

## DIVISION 5 - WATER

### TABLE OF CONTENTS

<b>501 WATER PIPE AND FITTINGS .....</b>	<b>1</b>
501.01.00 MATERIALS .....	1
501.01.01 DUCTILE IRON PIPE .....	1
501.01.01A DUCTILE IRON PIPE JOINTS .....	1
501.01.02 PVC PIPE .....	2
501.01.03 RED-BRASS PIPE .....	2
501.01.04 GALVANIZED STEEL PIPE AND FITTINGS .....	2
501.01.05 DUCTILE AND CAST IRON FITTINGS .....	3
501.01.06 LIGHTWEIGHT MECHANICAL COUPLINGS AND ADAPTERS .....	3
501.01.07 BACKFILL .....	3
501.01.08 STANDARD VALVE BOXES .....	3
501.02.00 CONSTRUCTION .....	4
501.02.01 EXCAVATION AND BACKFILL .....	4
501.02.01A WORKING AROUND EXISTING AC WATER LINES .....	4
501.02.02 OPERATION OF EXISTING VALVES .....	4
501.02.03 GRADE AND ALIGNMENT .....	4
501.02.04 UTILITY CONFLICTS .....	4
501.02.05 CONNECTION TO EXISTING, IN-SERVICE MAINS .....	5
501.02.06 SANITARY SEWER CROSSINGS .....	5
501.02.07 PIPE AND FITTING INSTALLATION .....	5
501.02.07A SANITARY PRACTICES DURING INSTALLATION .....	6
501.02.07B PIPE AND FITTING INSTALLATION .....	6
501.02.07C PIPE CONNECTION PROCEDURES .....	6
501.02.07D CUTTING DUCTILE IRON PIPE .....	7
501.02.07E ALLOWABLE DEFLECTION OF PIPE .....	7
501.02.08 STANDARD DEAD-END MAIN BLOWOFFS .....	7
501.02.09 ANCHORAGE .....	7
501.02.09A GENERAL .....	7
501.02.09B MECHANICAL THRUST RESTRAINT .....	7
501.02.09C CONCRETE THRUST BLOCKING .....	8
501.02.10 REPAIR OF DAMAGED WATER LINES .....	8
501.02.11 SURFACE RESTORATION .....	8
501.03.00 MEASUREMENT AND PAYMENT .....	8
501.03.01 PIPE INSTALLATION .....	8
501.03.02 ASSEMBLIES .....	9
501.03.03 INCIDENTALS .....	9
<b>502 VALVES AND RELATED EQUIPMENT .....</b>	<b>9</b>
502.01.00 MATERIALS .....	9
502.01.01 RESILIENT-SEATED, IRON BODY GATE VALVES .....	9
502.01.02 BUTTERFLY VALVES .....	9
502.01.03 TAPPING VALVES AND SLEEVES .....	9
502.01.03A TAPPING VALVES .....	9
502.01.03B TAPPING SLEEVES .....	10
502.01.04 ADJUSTABLE VALVE BOX ASSEMBLIES .....	10
502.01.05 AIR VALVES .....	10
502.02.00 CONSTRUCTION .....	11
502.02.01 VALVES AND VALVE BOXES .....	11
502.02.01A VALVE INSTALLATION .....	11

502.02.01B VALVE BOX INSTALLATION.....	11
502.02.02 TAPPING VALVES AND SLEEVES .....	11
502.02.03 AIR VALVES.....	12
502.03.00 MEASUREMENT AND PAYMENT .....	12
502.03.01 VALVE ASSEMBLIES .....	12
502.03.02 INCIDENTALS .....	12
<b>503 FIRE HYDRANTS .....</b>	<b>12</b>
503.01.00 MATERIALS .....	12
503.01.01 FIRE HYDRANTS .....	12
503.01.02 FIRE HYDRANT EXTENSIONS.....	13
503.01.03 BACKFILL.....	13
503.02.00 CONSTRUCTION .....	13
503.02.01 EXCAVATION AND BACKFILL.....	13
503.02.02 FIRE HYDRANTS.....	13
503.02.03 SURFACE RESTORATION.....	14
503.03.00 MEASUREMENT AND PAYMENT .....	14
503.03.01 HYDRANT ASSEMBLIES .....	14
503.03.02 INCIDENTALS .....	14
<b>504 WATER SERVICE INSTALLATION .....</b>	<b>14</b>
504.01.00 MATERIALS .....	14
504.01.01 GENERAL.....	14
504.01.02 POLYETHYLENE WATER TUBE .....	14
504.01.03 BRASS/BRONZE FITTINGS .....	15
504.01.03A CORPORATION STOPS.....	15
504.01.03B ANGLE METER VALVES.....	15
504.01.03C 1½ INCH AND TWO-INCH METER SETTER.....	15
504.01.03D POLYETHYLENE SERVICE COUPLINGS .....	15
504.01.03E CUSTOMER SERVICE VALVES.....	15
504.01.04 SERVICE SADDLES.....	16
504.01.05 METERS .....	16
504.01.06 CONCRETE METER BOXES.....	16
504.01.07 BACKFILL.....	16
504.02.00 CONSTRUCTION .....	16
504.02.01 EXCAVATION AND BACKFILL.....	16
504.02.02 PIPE AND FITTING INSTALLATION .....	16
504.02.02A PIPE INSTALLATION .....	16
504.02.02B CUTTING AND SIZING POLYETHYLENE TUBING .....	17
504.02.02C SERVICE TAPS .....	17
504.02.02D CORPORATION STOPS AND ANGLE METER VALVES.....	17
504.02.03 METER AND METER BOX INSTALLATION .....	17
504.02.04 REPAIR OF DAMAGED WATER LINES .....	18
504.02.05 SURFACE RESTORATION.....	18
504.03.00 MEASUREMENT AND PAYMENT .....	18
504.03.01 SERVICES .....	18
504.03.02 METER ASSEMBLIES .....	18
504.03.03 INCIDENTALS .....	18
<b>505 HYDROSTATIC PRESSURE/LEAKAGE TESTING AND DISINFECTION .....</b>	<b>18</b>
505.01.00 PRESSURE AND LEAKAGE TESTING .....	18
505.01.01 GENERAL.....	19
505.01.02 PRESSURE AND LEAKAGE TESTING .....	19
505.01.02A ISOLATED LOCATIONS .....	19
505.01.02B ALLOWABLE LEAKAGE.....	19
505.02.00 DISINFECTION OF WATER MAINS.....	20
505.02.01 GENERAL.....	20

505.02.02	FLUSHING .....	20
505.02.02A	WATER FOR FLUSHING.....	21
505.02.03	CHLORINATION .....	21
505.02.03A	DISPOSAL OF CHLORINATED WATER.....	21
505.02.03B	CONNECTION ASSEMBLIES AND EMERGENCY REPAIRS .....	22
505.02.04	BACTERIOLOGICAL TESTING .....	22

## **DIVISION 5 - WATER**

### **501 WATER PIPE AND FITTINGS**

#### 501.01.00 MATERIALS

Pipe for water lines 10" and smaller shall either be ductile iron (D.I.) or polyvinylchloride (PVC), all water lines larger than 10" shall be D.I. only.

#### 501.01.01 DUCTILE IRON PIPE

Pipe for water lines, with the exception of one-inch and two-inch polyethylene service lines and distribution lines 10" and smaller, shall be ductile iron of domestic manufacture, centrifugally cast of 60-42-10 iron, and shall conform to ANSI A21.51 or AWWA C 151.

The minimum thickness class for all sizes of ductile iron pipe shall be class 52. Ductile iron pipe that is to be threaded for flanges shall be class 53.

The pipe shall be cement-mortar lined and seal coated in accordance with ANSI A21.4.

The rubber-ring gaskets shall be suitable for the specified pipe sizes and pressure, shall conform to applicable parts of the latest Federal Specification WW-P-421, and shall be furnished by the pipe manufacturer. A nontoxic vegetable soap lubricant shall be supplied with the pipe in sufficient quantities for installing the pipe. Materials and installation requirements for electrical continuity or bond bars, as may be necessary in corrosive soils, shall be specified in the contract documents.

Acceptable ductile iron pipe:

Griffin Ductile Iron Pipe  
Pacific States  
U.S. Pipe  
American

#### 501.01.01A DUCTILE IRON PIPE JOINTS

Ductile iron pipe shall be supplied with push-on joint connections.

Where thrust restraint is required or specified, new water mains shall be constructed using ductile iron pipe with an internal, push-on joint restraint system. Ductile iron pipe 12-inches in diameter and smaller shall be restrained through the utilization of locking gaskets in push-on joint connections. Internal restraint for ductile iron pipe larger than 12-inches in diameter shall be achieved using a push-on joint restraint system that provides a positive axial lock between the interior surface of the bell and the spigot end of the pipe.

#### PUSH-ON JOINTS

Single, rubber gasket, push-on joints shall conform to AWWA C 111 (ANSI A21.11). Unless otherwise specified, gaskets and lubricant shall be of domestic manufacture provided by the manufacturer of the pipe on which they are to be used.

INTERNALLY RESTRAINED PUSH-ON JOINTS Acceptable push-on joint restraint systems for ductile iron pipe:

TR Flex brand as manufactured by U.S. Pipe.

Thrust Lock brand as manufactured by Pacific States Cast Iron Pipe Company.

Locking gaskets for "Tyton" style joints shall be Field-Lok brand as manufactured by U.S. Pipe.

Locking gaskets for American ductile iron pipe shall be "Fast-Grip" brand as manufactured by American.

#### MECHANICAL JOINTS

Mechanical joint ends on ductile iron pipe shall not be used without the approval of the City Engineer. Where approved, components of mechanical joints shall be in conformance with AWWA C 111 (ANSI A21.11).

Gaskets and glands shall be of domestic manufacture and provided by the manufacturer of the pipe or fitting on which they are to be used.

Bolts and nuts shall be of domestic manufacture and made of low carbon steel conforming to

#### RETAINER GLANDS

The use of retainer glands is limited to applications specified in the contract documents.

Approved retainer glands:

Mega-Lug brand as manufactured by EBAA Iron, Inc., Eastland, Texas Uni-Flange Series 1400 as manufactured by Ford Meter Box Co., Inc. Romagrip Brand as manufactured by Romac Industries, Inc.

#### FLANGED JOINTS

Flanged connections on ductile iron pipe shall not be used without the approval of the City Engineer. Where approved, flanged joints for ductile iron pipe shall be in conformance with AWWA C 115 (ANSI A21.15).

Gaskets shall be 1/8-inch thick rubber, either ring or full face, conforming to the pipe manufacturer's requirements.

Bolts and nuts shall be of domestic manufacture and made of low carbon steel conforming to ASTM A 307, Grade B, or ductile iron.

Threaded flanges for use in making custom ductile iron spools shall be forged steel, Class D, hub-type and shall conform to AWWA C 207-86 specifications.  
ASTM A 307, Grade B, or ductile iron.

#### 501.01.02 PVC PIPE

Pipe for water lines, with the exception of one-inch and two-inch polyethylene service lines and distribution lines larger than 10", shall be PVC of domestic manufacture, and shall conform to AWWA C900, "Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 in. through 12 in. for Water Distribution."

##### 501.01.01A PVC PIPE JOINTS

Pipe joints shall be gasket, push-on type. Gaskets shall be part of a complete pipe section and purchased as such. Lubricant shall be as recommended by the pipe or fitting manufacturer and shall not adversely affect the potable qualities of the water to be transported. The gasketed joint shall meet the laboratory performance requirements specified in ASTM D3139.

#### 501.01.03 RED-BRASS PIPE

Seamless, red-brass pipe shall be of domestic manufacture and supplied in conformance with ASTM B 43. Diameter of brass pipe used in the installation of air valves, blowoff assemblies, and other applications will be specified in the contract documents.

#### 501.01.04 GALVANIZED STEEL PIPE AND FITTINGS

Galvanized steel pipe and fittings shall not be used unless specified in the contract documents.

Hot-dipped, zinc-coated (galvanized), welded, or seamless steel pipe and galvanized steel fittings shall be of domestic manufacture and supplied in conformance with ASTM A 120.

#### 501.01.05 DUCTILE AND CAST IRON FITTINGS

Tees, crosses, elbows, reducers, sleeves, adapters, combinations thereof, and other miscellaneous iron fittings shall be ductile or cast iron, of domestic manufacture, and shall be in conformance with ANSI/AWWA C 110/A 21.10 and ANSI/AWWA C 153/A 21.53. Fittings shall be supplied with mechanical joint connections unless specified otherwise in the contract documents.

Fittings, with the exception of solid sleeve couplers, shall be cement lined. Cement lining shall be in conformance with AWWA C 104 (ANSI A 21.4).

Fittings that have a damaged cement lining or no cement lining will be rejected at the job site. Cement linings installed or repaired by the distributor/supplier shall be completed in strict accordance with AWWA C 104. Cement linings shall not be repaired at the job site.

Fittings shall have minimum pressure ratings that will accommodate maximum pressures expected to be experienced during pressure and leakage testing.

Acceptable ductile and cast iron fittings, couplers, and adapters:

American Mueller  
U.F.C.  
U.S. Pipe Tyler

#### 501.01.06 LIGHTWEIGHT MECHANICAL COUPLINGS AND ADAPTERS

Lightweight, multipurpose, mechanical couplings and adapters are limited in their application to connection of new pipe work to existing water lines, temporary installations, and where specifically called for in the contract documents.

Lightweight, multipurpose, mechanical couplings and adapters shall consist of a ductile iron sleeve, ductile iron follower rings, rubber gaskets, and corrosion-resistant bolts and hex nuts.

Mechanical couplings and adapters shall have minimum pressure ratings that will accommodate maximum pressures expected to be experienced during pressure and leakage testing.

Acceptable mechanical couplings and adapters:

Ford  
Romac  
Smith Blair (Rockwell) EBAA Iron, Inc.

#### 501.01.07 BACKFILL

Backfill material shall conform to requirements in Section 205 CONCRETE, ASPHALT, AND AGGREGATE MATERIALS.

#### 501.01.08 STANDARD VALVE BOXES

Standard valve box assemblies shall be cast iron. "WATER" shall be cast into the cover. The height of the valve box shall be 18 inches as measured from the bottom of the assembly sleeve to the top of the flange face. Adjustable valve boxes shall be supplied without bottom flanges.

Acceptable valve box assemblies:

501.02.00 CONSTRUCTION501.02.01 EXCAVATION AND BACKFILL

The trench shall be prepared for pipe laying and backfill as specified in Section 204 EXCAVATION, BACKFILL, AND OTHER SITE WORK and applicable standard details.

The trench bottom shall conform to the line and grade to which the pipe is to be laid, allowing for pipe thickness and bedding material, and shall form a continuous uniform bearing and support for the pipe between bell holes.

501.02.01A WORKING AROUND EXISTING AC WATER LINES

The actual location of AC water lines shall be determined ahead of the excavator. Hand excavation shall be used in conjunction with excavating equipment when working around or looking for AC water lines.

Compaction equipment shall not be operated directly over or immediately adjacent to AC water lines, regardless of methods used to stabilize backfill and to support appurtenances. Traffic or construction equipment shall not be permitted to pass over temporarily backfilled excavations containing AC pipe.

501.02.02 OPERATION OF EXISTING VALVES

The City Engineer will operate or supervise the operation of existing valves during the course of the work. The contractor shall not operate any existing valve unless specifically instructed to do so by the City Engineer.

The contractor shall be responsible for coordination of the work with the City Engineer to provide for the timely operation of existing valves.

When so instructed by the City Engineer, the contractor shall provide assistance in operating existing valves.

501.02.03 GRADE AND ALIGNMENT

Water mains shall be installed with a minimum depth of bury of three feet as measured from the top of pipe to finish grade. A greater depth may be necessary to avoid underground obstructions. A minimum of six inches of clearance shall be maintained between the pipe and obstructions.

When water lines are designed to be laid in a straight line and/or at a specific grade, the deviation from line and grade shall not be in excess of 0.2 of a foot horizontally for line and 0.1 of a foot vertically for grade.

501.02.04 UTILITY CONFLICTS

The contractor shall be responsible for exposing potential utility conflicts far enough ahead of pipeline construction sufficient to make necessary adjustments in grade and alignment of the new work within the specified limits of pipe and fitting deflection and/or the lines and grades stated in the contract documents. The intent of this requirement is to preserve the option of adjusting the horizontal and vertical alignment of the new water line to avoid such utilities without the need for additional fittings and thrust restraint.

The contractor shall be responsible for performing this work and for informing the City Engineer of the need for a grade and/or alignment adjustment.

The contractor shall not deviate from the design line and grade stated in the contract documents or pipe and fitting deflection requirements specified herein without the approval of the City Engineer.

Special care shall be taken to avoid compromising concrete thrust restraint on the existing water system.

Where existing thrust restraint is compromised, the contractor shall provide and install appropriate

temporary blocking and maintain such blocking until the existing water line is properly abandoned.

#### 501.02.05 CONNECTION TO EXISTING, IN-SERVICE MAINS

Existing water mains or individual service lines shall not be taken out of service without proper notification to the City Engineer and affected water users. Generally, scheduled interruptions of water service shall not occur on Fridays, weekends, holidays, and on days immediately preceding holidays.

Due to varying outside pipe diameters and the incompatibility of AC pipe fittings with modern waterworks materials, AC pipe shall be excavated and examined at each location where connections are to be made to existing pipe or fittings.

The contractor shall be prepared to begin work immediately after the scheduled beginning of the water shutoff. The excavation shall be completed and materials preassembled as much as possible prior to the scheduled time for the water shutoff. Scheduled water shutoffs will be cancelled by the City's project manager if the contractor is not prepared to begin cutting and draining the existing water line at the designated time for the work to begin. A scheduled water shutoff may also be cancelled if the project manager determines that the contractor does not have adequate equipment, including pumps and cut-off saws, to complete the work within the allotted time.

Once service has been turned off for scheduled work, the contractor shall work continuously, without interruption, and as expeditiously as possible to perform the required work. In every instance of a water shutoff, water service shall be restored as quickly as possible, regardless of the scheduled duration of the shutoff. To that end, it is expected that scheduled breaks, including lunch breaks, shall occur before or after such work.

Existing valves may not fully shut off water to the desired area. The contractor shall be expected to make required connections in situations where there is still a partial flow of water after the appropriate valves have been closed.

In situations where an existing pipe joint is found adjacent to a proposed cut-in and the City Engineer determines that construction operations may compromise the joint, the contractor shall remove the existing pipe between the joint and the new work, or as directed by the City Engineer, and replace that section with new materials.

#### 501.02.06 SANITARY SEWER CROSSINGS

In locations where the new water line crosses over or under an existing sanitary sewer pipe with less than 1½ feet of clearance between the two pipes, the contractor shall replace the sewer pipe with a 20-foot minimum length of equivalent size ductile iron or C-900 PVC pressure pipe centered on the new water line.

Watertight, mechanical couplers shall be used to reconnect the existing sewer pipe to the new ductile iron or C-900 PVC pipe section.

#### 501.02.07 PIPE AND FITTING INSTALLATION

##### 501.02.07A SANITARY PRACTICES DURING INSTALLATION

Pipe shall not be laid in standing water. Every precaution shall be taken to prevent dirt, debris, or other foreign materials from entering the pipe during all phases of construction. Tools, rags, and other materials shall be kept out of the pipe work at all times.

Whenever the trench site is left unattended, the open ends of the pipe shall be sealed with a watertight plug to prevent trench water and foreign materials from entering the pipe. If water is in the trench, the seal shall remain in place as long as water is able to enter the pipe.

##### 501.02.07B PIPE AND FITTING INSTALLATION

Pipe, fittings, and hydrants shall be lowered into the trench in such a manner that will preclude the



possibility of the materials being damaged.

Pipe shall be laid and joined one length at a time to the required line and grade. Pipe shall be placed with the bell end facing the direction of laying except for lines on a grade in excess of 15 percent in which case bells shall face upgrade.

Excess tar coating shall be removed from the bell and spigot end of each pipe and fitting prior to installation. The outside of the spigot and the inside of the bell shall be cleaned before the pipe or fittings are installed. If the pipe contains excessive dirt or other foreign matter that will not be removed during the flushing operation, the interior of the pipe shall be cleaned as necessary to remove the material.

After the first length of pipe is installed in the trench, the pipe shall be secured in place with approved backfill material tamped under and along sides to prevent movement. Pipe ends shall be kept clear of backfill. Backfill shall be placed after each section of pipe is joined to prevent movement of the previously laid pipe.

#### 501.02.07C PIPE CONNECTION PROCEDURES

Connection procedures shall be in accordance with the manufacturer's recommendations.

Lubricant for push-on joint and mechanical joint pipe shall be of a nontoxic vegetable soap type provided by the pipe manufacturer.

The use of slip-on flanges with retaining screws is not permitted unless specifically called for in the contract documents.

Coupling of ductile iron pipe with plain ends of the same diameter in new construction shall be accomplished with ductile iron, solid sleeve couplers with mechanical joints. Coupling of plain ends to flange ends during new construction shall be accomplished with solid ductile iron mechanical joint x flange (MJ x FLG) adapters/reducers.

The following are given as general guidelines for each type of pipe joint:

#### FLANGED JOINTS

Contact faces and gaskets for flanged connections shall be cleaned as necessary to remove any foreign matter before the connection is made.

Flanged joints shall be fitted so the contact faces bear uniformly on the gasket. Bolts shall be tightened progressively in a sequential, uniform manner to torque values recommended by the manufacturer of the flange and/or fitting.

Flanged fittings shall be properly anchored, supported, or restrained during installation to prevent bending or torsional strains at the connection during and after the jointing procedure.

#### MECHANICAL JOINTS

The pipe shall be inserted in the socket and supported as necessary to keep the pipe centered in the joint and to maintain uniform exposure of the gasket recess. The gasket shall be pressed firmly and evenly into the gasket recess prior to installing the bolts through the gland.

Bolts shall be tightened progressively in a sequential, uniform manner to torque values recommended by the manufacturer of the fitting. The gland shall not be allowed to deform during the tightening process.

Any required deflection of joints shall be made after the joint is assembled, but before final tightening of the bolts.

The jointing procedure shall be repeated if effective sealing is not attained at the maximum

torque. Bolts shall be tightened to manufacturer's specifications. Bolts shall not be overstressed to compensate for ineffective sealing or poor installation practices.

#### THREADED JOINTS

Threaded joint connections shall be made after all threaded surfaces have been thoroughly cleaned and prepared with sealing tape or pipe jointing compound approved by the manufacturer for use in potable water systems. Sealing tape and pipe jointing compound shall be applied in strict accordance with the manufacturer's instructions. Excessive use of sealing materials will not be permitted.

#### 501.02.07D CUTTING DUCTILE IRON PIPE

Cutting of ductile iron pipe for inserting valves, fittings, or closure pieces shall be done with a milling-type cutter or saw and in a manner that precludes damage to the pipe or cement lining and leaves a smooth end at right angles to the axis of the pipe. Flame cutting ductile iron pipe will not be permitted. The cut end of the pipe shall be ground smooth and for push-on joint connections shall be beveled as necessary to remove sharp edges that may damage the gasket. The width and general appearance of the bevel shall closely resemble the bevel on an original pipe end.

Any lining or coating damaged to a significant degree during the cutting process, as determined by the City Engineer, shall be cause for removing the damaged section by recutting the pipe or for rejecting the pipe altogether.

#### 501.02.07E ALLOWABLE DEFLECTION OF PIPE

When push-on or mechanical joint pipe is to be laid on a curve, either in the horizontal or vertical plane, the amount of deflection shall not exceed the maximum limits recommended by the manufacturer.

If any joint in any run of pipe appears to be deflected in excess of those specified herein, as determined by the City Engineer, the contractor shall, upon request of the City Engineer, expose a sufficient length of the newly laid pipe for the purpose of determining the actual deflection at any joint. The contractor shall take up and reinstall pipe that is found to have joint deflection in excess of that specified herein.

#### 501.02.08 STANDARD DEAD-END MAIN BLOWOFFS

Dead-ends on new water lines shall be closed with a cast iron, mechanical-joint plug threaded to accept a two-inch blowoff assembly in conformance with the applicable standard detail. Valve boxes (and meter boxes for blowoffs in non-traffic areas) shall be kept free of rocks and debris and shall be installed flush with finished grade.

Acceptable dead-end main blowoffs:

Kupferle Foundry No. 77 Mainguard Blow-Off Hydrant

#### 501.02.09 ANCHORAGE

##### 501.02.09A GENERAL

Water pipe and fittings shall be mechanically restrained in lieu of using conventional concrete blocking. New water mains shall not be restrained with concrete blocking without specific approval of the City Engineer. Calculations for determining restrained lengths of pipe to protect specified bends and other assemblies shall be based on the following general parameters: 1) minimum 2:1 safety margin, 2) minimum 150 PSI test pressure, 3) minimum three feet of cover at the time of pressure testing, and 4) marginal trench and backfill conditions. Details relative to materials and length of pipe runs to be restrained will require review and approval by the City Engineer.

##### 501.02.09B MECHANICAL THRUST RESTRAINT

New water mains shall be mechanically restrained through utilization of internal, push-on joint restraint (pipe) and retainer glands for mechanical joint connections (fittings, valves, and pipe). Mechanical joint bends 22° and larger shall be restrained. Tees shall be restrained with a run of restrained pipe consistent with the length required to restrain a dead-end run of pipe.

The use of tie-back rods will require approval of the City Engineer. Where approved, tie-back rod assemblies shall be 5/8-inch minimum diameter galvanized steel.

#### 501.02.09C CONCRETE THRUST BLOCKING

Concrete used for thrust blocking shall have a minimum compressive strength of 3,000 psi within 28 days.

Concrete thrust blocking shall be poured in place between undisturbed earth and the fittings to be anchored.

If, in the opinion of the City Engineer, the undisturbed earth against which the bearing surface has been established is compromised by adjacent trenches or excavations, the contractor shall, as directed by the City Engineer, excavate additional material as required to establish a new bearing surface that is consistent with the size, configuration, and location of the piping.

The area where the blocking is to be placed shall be sufficiently excavated to receive the concrete so that the proper shape and bearing surface is attained. The bearing surface shall be placed so that the pipe and fitting joints will be accessible for repair. Concrete shall in no case extend around more than one-half the circumference of the fitting at any point.

A plastic sheet or other similar protection shall be placed between the concrete and any portions of the valve, fitting, or nuts and bolts with which the concrete comes in contact.

The size of thrust blocks shall be determined by the size, configuration, and location of the piping. Minimum bearing areas for thrust restraint are outlined in the standard details. The contractor shall not increase the size of the bearing area or volume of concrete without the approval of the City Engineer. Thrust blocks with volumes of concrete that are in excess of or less than that specified for the size and configuration of the piping shall be removed by the contractor, at the contractor's expense, when directed to do so by the City Engineer.

Concrete gravity blocking is not permitted under any circumstances.

Joints between thrust collars and fitting assemblies shall be mechanically restrained.

#### 501.02.10 REPAIR OF DAMAGED WATER LINES

It is the contractor's responsibility to make emergency repairs to existing water lines that are damaged during the course of construction.

Procedures and materials used in repair work of this nature shall be as approved by the City Engineer. This requirement shall apply to existing water lines that have been previously located and marked by the owner prior to commencement of construction operations.

#### 501.02.11 SURFACE RESTORATION

Surface restoration shall be in conformance with applicable requirements of Section 208 RESURFACING and Section 209 CLEANUP AND SITE RESTORATION.

### 501.03.00 MEASUREMENT AND PAYMENT

#### 501.03.01 PIPE INSTALLATION

Measurement and payment for installation of water line pipe will be made on a linear-foot basis within the limits shown in the contract documents for the actual footage of pipe installed.

Payment for pipe installation shall constitute full compensation for all labor; equipment; materials; clearing the construction area; trench excavation; pipe bedding, pipe zone material, backfill, and compaction operations; thrust blocking, flushing, testing, and disinfection; all fittings, spools, and mechanical couplings required to complete the pipeline as designed; connection to and abandonment of existing water lines; and any other incidental expenses necessary to prepare the constructed water line for use.

#### 501.03.02 ASSEMBLIES

Assemblies (including blowoff assemblies) shall be paid for on a lump-sum basis as stated in the contract documents. Payment for each assembly shall constitute full compensation for furnishing and installing the fitting assembly, complete, including mechanical couplings, joint restraint, and any other incidental expenses or materials necessary to complete the installation.

#### 501.03.03 INCIDENTALS

Other materials, labor, and equipment required to complete the work in conformance with the contract documents and not listed as separate pay items in the proposal will be considered incidental to other items of work and no separate payment will be made.

### **502 VALVES AND RELATED EQUIPMENT**

#### 502.01.00 MATERIALS

##### 502.01.01 RESILIENT-SEATED, IRON BODY GATE VALVES

Gate valves shall be used on eight-inch diameter and smaller pipe lines.

Resilient-seated, iron body gate valves shall meet or exceed the provisions of AWWA C 509 and shall be a non-metallic seat, non-rising stem-type with O-ring seals and a two-inch square operating nut that opens the valve when turned counter-clockwise. With the valve fully open, an unobstructed waterway not less than the full nominal diameter of the valve shall be provided.

Acceptable resilient-seated gate valves:

Kennedy C-509 Resilient Wedge

##### 502.01.02 BUTTERFLY VALVES

Butterfly valves shall be used on 10-inch diameter and larger pipe lines.

Butterfly valves shall meet or exceed the provisions of AWWA C 504, Class 150B. Butterfly valves shall be short-bodied, cast iron construction.

Valves shall be of the watertight closing type with two-way thrust bearing and shall be equipped with a two-inch square operating nut that opens the valve when turned counterclockwise.

Acceptable butterfly valves:

Kennedy

##### 502.01.03 TAPPING VALVES AND SLEEVES

###### 502.01.03A TAPPING VALVES

Tapping valves shall have a flange on one end for bolting to the sleeve and a flanged or mechanical joint outlet.

The valves shall accommodate full-sized cutters.

In all other respects, tapping valves shall meet the requirements specified herein for iron-body gate valves.

Acceptable tapping valves:

Kennedy

#### 502.01.03B TAPPING SLEEVES

Tapping sleeves shall be two-piece, epoxy-coated, fabricated steel; full-circle stainless steel with stainless steel flange; or fabricated steel with mechanical joints. The type of tapping sleeve required is dependent upon the type of pipe material being tapped and the size of the tap relative to the receiving pipe. Where the City approves the use of a tapping sleeve, the type of sleeve for each application will be indicated on the construction permit or within the contract documents.

Generally, full-circle stainless steel sleeves shall be used on all asbestos-cement and cast iron water lines and on ductile iron water lines with size-on-size taps. Where stainless steel sleeves are indicated, the entire sleeve assembly, including body, outlet flange, and nuts and bolts shall be stainless steel.

Size-on-size taps on O.D. steel pipe water lines shall be weld-on style. In applications where the tap is smaller than the receiving O.D. steel pipe, a two-piece fabricated steel sleeve may be used. Due to the possible presence of a bead weld on this type of pipe, full-circle, stainless steel sleeves shall not be used on O.D. steel pipe.

Fabricated steel, mechanical joint tapping sleeves are generally used in larger diameter pipe applications where there is no stainless steel tap alternative.

Tapping sleeves shall be supplied with 3/4" inch test ports and flanged outlets.

Nuts and bolts used for the installation of the sleeves shall be stainless steel and supplied by the sleeve manufacturer.

Fabricated steel, mechanical joint tapping sleeves shall be supplied with a fusion-bonded epoxy coating. Acceptable tapping sleeves:

<u>Two-Piece Fabricated Steel</u>	<u>Full-Circle Stainless Steel</u>	<u>Fabricated Steel, Mechanical Joint</u>
Romac	Romac SST III w/SS FLG	Romac FTS 425

#### 502.01.04 ADJUSTABLE VALVE BOX ASSEMBLIES

The valve box assembly shall consist of a maximum of two components; the adjustable cast iron valve box (frame and cover) and a six-inch diameter 3034 PVC spool in one piece from the valve to the box. Adjustable valve boxes shall be supplied without bottom flanges. The valve box cover shall have the word WATER cast into it.

Acceptable adjustable valve box assemblies:

Olympic Foundry, Inc. Part No. VB910

See appropriate Standard Detail Drawing.

#### 502.01.05 AIR VALVES

Air valves shall be combination air-release type that permit entrained air to escape from the line while retaining water upon filling and under pressure and which permit a reverse flow of air into the line upon

draining.

The valve body, cover, and lever frame shall be cast iron or approved alloy. The float shall be stainless steel and shall close against a rubber valve seat. Other internal parts shall be either stainless steel or bronze or other approved non-corrodible material.

Acceptable combination air release valves:

Apco            143C or 145C

## 502.02.00 CONSTRUCTION

### 502.02.01 VALVES AND VALVE BOXES

#### 502.02.01A VALVE INSTALLATION

Valves that are 12 inches and larger shall be set to grade on a precast concrete pad placed on undisturbed earth such that the pipe will not be required to support the weight of the valve.

Following installation, the valve shall be operated from the fully open to fully closed position to ensure the valve does not bind during operation.

#### 502.02.01B VALVE BOX INSTALLATION

A valve box assembly shall be installed over every valve.

Valve box assemblies shall be set such that the completed assembly is straight and plumb with a minimum overlap of six inches between the frame and riser section. The completed valve box assembly shall be centered over the operating nut of the valve and shall not transmit shock or stress to the valve, operating nut, or valve operator extension.

The exposed end of the valve box assembly shall remain accessible at all times. The contractor shall be responsible for keeping the valve box assembly free of rocks and other debris for the duration of the project.

Valve box assemblies shall be set flush with finish grade during final surface restoration.

Misalignment of the valve box assembly components or misalignment of the valve box assembly over the operating nut shall be corrected by the contractor prior to final surface restoration. Damaged riser ends and frame and cover assemblies shall be replaced by the contractor prior to final surface restoration.

### 502.02.02 TAPPING VALVES AND SLEEVES

Tapping sleeves and valves shall be installed in accordance with the manufacturer's requirements by a tapping contractor approved by the City Engineer. Generally, provision and installation of tapping sleeves and valves and the actual tap shall be by contractors who are solely engaged in this type of work. With the exception of size-on-size taps, full-size cutters shall be used in making taps.

Tapping valves shall be supported by concrete blocks placed on compacted backfill material or undisturbed, stable subgrade to preclude rotation or settlement of the sleeve on the pipe being tapped.

Live-tap assemblies shall be supported at all times when working with AC pipe. Permanent support by means of precast or cast-in-place concrete is required. Precast support blocking shall utilize permanent hardwood shims to transfer the load to the blocks. Cast-in-place concrete support will require temporary support that is shimmed to support the assemblies prior to placing concrete. To reduce potential for shear, the size of the excavation shall be strictly limited to that required to install the improvements. The methods used to meet these requirements will require review and approval by the project City Engineer prior to

construction.

#### 502.02.03 AIR VALVES

Piping for air valves shall be threaded-brass pipe or one-inch poly (CTS) service pipe connected to a corporation stop installed in the main by the contractor. If one-inch polyethylene service pipe is used, there shall be no intermediate couplings between the corporation stop and the ball valve. Fittings shall be cast bronze.

The supply line shall be on a positive slope of at least two percent from the main to the air valve and shall be supported by a precast concrete block set directly below the valve. A hand operated valve shall be provided out the bottom of the air valve.

The assembly shall be protected by two, stacked Brooks No. 66 concrete meter boxes set so the lid is flush with finished grade. The vertical clearance between the top of the air valve and the Brooks No. 66 large meter box cover shall not exceed six inches. The inner box area shall be kept free of backfill material or other foreign matter at all times so the valve is readily accessible.

Drainage shall be accomplished by placing one-inch minus crushed gravel to a depth of at least six inches below the supply line pipe for the full trench width from the air valve to the main.

The air valve vent shall be extended above grade to prevent backflow contamination. The air valve vent shall be installed in an insulated enclosure mounted to a Brooks No. 66 traffic rated cover.

Details relative to installations located in streets, driveways, or other areas subject to vehicular traffic will require review and approval of the City Engineer.

See appropriate Standard Detail Drawing.

### 502.03.00 MEASUREMENT AND PAYMENT

#### 502.03.01 VALVE ASSEMBLIES

Valves shall be paid for on a per-each basis as stated in the contract documents.

Payment for each valve shall constitute full compensation for furnishing and installing the valve complete, including concrete valve pad, valve box, mechanical couplings, concrete thrust blocking, and any other labor, materials, and equipment required to complete the installation.

#### 502.03.02 INCIDENTALS

Other materials, labor, and equipment required to complete the work in conformance with the contract documents and not listed as separate pay items in the proposal will be considered incidental to other items of work and no separate payment will be made.

## **503 FIRE HYDRANTS**

### 503.01.00 MATERIALS

#### 503.01.01 FIRE HYDRANTS

Fire hydrants shall be manufactured in accordance with AWWA C 502, be of center-stem and safety-flange construction with a 5¼-inch main valve opening against the pressure, and the inlet connection shall be a six-inch mechanical joint.

Operating nuts shall be national standard, pentagon shape, 1½-inch point to flat and shall turn counterclockwise to open.

Hydrants shall have two 2½-inch hose nozzles with national standard threads (7½ threads per inch), one 4½-inch pumper nozzle with national standard threads (four threads per inch).

Hydrants shall be "high gloss safety yellow" in color, painted by the manufacturer.

A five-inch storz adapter shall be installed on the main pumper nozzle. Storz adapter shall be Hydra Shield model HYST-5045-ST CAP.

Acceptable fire hydrants:

Kennedy	K-81D Guardian
M&H	No. 129

#### 503.01.02 FIRE HYDRANT EXTENSIONS

Extension assemblies for fire hydrants shall be supplied by the manufacturer of the hydrant for which the extension is required.

#### 503.01.03 BACKFILL

Backfill material shall conform to requirements in Section 205 CONCRETE, ASPHALT, AND AGGREGATE MATERIALS.

### 503.02.00 CONSTRUCTION

#### 503.02.01 EXCAVATION AND BACKFILL

The trench shall be prepared for pipe laying and backfill as specified in Section 204 EXCAVATION, BACKFILL, AND OTHER SITE WORK and applicable standard details.

The trench bottom shall conform to the line and grade to which the pipe is to be laid, allowing for pipe thickness and bedding material, and shall form a continuous uniform bearing and support for the pipe between bell holes.

#### 503.02.02 FIRE HYDRANTS

Fire hydrant assemblies shall be installed as shown on the applicable standard detail at locations shown in the contract documents and marked at the job site.

Drainage shall be provided for the hydrant by placing one to 1½-inch drainage rock from the bottom of the trench at the base of the hydrant to at least six inches above the inlet pipe. Crushed gravel (one-inch minus) shall be placed in the inlet pipe trench for the full length from the hydrant to the main.

Hydrants shall stand plumb and shall have the main pumper nozzle facing in the direction specified in the contract documents. Hydrants shall be set so that the center of the safety breakaway flange is located a minimum of two inches and a maximum of eight inches above finished sidewalk or ground level.

When placed in the open area between the curb and sidewalk or directly behind the curb where no sidewalk is proposed, the hydrant barrel shall be set so that no portion of the pumper or hose nozzle cap will be less than 12 inches nor more than 18 inches from the gutter face of the curb. When set behind the sidewalk, no portion of the hydrant or nozzle cap shall be less than six inches or more than 18 inches from the sidewalk. It shall be the contractor's responsibility to ensure such horizontal clearances are satisfied regardless of approximate distances from the main as may be noted on the drawings. The contractor shall make any necessary horizontal adjustment to properly set hydrants at the contractor's sole expense.

Hydrants set too high shall be removed and replaced with an appropriate hydrant by the contractor at contractor's own expense. Extensions required for hydrants set too low shall be supplied and installed by the contractor at contractor's own expense. Extensions shall be installed per manufacturer's recommendations.



Following installation, the contractor shall cover each hydrant with a tarp, plastic sheet, or other approved covering until the water main is put into service.

The face of curb shall be painted yellow for a distance of 10 feet in either direction, or to the nearest curb return, whichever is closer. Paint material shall conform to the requirements of the ODOT Qualified Products List for centerline striping paint.

Marring, chipping, or other damage to the factory paint shall be repaired to the extent necessary to restore the hydrant to as-new condition. Paint meeting the manufacturer's specification shall be used to touch up or restore the factory finish.

#### 503.02.03 SURFACE RESTORATION

Surface restoration shall be in conformance with applicable requirements of Section 208 RESURFACING and Section 209 CLEANUP AND SITE RESTORATION.

### 503.03.00 MEASUREMENT AND PAYMENT

#### 503.03.01 HYDRANT ASSEMBLIES

A complete fire hydrant assembly includes the mainline tee and hydrant valve, all ductile iron pipe between the hydrant valve and the hydrant, hydrant, and associated internal thrust restraint.

Payment for fire hydrant assemblies shall be paid for on a per-each basis as stated in the contract documents.

Payment for each hydrant assembly shall constitute full compensation for costs of labor, materials, equipment, and excavation and backfill.

#### 503.03.02 INCIDENTALS

Other materials, labor, and equipment required to complete the work in conformance with the contract documents and not listed as separate pay items in the proposal will be considered incidental to other items of work and no separate payment will be made.

### **504 WATER SERVICE INSTALLATION**

#### 504.01.00 MATERIALS

##### 504.01.01 GENERAL

Water service components shall have minimum pressure ratings that will accommodate maximum pressures expected to be experienced during pressure and leakage testing.

The use of flared type connections to PE service pipe will be permitted only where approved by the City Engineer or when so specified in the contract documents for a specific project.

Private water service pipe (on the customer side of the meter) shall be Schedule 80 PVC sized to match the existing service. An approved trace wire shall be installed with PVC water service. The trace wire shall be bonded to existing metallic service piping, where found. The trace wire shall be accessible within the meter box.

##### 504.01.02 PE WATER TUBE

Polyethylene pipe for 1" & 2" service laterals shall be copper tube size hi-molecular strength, Class 200, NSF approved for drinking water, and shall conform to the requirements of AWWA C901. Acceptable tubing shall be manufactured by Endot, Centennial, Drisco or approved equal.

PE tubing shall be of domestic manufacture.

PE tubing for use as water service lines shall be one-inch or two-inch diameter, depending on the application.

### 504.01.03 BRASS/BRONZE FITTINGS

#### 504.01.03A CORPORATION STOPS

Corporation stops for services, air valves, and pressure testing shall be supplied in conformance with AWWA C 800-66.

Corporation stops for service installations shall be one-inch or two-inch diameter, depending on application. Sizing for corporation stops used in air valve applications will be specified in the contract documents. Corporation stops used for pressure testing shall be replaced with a threaded brass plug with AWWA taper threads after completion of chlorination and pressure testing of the water line.

Acceptable corporation stops:

Ford F-1100-4 (for 1" service)

#### 504.01.03B ANGLE METER VALVES

Angle meter valves shall be supplied in conformance with ASTM B 62.

Angle meter valves shall have one-inch inlet and outlet with padlock wings. Acceptable angle meter valves:

Ford KV43-444W (for 1" service)

#### 504.01.03C 1½ INCH AND TWO-INCH METER SETTER

For 1-inch and 2-inch meter installations, a meter setter shall be used in lieu of an angle meter valve.

Acceptable meter setters:

Ford 1½"- 2" Meter Setter

#### 504.01.03D PE SERVICE COUPLINGS

Intermediate couplings for PE water service tubing are not permitted unless specified in the contract documents or approved by the City Engineer.

When authorized for use, brass and bronze couplings for PE tubing shall have compression joint connections as specified for corporation stops and angle meter valves.

Acceptable copper water service couplings:

Ford C44-44Q for 1" service and C44-77Q for 2" service

#### 504.01.03E CUSTOMER SERVICE VALVES

A customer service valve shall be installed between the meter and the private service line and shall be located within the meter box. Customer service valves shall be constructed of waterworks brass with lever or hand wheel operation. Valve connections shall be consistent with the type of existing private service line encountered. Brass components shall be used between the meter and the customer service valve.

Acceptable customer service valves:

Ford SG 13-332 (¾ -inch straight) or approved equal.

Ford GA 13-332 (¾-inch angle) or approved equal.

Ford GA 13-444 (1-inch angle) or approved equal.  
Ford SG 13-444 (1-inch straight) or approved equal.

#### 504.01.04 SERVICE SADDLES

Standard service saddles (double strapped, ductile iron bodied) will be required for service taps on four-inch ductile iron pipe, two-inch service taps regardless of line size, and for service taps on steel and cast iron pipe.

Acceptable standard service saddles:

Romac          101S (for 1" service), 202S (for 2" service and larger)

Bronze service saddles (bronze double straps, bronze bodied) will be required for service taps on AC pipe. Model numbers for bronze saddles are:

Service saddles shall be supplied with AWWA taper thread.

#### 504.01.05 METERS

The City will supply meters and adapters as required.

#### 504.01.06 CONCRETE METER BOXES

Precast concrete meter boxes shall be constructed of concrete with a minimum compressive strength of 4,000 psi.

Covers to be furnished with the boxes shall be reinforced concrete with a cast iron reading lid or a solid cast iron traffic lid for traffic applications.

Acceptable concrete meter boxes:

<u>¾" &amp; 1" meters</u>	<u>1½" - &amp; 2" meters</u>
Brooks          37-H	Brooks          66-H
	(Use 66-TR STEEL in traffic area)

#### 504.01.07 BACKFILL

Backfill material shall conform to requirements in Section 205 CONCRETE, ASPHALT, AND AGGREGATE MATERIALS.

### 504.02.00 CONSTRUCTION

#### 504.02.01 EXCAVATION AND BACKFILL

The trench shall be prepared for pipe laying and backfill as specified in Section 204 EXCAVATION, BACKFILL, AND OTHER SITE WORK and applicable standard details.

The trench bottom shall conform to the line and grade to which the pipe is to be laid, allowing for pipe thickness and bedding material, and shall form a continuous uniform bearing and support for the pipe between bell holes.

#### 504.02.02 PIPE AND FITTING INSTALLATION

##### 504.02.02A PIPE INSTALLATION

PE service piping shall be of the size shown in the contract documents.

Generally, water service lines shall be installed with a minimum depth of bury of 30 inches as measured from the top of pipe to finished grade. A greater depth may be necessary to avoid existing

underground utilities or other obstructions. When extending new service piping across existing streets, the minimum cover shall be established at the gutter elevation and the polyethylene service extended across the street at a flat grade.

PE service piping shall be direct buried and bedded in select rock backfill such that no portion of the service assembly is in contact with native soil. Service lines shall not be installed by jacking or other methods which will result in the completed service assembly being in contact with native soil. PE service piping may be installed in PVC casings where approved by the City Engineer.

When two or more water service lines are installed in a common trench, the minimum spacing between services shall be one foot.

Piping shall be extended from the corporation stop at the main to the angle meter valve at the meter with a continuous length of pipe and without the use of intermediate couplers.

Piping shall be carefully deflected as necessary to complete the service connection but at no time shall the pipe be allowed to become kinked so as to reduce its cross-section. Kinked or twisted piping shall be replaced by the contractor at the contractor's expense in its entirety from the corporation stop on the main to the angle meter valve at the meter.

Individual service assemblies, including the service tap, PE piping, and angle meter valve, shall not be backfilled until they have been inspected and approved by the City Engineer. The contractor shall coordinate the inspection of service assemblies with the City Engineer.

#### 504.02.02B CUTTING AND SIZING PE TUBING

PE tubing shall be cut, reamed, sized, and configured using tools and practices specific to those operations.

#### 504.02.02C SERVICE TAPS

Service taps required on new water mains shall be performed by the contractor. Service taps required on existing water mains will be constructed by the City. Tapping operations shall be performed with industry standard equipment manufactured solely for the purpose of tapping potable water lines.

Generally, ductile iron water lines shall be direct tapped with AWWA taper threads. Service saddles are required in some applications. See subsection 504.01.04 SERVICE SADDLES and the appropriate standard detail drawing for specific applications for service saddles.

Service taps shall be located at 10:00 or 2:00 on the circumference of the pipe.

Taps shall be made with a minimum clear distance of 18 inches from any pipe joint or between taps on the water main.

#### 504.02.02D CORPORATION STOPS AND ANGLE METER VALVES

Threaded joint connections shall be made after all threaded surfaces have been thoroughly cleaned and prepared with sealing tape or pipe jointing compound approved for use in potable water systems.

Generally, angle meter valves shall be installed in the correct position relative to the proposed meter location prior to pressure and leakage testing. Angle meter valves shall not be repositioned, removed, or the polyethylene tubing recut after final acceptance of pressure and leakage testing. Removal and/or relocation of the angle meter valve, or any other components, after pressure and leakage testing shall require retesting of the new water main prior to acceptance by the City. Details relative to the retesting of water mains will be determined by the City Engineer.

#### 504.02.03 METER AND METER BOX INSTALLATION

The contractor shall install the angle meter valve such that the operating nut is ten inches below the top of the meter box cover.

Both the angle meter valve and customer service valve operating nuts/handles shall operate freely without striking the inside of the meter box.

Reconnection of existing house service lines to new meters shall be made with Schedule 80 PVC pipe and appropriate fittings sized to match the existing service.

Each angle meter valve or meter assembly shall be covered by a meter box. Each meter box shall be set on four inches of compacted one-inch minus crushed aggregate at an elevation that places the top of the meter box cover flush with the existing or proposed grade.

Meter box locations shall be kept clear of pedestrian hazards during the different phases of service installation. Open excavations shall be kept covered with plywood or other approved materials. Water system components, meter boxes, and other debris shall be not be allowed to accumulate in the parking strip.

#### 504.02.04 REPAIR OF DAMAGED WATER LINES

It is the contractor's responsibility to make emergency repairs to existing water lines damaged during the course of construction.

Procedures and materials used in repair work of this nature shall be as approved by the City Engineer.

This requirement shall apply to all existing water lines located and marked by the owner prior to commencement of construction operations.

#### 504.02.05 SURFACE RESTORATION

Surface restoration shall be in conformance with applicable requirements of Section 208 RESURFACING and Section 209 CLEANUP AND SITE RESTORATION.

### 504.03.00 MEASUREMENT AND PAYMENT

#### 504.03.01 SERVICES

Payment for installation of services shall be made on a linear-foot basis as stated in the contract documents. Pipe will be measured horizontally from the center of the water line to the angle meter valve.

Payment for PE service installation shall constitute full compensation for labor; equipment; materials; trench excavation, backfill, and compaction operations; installation of PE service line including service saddle, corporation stop, and the angle meter valve; flushing, testing, and disinfection; and any other incidental expenses necessary to prepare the constructed service line for use.

#### 504.03.02 METER ASSEMBLIES

Payment for meter assemblies and installation will be made on a unit-price basis per assembly and will include all labor; materials; equipment; trench excavation, bedding, and backfill operations; providing and installing the meter, any required adapters, meter setter, customer service valve, and meter box; connection to and abandonment of the existing service; and restoration of the ground surface to original condition.

#### 504.03.03 INCIDENTALS

Other materials, labor, and equipment required to complete the work in conformance with the contract documents and not listed as separate pay items in the proposal will be considered incidental to other items of work and no separate payment will be made.

### **505 HYDROSTATIC PRESSURE/LEAKAGE TESTING AND DISINFECTION**

#### 505.01.00 PRESSURE AND LEAKAGE TESTING

#### 505.01.01 GENERAL

Hydrostatic pressure and leakage tests shall be made on all sections of the new water line including hydrant assemblies and PE service lines. Depending on the diameter, length, and number of appurtenances that comprise the new water line, the City may require the water line be tested for acceptance in sections rather than in its entirety. New valves shall be tested in the closed position against test pressure at some point during acceptance testing. The City Engineer will monitor all final testing of the completed system. The contractor shall be reasonably sure the system will pass the required testing prior to scheduling an appointment with the City Engineer to witness testing.

Testing shall be against closed hydrants with hydrant valves open and against the closed angle meter valve with the corporation stop open.

Backfill shall be in place and compaction requirements satisfactorily met and approved by the City Engineer prior to conducting final pressure and leakage testing.

Concrete thrust blocking required for any reach of pipe shall be allowed a minimum of five days cure time prior to pressure testing. If high-early concrete is used, the time may be reduced to two days.

The leakage test shall be conducted concurrently with the pressure test. The contractor shall furnish all necessary apparatus and shall conduct the test.

Pressure testing and disinfection operations shall not be conducted concurrently unless there is a physical separation between the new and existing water lines or there is an approved backflow device installed between the new and existing water lines.

Testing equipment shall be set up in a manner that will ensure an accurate method of measurement for the amount of water required to maintain the specified test pressure for the duration of the test.

#### 505.01.02 PRESSURE AND LEAKAGE TESTING

The minimum test pressure shall be 150 psi. The test pressure shall not be allowed to drop below 150 psi for the duration of the test. The test pressure shall be applied and maintained for a two-hour duration. If the test pressure drops below 150 psi at any time, the test will be void.

The test pressure shall be calculated for the point of highest elevation of the water line but shall not exceed 200 psi at any point.

Any defective components of the new water system shall be removed and replaced by the contractor and the tests repeated until test results meet the specified requirements.

The use of bell repair clamps or other similar devices to stop leaks due to defective materials or poor workmanship will not be permitted.

##### 505.01.02A ISOLATED LOCATIONS

New pipe and fittings not subjected to standard pressure testing procedures shall be tested at system pressure after final connections to the existing water system have been made. Pipe and fittings at these locations shall be kept open until the City Engineer can conduct a visual inspection for leaks.

##### 505.01.02B ALLOWABLE LEAKAGE

Leakage shall be defined as the quantity of water necessary to maintain the specified test pressure for the duration of the test period.

Leakage shall not exceed the number of gallons per hour as determined by the following formula:

$$L = \frac{N \cdot D \cdot (P)^{1/2}}{8400}$$

L = Allowable leakage in gallons per hour

N = Number of joints in the length of pipe tested ≠

D = Nominal diameter of the mainline pipe in inches

P = Test pressure during the leakage test in psi

(≠ = Each service installation completed shall constitute one joint)

The allowable leakage at various pressures for pipe of various diameters is shown in Table II below.

TABLE II  
ALLOWABLE LEAKAGE PER 100 JOINTS - gph

AVERAGE TEST PRESSURE	PIPE DIAMETER - INCHES									
	4	6	8	12	16	20	24	30	36	42
200	0.67	1.00	1.35	2.02	2.69	3.37	4.04	5.05	6.06	7.07
195	0.67	0.99	1.33	2.00	2.66	3.33	3.99	4.99	5.98	6.98
190	0.65	0.98	1.31	1.97	2.63	3.28	3.94	4.92	5.90	6.89
185	0.65	0.97	1.30	1.94	2.59	3.24	3.89	4.86	5.83	6.80
180	0.64	0.96	1.28	1.92	2.55	3.20	3.83	4.79	5.75	6.71
175	0.63	0.94	1.26	1.89	2.52	3.15	3.78	4.73	5.67	6.61
170	0.62	0.93	1.24	1.86	2.48	3.10	3.73	4.66	5.59	6.52
165	0.61	0.92	1.22	1.83	2.45	3.06	3.67	4.59	5.51	6.42
160	0.60	0.90	1.20	1.81	2.41	3.01	3.61	4.52	5.42	6.33
155	0.59	0.89	1.19	1.78	2.37	2.97	3.56	4.45	5.34	6.23
150	0.58	0.88	1.17	1.75	2.33	2.91	3.50	4.37	5.25	6.12

## 505.02.00 DISINFECTION OF WATER MAINS

### 505.02.01 GENERAL

New water mains, repaired portions of existing mains, and extensions to existing water mains shall be disinfected in strict accordance with AWWA C-651 and the Oregon Health Division. In situations where they differ, the Oregon Health Division shall supersede AWWA requirements.

Testing equipment, chlorination chemicals, temporary valves, temporary blow-off assemblies, backflow devices, or other water control equipment and materials required for proper disinfection of new water mains shall be furnished by the Contractor. No procedures or materials shall be used which may be injurious to the water main or compromise its long-term function.

### 505.02.02 FLUSHING

The contractor shall coordinate flushing operations with the City Engineer. The contractor shall give the City Engineer a minimum of 24 hours advance notice of the flushing schedule. Flushing operations shall not commence without the approval of the City Engineer.

Prior to chlorination, the main shall receive a complete flushing through all hydrants and blowoffs such that a minimum velocity of 2½ feet per second is developed in the main.

Valves shall be operated through their extreme open and closed positions during flushing. Each hydrant

shall be inspected after flushing to see that the entire valve operating mechanism is in good condition.

Flushing water onto the street subgrade will not be allowed at any time. Prior to any flushing operations, the contractor shall make provisions for the disposal of the water onto areas where no damage will be caused.

#### 505.02.02A WATER FOR FLUSHING

The City will provide the water necessary for a flushing duration of:

$$T \text{ (in sec.)} = L, \text{ where } L = \text{the length of the line in feet.}$$

Additional water for a flushing duration in excess of this time period shall be computed by the City and shall be provided at the contractor's sole expense. Water usage shall be computed by using an estimated main velocity of  $2\frac{1}{2}$  feet per second and the actual time of flushing beyond the allowed time (T). The charge for this extra use shall be at a rate of \$.50 per 100 cubic feet of water.

#### 505.02.03 CHLORINATION

The maximum allowable initial concentration of chlorine to be used in disinfecting new water lines shall be 50 milligrams per liter (mg/L).

The point of chlorine application shall be not more than 10 feet downstream from the beginning of the new main. If a corporation stop is utilized to feed the chlorine, it shall be located on the top of the pipe, and shall be removed and plugged with a brass plug prior to putting the line in service.

Chlorination shall be performed in such a manner that will prevent super-chlorinated water from backflowing into the City's potable water system.

A mixture of water and a chlorine-bearing compound of known chlorine content shall be used in disinfection. Acceptable compounds are calcium or sodium hypochlorite. Prior to use, these compounds shall be thoroughly mixed with water to yield a one percent chlorine solution. If powdered or granular chlorine is used, it must be fully dissolved before being introduced into the new water main.

The Continuous Feed Method shall be used to disinfect new water mains. The chlorine/water solution shall be uniformly introduced into the water main via an electronic metering pump as manufactured by Wallace & Turnin, or approved equal. The contractor shall meter the flow of chlorine/water solution being introduced into the water main and the flow of the water at the outlet point to ensure the proper chlorine content is obtained throughout the water main. Water from the existing distribution system shall be controlled so as to flow slowly into the main to be chlorinated. The feed rate of the chlorine mixture shall be in such proportion to the rate of flow of the water entering the pipe that a minimum free chlorine residual of 25 milligrams per liter (mg/L) will be introduced into the system in a manner that results in a complete distribution of the solution throughout the system.

The solution shall remain in place for 24 hours. Valves shall be operated through their extreme open and closed positions during chlorination.

After the 24-hour period, a free chlorine residual of not less than 10 mg/L shall remain in the water at all points. This residual may ordinarily be expected with an initial application of 25 mg/L although some conditions may require more.

#### 505.02.03A DISPOSAL OF CHLORINATED WATER

Chlorinated water with concentrations greater than 0.1 mg/L shall not be discharged onto the ground or into other surface drainage ways unless an approved procedure is followed. Disposal of chlorinated water shall be in accordance with the following guidelines:

- (1) Chlorinated water with concentrations under 0.1 mg/L may be discharged onto the ground, into



surface drainage ways, or into the storm drainage system.

- (2) Chlorinated water with concentrations between 0.1 mg/L and 4.0 mg/L may be discharged into storm drainage systems if the distance between the point of discharge and the receiving stream is over 1,000 feet. Generally, this requirement applies to water discharged during initial flushing of the water line. If the distance to the receiving stream is less than 1,000 feet, the chlorine concentration shall be reduced to 0.1 mg/L before being discharged into the storm drainage system. Methods and/or materials used to lower the chlorine concentration to acceptable limits shall require review and approval by the City of Sutherlin Public Works Department. City of Sutherlin drinking water has a chlorine concentration range of 0.4 mg/L to 1.2 mg/L depending upon the location within the system.
- (3) Chlorinated water with concentrations over 4.0 mg/L and up to 50.0 mg/L shall be discharged into sanitary sewer systems where approved by the City of Sutherlin Public Works Department. Generally, this requirement applies to water discharged during the disinfection process and final flushing of the chlorine solution from the system. Chlorinated water shall be conveyed to the sanitary sewer in closed conduits. An air gap shall be maintained between the discharge conduit and the rim of the receiving manhole. The rate of discharge shall not exceed the capacity of the system.
- (4) Chlorinated water with concentrations over 50 mg/L shall require de-chlorination prior to discharge into the sanitary sewer. Methods and/or materials used to lower the chlorine concentration to acceptable limits shall require review and approval by the City of Sutherlin Public Works Department.

#### 505.02.03B CONNECTION ASSEMBLIES AND EMERGENCY REPAIRS

Disinfection procedures will not be possible for some limited portions of new water line construction and for emergency repairs to in-service water lines. These situations include, but are not necessarily limited to, short runs of pipe and fittings used to connect newly disinfected water lines to existing laterals, emergency, or otherwise unscheduled work on existing water lines, and other similar situations.

The City Engineer will review and approve procedures used to meet specified disinfection requirements for connection assemblies prior to commencement of the work. The City Engineer will make timely onsite assessments of disinfection procedures for situations involving emergency and unscheduled work.

At a minimum, materials that will not be subject to standard disinfection procedures, regardless of the situation, shall be thoroughly cleaned and then washed with an application of 300 mg/L hypochlorite solution. Materials shall be sealed or similarly protected in a manner that will preclude the materials from being contaminated prior to installation. The local water system shall be flushed immediately following completion of the work.

#### 505.02.04 BACTERIOLOGICAL TESTING

Following chlorination, chlorinated water shall be thoroughly flushed from the pipeline at all points including each individual service until the replacement water throughout its length shall, upon test, be 1 mg/L or less.

Upon testing, this satisfactory chlorine residual level shall be found to exist in the main 24 hours after final flushing.

The Contractor will conduct all sampling and testing procedures required for testing the bacteriological quality and final chlorine residuals. All such testing shall be witnessed by an City of Sutherlin Public Works Department representative. Should the initial disinfection treatment fail to result in the specified

conditions, the original chlorination procedure shall be repeated at the contractor's expense until satisfactory results are obtained. No extra payment or extension of contract time will be allowed to the contractor for the time elapsed to achieve acceptable disinfection of the water system.

**\*\* END OF DIVISION \*\***