade A, respectively.

B. Provide washers for each nut. Washers shall be of the same material as the nuts.

C. Gaskets shall be asbestos-free, drop-in ring type, 1/16-inch or 1/8-inch thick, and shall be acrylic or aramid fiber bound with nitrile. Gaskets shall be suitable for a water pressure of 500 psi at a temperature of 400 degrees F. Provide per Approved Materials List or approved equal.

2.14 WAX TAPE COATING

A. See Section 09868.

2.15 POLYETHYLENE ENCASEMENT

A. See Section 09867.

PART 3 - EXECUTION

3.01 INSTALLING COUPLINGS

A. Clean oil, grease, scale, and dirt from pipe ends. Repair any damage or holidays in the shop applied coating before installing couplings. Clean gaskets in flexible pipe couplings, transition couplings, and flanged coupling adapters before installing.

B. Clean sleeve bolts and nuts by wire brushing before installing in follower rings. Lubricate threads of bolts and nuts with oil or graphite prior to installation. Tighten nuts uniformly and in a progressive diametrically opposite sequence and torque with a calibrated torque wrench. All clamping torque shall be applied to the nuts only.

C. Where couplings are installed on buried metallic pipe, provide bond wires across the coupling and bond the follower ring to the pipe per Section 16640.

D. If couplings leak under pressure testing, loosen or remove the nuts and sleeve bolts, reset or replace the gaskets, reinstall or retighten the bolts and nuts, and retest the coupling. Couplings shall be watertight.

E. After testing, wrap sleeve bolts and nuts of buried couplings with wax tape coating per Section 09868.

3.02 INSTALLING FLANGED JOINTS

A. Clean bolts, nuts, and flange faces by wire brushing before installing flanged coupling adapters. Inspect gasket seating surfaces, gasket, each stud or bolt, nut, and washer. Replace any damaged item. Coat bolt shafts with waterproof gear grease or primer for wax tape coating prior to insertion in flange bolt holes. Do not apply grease or primer to threads. Lubricate threads of bolts and nuts with oil or graphite prior to installation. Assemble all bolts and nuts in the flange, and then uniformly tighten bolts and nuts in a progressive diametrically opposite sequence and torque with a calibrated torque wrench. All clamping torque shall be applied to the nuts only.

B. If flanges leak under pressure testing, loosen or remove the nuts and bolts, reset or replace the gasket, reinstall or retighten the bolts and nuts, and retest the joints. Joints shall be watertight. Replace galled, cracked, or disturbed bolts and nuts.

C. After testing, coat exposed surfaces of bolts and nuts to be buried with waterproof gear grease or primer for wax tape coating per Section 09868.

3.03 INSTALLING POLYETHYLENE ENCASEMENT

A. Wrap buried couplings and adapters with polyethylene material per Section 09867.

3.04 PAINTING AND COATING

A. Coat flexible pipe couplings, transition couplings, flanged coupling adapters and joint harnesses located above-ground, in vaults or in structures per Section 09900. The color of the finish coat shall match that of the adjacent piping.

3.05 PRESSURE TESTING

A. Test couplings and adapters at the same time that the connecting pipelines are pressure tested. See Section 15042 for pressure testing requirements. Repair leaks in piping and retest.

3.06 DISINFECTION

A. See Section 15041 Disinfection of Piping.

END OF SECTION

SECTION 15130

AIR RELEASE AND VACUUM VALVES

PART 1 - GENERAL

1.01 DESCRIPTION

The work of this section includes providing air release and vacuum valves as indicated, complete and operable, including accessories and drain connections in accordance with the District Standard Drawings.

1.02 QUALITY ASSURANCE

A. Valves shall be provided at the locations and shall be of the sizes shown. The valves shall be designed for the operating and testing pressure of the associated pipeline as specified.

1.03 REFERENCES

A. This section references the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

ASTM A536	Standard Specifications for Ductile Iron Castings
AWWA C512	Air Release, Air/Vacuum, and Combination Air Valves for Waterworks Service

1.04 SUBMITTALS

The following shall be submitted in accordance with Section 01300.

A. Manufacturer’s catalog data including detailed drawings showing dimensions, materials, size, and weight.

B. Manufacturer’s installation, operation and maintenance instructions.

C. Manufacturer’s certification that products comply with the indicated requirements.

PART 2 - PRODUCTS

2.01 GENERAL

A. Combination air/vacuum assemblies shall be furnished and installed by the Contractor at the locations shown on the Plans, or as required by the District.

B. The tap of an air and vacuum valve assembly shall be no closer than 18-inches to the valve, coupling, joint or fitting.

C. Air and vacuum relief valves shall be hydrostatically tested in conjunction with the connecting pipelines.

2.02 AIR AND VACUUM VALVES

A. Air and vacuum valves shall be capable of venting sufficient quantities of air, as determined by the manufacturer's approved sizing methods, while pipelines are being filled and allowing air to re-enter while pipelines are being drained.

B. Air and vacuum valves shall be of the size indicated with flanged or screwed ends to match the piping.

C. Screws and bolts shall be Type 316 stainless steel.

D. Valves shall be rated for the maximum operating pressure of the pipeline on which they are installed.

2.03 AIR RELEASE VALVES

A. Air release valves shall vent accumulating air while system is in service and under pressure and be of the size indicated and shall meet the same general requirements as specified for air and vacuum valves except that the vacuum feature will not be required.

2.04 COMBINATION AIR VALVES

A. Combination air valves shall combine the characteristics of air and vacuum valves and air release valves by exhausting accumulated air in systems under pressure and releasing or re-admitting sufficient quantities of air, as determined by the manufacturer's approved sizing methods, while the system is being filled or drained, respectively.

B. Combination air valves shall have the same general requirements as specified for air and vacuum valves.

2.05 MANUFACTURERS

A. Air release and vacuum valves shall be manufactured per Approved Materials List or approved equal.

2.06 AIR VALVE ENCLOSURES

A. Air valve closures shall be of polyethylene construction with UV stabilizers.

B. The cover shall lock to the base with an integral latch and padlock. The base shall be designed to anchor to a concrete pad. All hardware shall be stainless steel.

C. Color: submittal required.

D. Manufacturer: Approved Materials List or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All valves shall be installed in accordance with the manufacturer's printed recommendations and District Standards.

B. Air release and vacuum valves shall be installed at high points in piping systems and where indicated.

C. Combination air/vacuum assemblies shall be installed on a section of pipe no closer than 18-inches to a bell, coupling, joint or fitting.

D. Valves shall be installed with a sanitary vent screen on the exhaust port unless otherwise specified by the District.

E. Valve assemblies shall have an isolation valve to permit future maintenance. Isolation valves installed above ground will have the capability to be locked out. Isolation valves installed below ground will be required to have a debris cap with a locking device.

F. Gate well assemblies shall be field coated with safety yellow paint according to District Standards.

END OF SECTION