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TECHNICAL SPECIFICATIONS

SECTION 1

WATER LINES

PART 1 - GENERAL

1.1 Scope

These specifications cover the furnishing and installation of potable water lines, valves, fittings, and related appurtenances. This work includes, unless otherwise specified, furnishing all labor, materials, tools, equipment, and incidentals required to construct a complete water line ready for service as outlined on the Drawings and Specifications. Requirements for excavation and backfill of trenches, surface restoration, traffic control, and special appurtenance, etc. are specified under other Technical Specifications, when applicable.

Items specified in this Technical Specification are intended to be broad in scope and may not always apply to all items of work to be constructed. All applicable sections, as determined by the City Engineer, shall control the work outlined in the Drawings and Specifications.

1.2 Specifications References

Specification references made herein for manufactured materials such as pipe, valves, fittings, refer to designations for the American Water Works Association (AWWA), American National Standards Institute, Inc. (ANSI), National Sanitation Foundation (NSF), or to the American Society for Testing and Materials (ASTM).

1.3 Catalog Information

Catalog information on all materials and/or equipment to be installed shall be submitted to the City Engineer prior to purchase and installation.

1.4 Interruption of Utility Service

See the "Existing Utilities" section of the General Requirements.

1.5 Care and Handling of Pipe and Valves

Adequate precautions shall be taken to prevent damage to piping and protective coatings. During transporting, pipe and other materials shall be secured individually by use of wood spacer blocks, wood crates, or otherwise protected to prevent collision of individual pieces and accompanying damage. Where possible, all materials furnished by the Contractor shall be delivered and distributed at the site by the Contractor so that each piece is unloaded opposite or near the place where it is to be placed in the trench. All pipe, fittings, valves, hydrants, and accessories shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock

or damage. During freezing weather, valves shall be stored to prevent accumulation of water in housing which could freeze and damage valves. Under no circumstances shall such materials be dropped. All pipes, valves, fittings and all other materials used in the construction of the water lines shall be carefully inspected by the Contractor prior to installation. All defective materials shall be rejected.

Proper materials, tools and equipment shall be used by the Contractor to provide safe and convenient prosecution of the work.

1.6 Materials Furnished by the City

The Contractor's responsibility for materials furnished by the City shall begin at the point of delivery to the Contractor. Materials already on the site shall become the Contractor's responsibility on the day of the award of the Contract. The Contractor shall examine all material furnished by the City at the time and place of delivery to him and shall separate all defective material. Any material furnished by the City that becomes damaged by the Contractor shall be replaced by the Contractor at his own expense. The Contractor shall assume full responsibility for materials furnished by the City once they are received by the Contractor.

1.7 Certification by Manufacturer

If requested to do so, the Contractor shall furnish to the City Engineer a sworn statement from the product manufacturer, stating that inspection and all specified tests have been made on the supplied material and that the results thereof comply with all appropriate specifications. The statement shall also state that all materials furnished are in accordance with the Drawings and Specifications and that all materials are new.

PART 2 - MATERIALS

2.1 General

Furnish and install water lines and valves of the size, type, class, and material called for on the Drawings and as specified. Where no specific type of pipe is called for, the Contractor may select any type listed herein. Once a particular type and manufacturer is selected, the Contractor shall use that type for the entire project unless other types are specifically called for on the Drawings.

Materials and products that come into contact with drinking water supplied by public water systems or which come into contact with drinking water treatment chemicals used by public

water systems shall meet the requirements of both NSF/ANSI Standard 61 Drinking Water System Components - Health Effects (current edition), NSF/ANSI Standard 372, or equivalent. These materials and products include, but are not limited to, process media, protective materials, joining and sealing materials, pipes and related products, and mechanical devices used in treatment, transmission, and distribution systems.

2.2 Pipe

A. Class 150 PVC Pipe

1. Unless specified otherwise, pipe for water lines shall be PVC pipe conforming to AWWA C900, DR 18 (150 psi pipe) for pipe up to 12 inches in diameter and C905 DR 25 (165 psi) for pipe over 12 inches in diameter.

2. The pipe shall have flexible rubber gasketed joints.

B. Ductile Iron Pipe

1. Ductile iron pipe and fittings shall be furnished and installed, where called for on the Drawings, and shall conform to AWWA C150, AWWA C115, AWWA C151, AWWA C153, and AWWA C110 and shall be minimum pressure Class 350 unless specified otherwise.

2. All ductile iron pipe shall have a bituminous sealed cement mortar lining conforming to AWWA C104 on the interior.

3. All joints unless otherwise specified shall be push-on rubber gasket joints conforming to AWWA C111 and shall be furnished complete with all necessary accessories.

   a. Flanges for couplings and fittings shall conform to ANSI B16.1, 125-pound bolt hole template.
   b. Mechanical joints shall conform to AWWA C111.

4. When flanged pipe is required, the Contractor shall provide the ductile iron pipe class required by the flange manufacturer to ensure the pipe and flange units are compatible. This data shall be provided to the City Engineer for review prior to ordering these materials.

C. High Density Polyethylene Tubing for Service Lines

High density polyethylene tubing for service lines shall be copper tube size ID meeting the requirements of AWWA C901 and ASTM D2239, SIDR 7(PE 3408) and shall be rated for 200 psi working pressure. Stainless steel inserts shall be installed at all compression fittings. The minimum size for residential service lines shall be 1-inch diameter copper tube size.

2.3 Fittings for Iron and PVC Pipe

Unless specified otherwise, all fittings such as elbows, tees, crosses, valves, etc., shall be mechanical joint short-bodied compact ductile iron fittings conforming to AWWA C153, Class 350. When called for, flanged cast iron fittings shall conform to AWWA C110 with ANSI B16.1, 125-pound bolt hole template. All fittings shall be cement mortar lined in accordance with AWWA C104. Gaskets shall be either ring or full faced, 1/8-inch thick conforming to AWWA C111, Appendix B.

2.4 Restrained Pipe Joints and Fittings

Where called for on the Drawings, restrained pipe joints shall be mechanical joint ductile iron with "MEGALUG" field-installed restraint devices as manufactured by EBAA Iron, Inc., or approved equal.

2.5 Water Main Couplings

Water main couplings shall be ductile iron or fabricated steel "Dresser" style couplings, Smith-Blair, Ford, or approved equal, conforming to AWWA C219. The Contractor shall provide the appropriate coupling and gaskets as required to match the water lines types and sizes being utilized. Couplings shall be rated for the working pressure of the pipe main for which they will be utilized.

2.6 Valves

A. Gate Valves

1. Valves 2 inches and smaller shall be all bronze gate valves, non-rising stem, conforming to Manufacturers Standardization Society (MSS) SP-80, Class A rated for a minimum working pressure of 125 psi.

2. Valves 2-1/2-inch to 12-inch shall be gate valves conforming to AWWA C515. Valves shall be designed for 200 psi minimum working pressure and shall be of iron body, resilient wedge, non-rising stem construction. Valves shall be equipped with O-ring type packing. The valve shall have a 2-inch AWWA operating nut for buried service or as called for on the Drawings. The valve ends shall be of the type required to match the pipe to which they will be connected, or as shown on the Drawings. Valves shall have mechanical joint connections, unless called for otherwise on the Drawings. Valves shall be resilient wedge Kennedy, KSRW or KSFW, M&H Style 4067 or 7000, Clow, or equal.

B. Butterfly Valves

Valves 14-inch and larger shall be butterfly valves. All butterfly valves shall be of the rubber-seated tight-closing type. They shall meet or exceed the requirements of AWWA C504. All valves shall be M&H 4500 butterfly valves, or equal. The valve shall be for buried service with a sealed gear operator having 2-inch AWWA operating nut and shall open counter-clockwise. The valve ends shall be of type required to match the pipe to which they will be connected as shown on the Drawings.

C. Cast Iron Valve Box

Each valve shall be equipped with an adjustable cast iron box of the sliding type with a base large enough to cover the top casting of the valve. The diameter of the valve box shall be not less than five (5) inches, and shall be of such length so as to provide the depth of cover over the pipe without full extension. Valve box top and lid shall be Olympic Foundry 910 Vancouver style or approved equal.

2.7 Fire Hydrants

Fire hydrants shall conform to AWWA C502 and shall have 5-1/4-inch main valve opening, two 2-1/2-inch NST nozzles and one 4-1/2-inch NST pumper nozzle. Operating nut shall be 1-1/2-inch pentagon. Fire hydrants shall Clow Medallion or approved equal. Due to stocking of repair parts for the service and repair of hydrants, the City will not generally accept hydrants by other manufacturers. All hydrants shall have a minimum depth of bury of 48 inches, measured from the finish grade to the top of the lead pipe. Where conditions require, hydrant extensions shall be provided and installed to provide the proper placement and installation of the hydrant. Hydrants shall receive factory coats of yellow enamel paint and shall also receive an additional field coat after installation. All hydrants shall be of the traffic model type.

2.8 Combination Air Release Valves

Air release valves shall be a combination air and vacuum type such as APCO No. 143 C, ValMatic No. 201C, or approved equal, with 1-inch inlet and designed for 150 psi operating pressure.

2.9 Service Saddles

Service saddles shall have a ductile iron body, wide stainless steel band, and stainless steel bolts and nuts. Service saddles shall be Ford FS101 style for 3/4-inch and 1-inch taps and Ford FS202 for all taps larger than 1 inch, or approved equal. Saddle sizes and threads shall be compatible with the pipe type and sizes being utilized. Saddle sizes shall be compatible with the pipe type and sizes being utilized. Service saddles are not required for ductile iron pressure class pipe for taps 1-inch and less. Service saddles are required for ductile iron pressure class pipe for taps greater than 1-inch. Service saddles used on PVC water mains shall be specifically sized at the factory for the type of PVC water main used.

2.10 Corporation Stops

Corporation stops shall be brass ball valve stops complying with AWWA C800. Corporation stops shall be Ford ball corp with pack joint, or approved equal. Inlet threads and outlet connections shall be as required for type and size of water service lines and service saddles being utilized. Corporation stops shall meet the requirements of Section 2.1 herein.

2.11 Curb Stops

Curb stops shall be Ford brass ball valves, or approved equal. Valve configuration, inlet, and outlet requirements shall be as required for the size and type of water service lines and setters being utilized. Curb stops shall meet the requirements of Section 2.1 herein.

2.12 Service Line Couplings

Service line couplings shall be Ford pack joint couplings, or approved equal. Provide appropriate coupling as required to match water service lines types and sizes being utilized. Appropriate stainless steel insert stiffeners shall be used for all PVC pipe and polyethylene tubing. Where metal pipe of dissimilar type are being connected, an insulating adaptor gasket such as Dresser Style 65, or approved equal, shall be utilized to prevent galvanic corrosion..

2.13 Curb Stop Box

Each curb stop shall be equipped with an adjustable cast iron box of the sliding type and shall be of such length so as to provide the depth of cover over the pipe without full extension. The curb stop box shall be equal to Ford Arch Pattern Curb Boxes with 1-inch upper section and stationary rod and Type PS plug style lid with pentagon bolt, or approved equal. For service curb stops larger than 1-inch, a curb box base, Ford CB-7, shall also be provided.

2.14 Meter Setters

Meter setters for 1-inch and smaller meters shall be Ford 70 Series coppersetters, or approved equal. Meter setters for 1-1/2-inch or 2-inch water meters shall be Ford all brass and copper custom setters or approved equal. A Ford angle meter ball valve shall be provided on the meter inlet and a Ford cartridge dual check valve shall be provided on the meter outlet. Provide appropriate meter setter heights, sizes, and connections, etc., as required for the meter and water service lines sizes and types being utilized. Brace pipes of 1-inch diameter Schedule 40 PVC shall also be installed in the setter pipe eyelets to increase the stability of the meter setting. Meter setters shall meet the requirements of Section 2.1 herein.

2.15 Water Meters

The City will provide water meters for new service installations. Water meters for 1-1/2-inch and 2-inch sizes shall be Badger M120 and M170, respectively, with Orion transmitter and data profiling. Water meters for 3/4-inch and 1-inch sizes shall be Badger Model 35 or 55, respectively, no substitution. Meters larger than 2-inch shall be as required by the City. All meters shall read in cubic feet and have low lead content meeting the requirements of Section 2.1 herein. Typical residential services shall have 3/4-inch meters installed unless otherwise approved by the City.

2.16 Water Meter Box and Cover

A. Water meter boxes in non-traffic areas for 1-inch and smaller meters shall be 21-inch diameter 80 psi PIP PVC pipe, or approved equal. Meter box covers shall properly fit the meter box provided. Cast iron covers shall be Model A4, 11-1/2-inch lid size as manufactured by Ford, or approved equal. When installing ten or more meter boxes, the Contractor shall furnish two lid keys of each type to the City.

B. For 1- and 1-1/2-inch meters in non-traffic areas, the box shall be Mid-States Plastics 17-inch x 30-inch with a 17-inch x 30-inch ductile iron cover by the box manufacturer. Provide cover without hinged meter read lid or accommodation for radio read antenna.

C. Traffic rated water meter boxes shall be installed only where specifically requested by the City. For 1-inch and smaller meters, 20K traffic rated concrete boxes, as manufactured by Meter Box Equipment Co., Portland, Oregon, No. 67T, Oldcastle Precast Model MB65, or equal, shall be provided. The lid shall be 13-inch x 24-inch ductile iron 20K traffic rated to accommodate radio read meter reading. Larger meter installations shall require the Contractor to provide a shop drawing of a traffic rated meter box to the City Engineer for review and approval.

2.17 Locating Wire

Locating wire shall be a minimum of 12 awg UF solid copper with blue colored insulation. The use of THHN wire will not be acceptable. At all splices the connecting ends of the wires shall be overlapped and tied. The ends shall be stripped and connected with a wire nut to ensure an electrical connection and made waterproof with an approved silicone splice kit. The splice kit shall be King Technology Model 50-566 (1637 N. Warson Road, St. Louis, MO 63132, 1-800-633-0232), or approved equal. Where location wire is to be secured to the exterior of fire hydrants, valve boxes, posts, etc., stainless steel pipe straps shall be used.

2.18 Thrust and Anchor Blocks and Concrete Collars

Concrete used for thrust and anchor blocks, and concrete collars shall be Portland Cement concrete with a minimum 28-day compressive strength of 2500 psi. Anchor rods shall be 3/4-inch diameter galvanized steel or epoxy coated reinforcement bar conforming to AASHTO M284, embedded a minimum of 18 inches in the concrete.

PART 3 - EXECUTION

3.1 Trench Excavation and Backfill

Trench excavation and backfill shall be performed as specified in the Technical Specifications for "Excavation and Backfill of Trenches."

3.2 Record Drawings

The requirements for Record Drawings, etc., as stated in the General Requirements, shall be carefully complied with.

3.3 Installation of Pipe

A. Water pipe shall be installed in accordance with best current practices as required by the manufacturer and as specified herein. PVC pipe installation shall conform to the Uni-Bell Plastic Pipe Association, "Guide for Installation of PVC Pressure Pipe for Municipal Water Main Distribution Systems" and also AWWA M23 "PVC Pipe - Design and Installation." Ductile iron pipe installation shall conform to the requirements of AWWA C600.

B. Water pipe shall be installed with bell ends laid facing in the direction of laying unless directed otherwise by the City Engineer. Each pipe shall be properly bedded so as to be supported for the full length of the pipe. A suitable foundation shall be achieved by a slight excavation under the bell at each joint. All rubber ring joints shall be lubricated and installed in accordance with the installation instructions of the pipe manufacturer, taking particular care to avoid pinching or otherwise causing damage to the rubber ring. All joints shall be free of dirt and other foreign matter prior to the joining of the next pipe. All joints shall be restrained to prevent creep and misalignment of joints.

C. Water lines shall be installed to the minimum depths called for on the Drawings and to the lines and grades when shown. It shall be recognized that water line depths may vary from the minimum depths shown when adjustment of grade is required to avoid conflict with existing utilities. Additional fittings may also be required when a grade adjustment is required. Grade adjustments to accommodate existing utilities shall be considered a normal part of the work.

D. No pipe shall be installed in water or when conditions exist that, in the opinion of the City Engineer, are unsuitable for the laying of the pipe. At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other approved means. This provision applies during the noon hour as well as overnight. If there is water in the trench, the seal should remain in place until the trench is dewatered sufficiently to prevent groundwater from entering the pipe. Adequate provisions shall be made by the Contractor for final disposal of the groundwater pumped from trenches.

E. All pipe shall be installed true to line, except when approved or specified, the Contractor may install a pipeline on a curve. For rubber gasketed ductile iron pipe installed on a curve, the pipe shall be joined in a straight alignment, then deflected. The amount of deflection shall not exceed 80 percent of the recommended maximum deflection specified in AWWA C600. For PVC pipe installed on a curve, deflection of the pipe shall

be achieved by bending the pipe within the limitations specified by the pipe manufacturer. Joint deflection of PVC pipe is not allowed.

F. Thrust and anchor blocks shall be constructed as shown on the Drawings and placed at all changes in direction, all changes in the diameter of the pipe, all dead-ends, as specifically shown on the Drawings and as required by the City Engineer. All thrust blocks shall be placed between the undisturbed ground and the fitting to be anchored. Plastic sheeting shall be used to provide a bonding barrier between the fittings and the concrete. The quantity of concrete and the area of bearing on the soil shall be as shown on the Drawings. All thrust blocks shall be placed so that the entire pipe and fitting joints will be accessible for repairs. Bolts for mechanical and flange fittings and fire hydrant weep holes shall not be covered with concrete. All bolts shall be accessible and removable without interference from the thrust block. Thrust blocks may not be required where approved restraint joint pipe and fittings are utilized. No backfill of thrust blocks shall occur until the work has been observed by the City.

3.4 Locating Wire

A continuous solid copper locating wire shall be placed along the top of all water pipe, including service lines. This wire shall be secured to the top of the pipe at maximum 10-foot intervals using 6-inch strips of 2-inch wide duct tape. All splices shall be tied, electrically continuous, and made waterproof. Access to terminal ends of the locating wire shall be made at all valve boxes, meter boxes, fire hydrants, vaults, etc. The result of this installation shall be a continuous wire circuit electrically isolated from ground. The Contractor shall be responsible for testing continuity and for testing isolation from ground in the wire after all work has been completed on the test section. The Contractor is advised to do intermediate testing on his own after backfilling operations and prior to surface restoration work to be sure continuity is maintained. If there is a break or defect in the wire, it shall be the Contractor's responsibility to locate and repair the defect. The continuity of the location wire shall be tested from one test load point to the next by use of a temporary wire laid between test points in-line with an ohmmeter. Resistance shall be measured with an approved ohmmeter that has been properly calibrated. The continuity of a test section will be accepted if the resistance of the test section does not exceed 5 ohms per 500 feet of location wire being tested. Isolation from ground shall be measured with a megohmmeter and shall be a minimum of 20 megohms for any section of location wire tested. The City shall witness the acceptance test.

3.5 Service Connections

The Contractor shall connect service lines to new or existing water mains as shown on the Drawings. This work includes the installation of a saddle and corporation stop, and making the connection. The work will include potholing to locate any existing pipeline or service lines as required so the service connection can be performed.

3.6 Service Lines

A. The installation of new service lines and the connecting of existing service lines shall be performed in accordance with the Drawings, manufacturer requirements, and as specified herein. Water service lines shall be laid by placing the pipe on the trench bottom with sufficient slack to prevent pulling apart of the joints when the backfill is placed. Splices shall be kept to an absolute minimum. If required, they shall be made using brass compression joint couplings equal to Ford Pack-joint. When constructing a new water line to replace an existing line, the existing water line shall remain in service until the new water line has been tested, and disinfected. When possible, the existing line and new line shall both be in operation during the transfer of service lines. The transfer shall be made so that the interruption of water service to the utility customer is held to a minimum. All service lines shall be thoroughly flushed before connecting to existing lines or meters. The City will assist the Contractor in locating existing service lines; however, the primary responsibility for performing excavation work to locate existing lines will be the Contractor's. The work includes potholing to locate any existing pipelines or service lines as may be required so the service lines can be installed. The work also includes connecting to the existing services lines when required.

B. When the Drawings indicate that existing service lines will be utilized, and if the Contractor encounters an existing service line which appears to be in poor or unserviceable condition, he/she shall promptly contact the City.

3.7 Service Lines by Boring and Open Trench Methods

A. It is the general intent to try and install service lines under paved streets by boring where possible. A pneumatic boring tool or other approved method will be used to install service lines under all paved streets. There may be areas where it is not possible to bore due to ground conditions which interfere in the operation. Where requested by the City, the Contractor shall attempt to bore under paved streets. In areas where it appears that boring will be difficult as determined by the City and the Contractor, the service lines shall be installed by the open trench method. The Contractor shall make

two attempts, if required, to bore under paved streets. If the second attempt fails, the Contractor shall install the service line by the open trench method. If the Contractor encounters an obstacle and is unable to continue boring, he shall notify the City prior to withdrawing the boring device.

B. The Contractor shall take care to not damage other utilities which might exist in the area. Prior to boring, the Contractor shall pothole to locate existing utilities. "Blind-boring" is not allowed. Repairs for damage to other utilities shall be the responsibility of the Contractor.

C. Service lines to be installed in areas **not** under asphalt streets or in asphalt street areas the City believes will be difficult to bore may be installed by open trenching. Refer to the Drawings for additional requirements. All service lines shall be thoroughly flushed and disinfected before connecting to existing lines or meters.

3.8 Valves and Valve Boxes

Valves and valve boxes shall be installed as shown in the Drawings. All valves and valve boxes shall be set plumb. The valve box shall be centered over the valve operator and free of any obstruction which would prevent operation of the valve nut. If the bury depth of the valve is greater than 4 1/2 feet, a valve operator extension shall be provided to within 1 foot of finish grade. The extension shall be permanently attached to the valve operator and a self-centering device shall be provided near the top of the valve operator extension. The box cover shall be flush with the finished grade. A concrete collar shall be installed.

3.9 Fire Hydrants

Hydrant installation shall conform with AWWA Manual M17 and AWWA C600, and as shown on the Drawings. Extensions required for hydrant adjustment shall be installed to the manufacturer's specifications. Hydrants may be installed on new water mains, installed as part of the work, or on existing mains. Special attention shall be given when installing hydrants on existing mains to ensure that adequate thrust restraint is being achieved as the hydrants can be placed in service before normal cast-in-place thrust blocks can achieve the required strength. The block and plug shall be held securely by temporary thrust block or other approved method, such as precast thrust blocks, restraining rods, etc. The newly installed hydrants shall be covered in a manner acceptable to the City until they are placed into permanent service.

3.10 Removal of Existing Fire Hydrants

All hydrants removed shall remain the property of the City and shall be delivered and properly stacked at a site designated by the City. After the old hydrant is removed, the lead line, if it is to be abandoned, shall be plugged at the main line tee with a watertight plug and thrust block. When the lead pipe is connected to a water main which is being abandoned, it will not need to be plugged. The Contractor shall apply black paint the same day the existing hydrant is disconnected from service; otherwise, mark the hydrant in a manner acceptable to the City.

3.11 Water Line Blowoffs

The 2-inch water line blowoffs shall be constructed as shown on the Drawings.

3.12 Connections to Existing Lines

A. If shown on the Drawings, information indicating the size, type, class, and location of existing lines and associated fittings has been obtained from as-built drawings and other municipal records. It is expected that there may be some discrepancies and omissions in the information shown on the Drawings. Therefore, it shall be the responsibility of the Contractor to excavate and inspect existing water lines requiring a connection in order to determine the exact fittings needed. In connecting to existing lines, the Contractor may select the combination of fittings he wishes to use, subject to approval of the City Engineer. Approved fabricated steel couplings, repair bands, transition couplings, or tapping sleeves are among the options available to the Contractor. The Contractor shall submit to the City Engineer information on the type of couplings he proposes to use. Proper disinfection, as described hereafter, shall always be accomplished. The Contractor shall provide watertight plugs and thrust restraints, as required, to cap old lines after they are disconnected.

B. The Contractor shall provide special attention in providing thrust restraint for fittings installed as part of a connection to an existing line, when such connection will be placed into service before normal cast-in-place thrust blocks can achieve required strength. In such cases thrust restrained joints, precast thrust blocks, etc., must be utilized to provide thrust restraint. Methods used by the Contractor shall be approved by the City Engineer.

C. The Contractor shall not interrupt service for the purpose of connecting to an existing line until he has excavated the required location, visually inspected the connection point, and verified that he has available on the site all fittings required for completion of

the connection or connections. Isolation of a section of line to be modified will be accomplished by the Contractor only after consultation with the City for the purpose of determining the proper valves to close to effect the isolation. The Contractor shall cooperate with the City in accomplishing this isolation. When work is started on a connection, it shall proceed continuously without interruption, and as rapidly as possible until completed. If the connection involves turning off the water, the Contractor shall be responsible for notifying the residents affected by the shutoff. See the "Existing Utilities" section of the General Requirements.

3.13 Water Meter Installation

The Contractor shall furnish all materials required and shall install the water meters as shown on the Drawings and described herein. Water meter installations shall include appropriate meter box and cover, coppersetter, yokes, and fittings, and shall include the water meter. Meter boxes shall be set plumb with cover level and with equal clearance on all sides between the box and the plumbing.

3.14 Water-Sewer Line Crossings

A. Wherever possible, the bottom of the new water line shall be 1.5 feet or more above the top of any sanitary sewer line. One full length of water line shall be centered at all sewer crossings when the vertical separation is less than 1.5 feet. Where the water line crosses over an existing sanitary sewer line but with a clearance of less than 1.5 feet, the sewer line shall be exposed to the sewer line joints on both sides of the crossing to permit examination of the sewer pipe. If the sewer pipe is in good condition and there is no evidence of leakage from the sewer line as observed by the City Engineer, the 1.5-foot separation may be reduced. When the vertical separation is less than 1.5 feet, the Contractor shall center one full length of the new water pipe over the sewer line. If the City and/or City Engineer determines that the conditions are not favorable or finds evidence of leakage from the sewer line, the sewer line shall be replaced with a full length of PVC pressure pipe (AWWA C900, DR 18, 150 psi pipe) centered at the crossing point. When new sewer pipelines are installed as a part of the project, it will not be necessary to expose the new sewer pipe to verify the pipes condition.

B. Where the water line crosses under the sanitary sewer line, the Contractor shall expose the existing sewer line and examine it as indicated above. If conditions are favorable and there is no evidence of leakage from the sewer line, the sewer line may be left in place. The existing sewer line shall be supported with a steel beam, reinforced concrete beam, or other means of preventing settlement when it spans the water line trench,

unless otherwise approved by the City. Special precautions must be taken to assure that the backfill material over the water line in the vicinity of the crossing is thoroughly compacted in order to prevent settlement which could result in the leakage of sewage. In this situation, the Contractor shall center one length of the new water line at the crossing. If the City and/or City Engineer determines that conditions are not favorable or finds evidence of leakage from the sewer line, then the sewer line at the crossing shall be replaced as detailed on the Drawings.

C. When constructing water service lines, the depth of the service lines shall be revised in order to eliminate the need for a water-sewer line crossing.

3.15 Capping Existing Water Mains and Services

When required, the Contractor shall cap an existing water main or service tap when an existing main or service is to be taken out of service. Each location will require different types of fittings, etc., to accomplish the work. All caps are to be permanent and watertight. When required, thrust restraints shall be provided. Corporation stops on service taps shall be in "off" position and an approved watertight cap installed. Unless specified otherwise, the capping shall be performed at the connection to the water main which is to remain in service. No stubbed water mains or service lines shall be left in the ground unless approved otherwise by the City Engineer. The Contractor shall excavate and expose the piping to be capped, perform the work, and backfill as required.

3.16 Abandoned Water Lines

The existing water lines to be taken out of service are to be shown on the Drawings. These lines are to remain in service until the new lines are properly installed and tested, and water services have been connected. Approval from the City shall be obtained before any line is abandoned. The existing lines shall then be abandoned and their actual location and abandoned designation recorded on all Record Drawings. Unless called for otherwise, the abandoned lines will remain in the ground. The ends of all pipes which are abandoned shall be plugged with concrete or other methods approved by the City Engineer.

3.17 Air Release Valves

Air release valves shall be installed as shown on the Drawings, and as required by the manufacturer.

3.18 Other Installations

Installations of valves and valve boxes shall be in accordance with the manufacturer requirements and the Drawings.

3.19 Existing Equipment Removal and Salvage

A. The Contractor shall remove all existing valves, hydrants, and fittings as required to properly perform the work, or as shown in the Drawings. All such materials shall be transported to an area designated by the City and stockpiled. Materials shall be removed and handled in such a manner which will prevent damage.

B. All other existing valves and hydrants not used in the new system or specified for removal will be removed by the City after the new system is in operation. Salvaged material shall remain the property of the City. The abandoned existing pipe is to remain in the ground, unless otherwise specified. The Contractor shall apply black paint the same day to all existing hydrants when permanently disconnected from service.

3.20 Work with Existing Asbestos Cement (A/C) Pipe

When working with A/C pipe, the Contractor shall take all precautions necessary to reduce airborne asbestos during construction. All work with A/C pipe shall conform with American Water Works Association Publication "Work Practices for Asbestos Cement Pipe." The Contractor shall cut asbestos cement pipe by using carbide tipped blades or snap cutters. Machining of this pipe shall be done with a manual or power-driven field lathe, or with a manual rasp. Hole cutting shall be accomplished with a tapping machine, a shell cutter, an electric drill and rasp, or a chisel and rasp. Uncoupling of asbestos cement pipe shall be accomplished with a hammer and chisel. Use of abrasive disc cutters, right angle sanders, or other high speed abrasive tools shall not be permitted. Dust and cuttings from all work shall be removed by wet mopping. All waste material shall be collected in a covered container and disposed at a landfill certified by the State or EPA to accept demolition waste.

3.21 Testing and Disinfection

A. General

The Contractor shall furnish all necessary equipment and other apparatus, including gauges, necessary to properly perform the testing and disinfection of water lines as specified. Lines to be tested include mains and service lines. Each section of the lines before being tested and placed into service shall be isolated and slowly filled with water.

Air should be expelled from the line through hydrants or taps made at the high points. The City and/or City Engineer shall have the option of requiring the use of his own gauges. Water mains shall be generally tested in sections between valves and as the work progresses. The Contractor shall be responsible for determining the length, timing, and section of lines to be tested, unless otherwise noted. When appropriate, testing intermediate sections of long lines should be considered. The Contractor shall provide any temporary test heads, fittings, blocking, etc., as may be required to properly test any given water main section. The Contractor shall be responsible for locating and repairing any defects in the water mains which fail to pass the required test.

B. Acceptance Test

The Contractor shall perform all preliminary testing required to determine that the lines to be tested are acceptable and comply with the requirements of this section of the Specifications. After the Contractor has determined that the lines will pass the required test, the Contractor shall arrange for an acceptance test to be witnessed by the City and/or City Engineer. The lines will not be accepted until the acceptance test has been witnessed and documented as passing. Forms for performing the various tests are included at the end of this Technical Specification for use and reference by the Contractor.

C. Hydrostatic Testing of Pressure Lines

All lines shall be pressure tested at 150 psi gauge or 1.5 times the actual working pressure, whichever is greater, for one hour. Any cracked or defective pipe, joints, or fittings shall be removed and replaced.

D. Leakage Test

Each section of the line, after all backfill and compaction work has been completed and before being placed into service, shall be tested for leakage for a period of two hours at a minimum average gauge pressure of 100 psi. Leakage is defined as the quantity of water supplied into the section of line being tested, during and at the end of the test, that quantity being such that the pressure at the end of the test is equal to the pressure at the beginning of the test. Should any test disclose leakage greater than that specified, the Contractor shall locate and repair the defective joints until the leakage is within the specified allowance.

PVC Pipe: $L = \frac{ND\sqrt{P}}{7,400}$ DI Pipe: $L = \frac{SD\sqrt{P}}{133,200}$

In which:

L = Allowable Leakage Gal/Hr
S = Length of Pipe Tested in Ft.
N = Number of Joints or Connections
D = Nominal Diameter in Inches
P = Gauge Pressure in psi

E. Disinfection of Potable Water Mains

1. Each section of the line, before being placed into service, shall be thoroughly flushed and disinfected in accordance with regulations of the Oregon Health Authority - Drinking Water Services (DWS), specifically Oregon Administrative Rule, Section 333-061-0050(10) Construction Standards, which reads as follows:

"(10) Disinfection of facilities:

(a) Following completion of new facilities and repairs to existing facilities, those portions of the facilities which will be in contact with the water delivered to users shall be disinfected with chlorine before they are placed into service. Other disinfectants may be used if it is demonstrated that they can also achieve the same result as chlorine;

(b) Prior to disinfection, the facilities shall be cleaned and flushed with potable water according to AWWA Standards C651 through C654;

(c) For new construction and installation of wells, pumps, and water mains (with any associated service connections and other appurtenances installed at the time of construction), disinfection by chlorination shall be accomplished according to AWWA standards C651 through C654 which includes, but is not limited to the following:

(A) The introduction of a chlorine solution with a free chlorine residual of 25 mg/l into the system in a manner which will result in a thorough wetting of all surfaces and the discharge of all trapped air. The solution shall remain in place for 24 hours.

(B) After the 24-hour period, the free chlorine residual shall be checked, and if it is found to be 10 mg/l or more, the chlorine solution shall be drained and the facility flushed with potable water. If the check measurement taken after the 24-hour contact period indicates a free chlorine residual of less than 10 mg/l, the facilities shall be flushed, rechlorinated and rechecked until a final residual of 10 mg/l or more is achieved after a 24-hour standing time.

(C) After the final residual is confirmed at 10 mg/l or more, and after the facility is flushed and filled with potable water, bacteriological samples shall be taken to provide a record for determining the procedures' effectiveness. A minimum of two consecutive samples must be collected at least 24 hours apart from the new facilities for microbiological analysis. If the results of both analyses indicate that the water is free of coliform organisms, the facility may be put into service. Likewise, if the microbiological analysis indicates the presence of coliform organisms, the flushing and disinfection must be repeated until a sample free of coliform organisms is obtained.

(d) For repaired wells, pumps, and completely depressurized water mains, disinfection by chlorination shall be accomplished according to AWWA standards C651 through C654. Following thorough flushing, a minimum of one sample must be collected from each direction of flow downstream from the repaired facilities for microbiological analysis. If the direction of flow is unknown, then samples shall be taken on each side of the repaired facility. If the microbiological analysis indicates the presence of coliform organisms, a follow-up sample shall be taken. If the follow-up sample indicates a presence of coliform organisms, then the repaired components shall be flushed and resampled until a sample free of coliform organisms is obtained.

(e) through (i) do not apply to water lines.

(j) A water line may be returned to service, following repairs or routine maintenance, prior to receiving a report on the microbiological analysis if the following procedures have been completed.

(A) Customer meters were shut off prior to placing the water line out of service;

(B) The area below the water line to be repaired was excavated and dewatered;

(C) The exposed pipe was treated with a hypochlorite solution;

(D) The water line and any other appurtenance or item affected by the repair and/or maintenance was disinfected by chlorination according to AWWA standards C651 through C654;

(E) The water line was flushed thoroughly, and a concentration of residual chlorine has been re-established that is comparable to the level normally maintained by the water system, if applicable; and

(F) Microbiological analysis has been conducted as a record of repair effectiveness.

2. When fittings, service lines, or other components of the water system are not disinfected in conjunction with water mains, the Contractor shall disinfect all fittings and service lines using a 300 mg/L minimum chlorine solution. All fittings shall be flushed with the chlorine solution prior to connection with the new service line. The new service line shall be flushed slowly with a 300 mg/L minimum chlorine solution in a manner which will result in a thorough wetting of all surfaces on the inside of the service line. The service line shall have at least 15 minutes contact time prior to flushing and putting it into service.

3. After disinfection, the Contractor shall collect bacteriological samples for testing in the presence of the City. A minimum of one sample shall be taken every 1,000 feet of water line to be tested. The City may require additional samples to be taken if the section to be tested is complex and proper disinfection could be difficult. The analysis shall be performed by a laboratory certified by the DWS or the EPA. The cost of the bacteriological testing(s) is to be paid by the Contractor. If positive results are obtained, the system shall be disinfected again by the Contractor, at his own expense. Bacteriological samples will again be collected in the presence of the City and resubmitted for testing. This shall be repeated until negative results are obtained. The method of disinfecting and the

chlorination materials used are subject to the approval of the City Engineer. Disinfection by introducing granular or tablet chlorine compounds in each pipe length is not an acceptable method of disinfection.

4. The results of all bacteriological tests shall be submitted to the City and to the City Engineer and placed in the Operation and Maintenance Manual. No section of pipe shall be placed into service until acceptable bacteriological tests have been obtained.

5. Disposal of any water containing chlorine shall be performed in accordance with AWWA C651, Section 01100, and any other local requirements. Disposal may be made into existing sanitary sewer systems providing approvals are obtained from the City. Any chlorinated water discharged to open stream channels must be dechlorinated prior to discharge.

3.22 Restoration, Finishing, and Cleanup

The Contractor shall restore or replace all paved surfaces, graveled surfaces, curbing, sidewalks, trees, shrubbery, lawns, pastures, fences, and other existing facilities equal to their original condition. All surplus material and temporary structures as well as excess excavation shall be removed and the entire site of Contractor operations shall be left in a neat and clean condition as outlined in the General Requirements. Also see Technical Specifications - "Excavation and Backfill of Trenches" and Technical Specifications - "Surface Restoration" for specific requirements.

END OF SECTION

TEST WORKSHEET FOR THE

WATER LINES - LEAKAGE TEST

Project Name _____

Date _____ Job No. _____

Location of Test/Stationing _____

_____

Hydrostatic Test

Test Pressure _____

Time Test Started _____

Time Test Completed _____

TOTAL TIME _____ minutes

Test Passed ☐ Yes ☐ No

Leakage Test (Min. Test Pressure 100 psi)

PVC Pipe: $L = \frac{ND\sqrt{P}}{7,400}$ DI Pipe: $L = \frac{SD\sqrt{P}}{133,200}$

In which:

L = Allowable Leakage Gal/Hr
S = Length of Pipe Tested in Ft.
N = Number of Joints or Connections
D = Nominal Diameter in Inches
P = Gauge Pressure in psi

Allowable Leakage

Pipe Section	Nominal Diameter	Number of Joints or Connections	Length of Pipe	Allowable Leakage

Total Allowable Leakage _____ gal/hr

Time Test Started _____ Total Leakage Measured _____gal.

Time Test Completed _____ Total Leakage Measured/Gal=_____ gal/hr

TOTAL TIME _____mins. _____Time (hr.)

Test Passed ☐ Yes ☐ No

Contractor's Firm Name: _____

_____

Contractor's Representative Signature _____

Engineer's Representative Signature _____

Note: See Technical Specifications for directions of use.