

## SECTION 2556

### WATER DISTRIBUTION AND SERVICE LINES

#### PART 1: GENERAL

##### 1.1 GENERAL DESCRIPTION OF WORK COVERED

The contractor shall furnish and install all pipes, fittings, structures and accessories required for water distribution and/or service lines in accordance with the requirements of the Construction Plans and related Contract Documents.

##### 1.2 QUALITY ASSURANCE

###### AWWA Standards

Construction materials and methods shall comply with the requirements of the latest published edition of American Water Works Association (AWWA) Standards. Applicable standards include, but may not be limited to, the following:

1	AWWA C104	Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water
2	AWWA C105	Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids
3	AWWA C110, C110a	Gray Iron and Ductile Iron Fittings, 2-inch through 48-inch for Water and Other Liquids
4	AWWA C111	Rubber Gasket Joints for Cast Iron Pressure Pipe and Fittings
5	AWWA C151	Ductile Iron Pipe, Centrifugally Cast in Metal Mold or Sand Lined Molds, for Water or Other Liquids
6	AWWA C153	Ductile Iron Compact Fittings, 3-inch through 12-inch for Water and Other Liquids
7	AWWA C213	Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines
8	AWWA C301	Prestressed Concrete Cylinder Pipe (PCCP), 16-inch and Larger
9	AWWA C502	Fire Hydrants
10	AWWA C504	Butterfly Valves
11	AWWA C509	Resilient Seated Gate Valves
12	AWWA C550	Protective Epoxy Interior Coatings for Valves and Hydrants
13	AWWA C600	Installation of Ductile Iron Water Main and Appurtenances
14	AWWA C605	Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
15	AWWA C651	Disinfection of Water Mains
16	AWWA C800	Underground Service Line Valves and Fittings
17	AWWA C900	Polyvinyl Chloride (PVC) Pressure Pipe 4-inch through 12-inch for Water
18	AWWA C901	Polyethylene Pressure Pipe and Tubing 1/2-inch through 3-inch
19	AWWA C905	Polyvinyl Chloride (PVC) Pressure Pipe, 14-inch and Larger
20	AWWA C906	Polyethylene (PE) Pressure Pipe, 4-inch through 63-inch
21	AWWA C907	Polyvinyl Chloride (PVC) Pressure Fittings, 4-inch through 8-inch

###### ASTM Standards

In addition, construction materials and methods shall also comply with the requirements of the latest published editions of the American Society for Testing and Materials (ASTM) Standards, and the National Sanitation Foundation (NSF) Standard 61.

## **PART 2: MATERIALS AND EQUIPMENT**

### **2.1 GENERAL**

All pipe, fittings and accessories shall be new, and shall be suitable and rated for potable water use.

### **2.2 DELIVERY, STORAGE, AND HANDLING**

Certificates of Compliance with the Specifications shall be required for all materials used on the Project. All materials shall be protected during transportation, storage, handling, and installation to avoid physical damage. All materials shall be stored to prevent physical deterioration due to sun and weather. The ECUA reserves the right to reject material which in any way does not meet the requirements of these Specifications.

### **2.3 WATER MAINS**

#### **2.3.1 Polyvinyl Chloride Pipe (PVC)**

PVC pipe shall meet AWWA Standard C900 or C905, or ASTM Standard D2241, with minimum designations per Table 2.3.1 below. PVC pipe shall be provided with push-on or insert-lock-type joints with the bell integrally cast into the pipe. PVC pipe shall be installed with elastomeric gaskets meeting ASTM Standard F477.

Standard	Nominal Size	Dimension Ratio	OD	Pressure Class (psi)	Pressure Rating (psi)
AWWA C900	4-inch thru 12-inch	DR25	CI	100	(165)*
AWWA C905	14-inch thru 36-inch	DR25	CI	(100)*	165
ASTM D2241	2-inch thru 3-inch	SDR26	IP	(95)*	160

\*Pressure class and rating designations shown in parentheses are nominal designations.

#### **Markings**

PVC pipe shall be marked to indicate the following:

1. Nominal Pipe Size and OD Base
2. Material Code Designation
3. Dimension Ratio
4. Pressure Class or Pressure Rating
5. Manufacturer's Name or Trademark
6. National Sanitation Foundation Approved Marking
7. Appropriate AWWA or ASTM Standard Number

#### **Color-Coding**

PVC water pipe shall be color-coded blue in accordance with AWWA Standards. If blue pigmented pipe is not available, white pipe may be substituted subject to the approval of the Director of Engineering or his designee. White pipe used for potable water shall be marked with 3 blue stripes (1/2 inch wide) in permanent ink along the entire length and evenly spaced around the pipe circumference with the word WATER in 3/4-inch letters every 21 inches along each stripe.

### 2.3.2 Ductile Iron Pipe (DIP)

Ductile iron pipe shall meet AWWA Standard C151 and pressure class based on Table 2.3.2 below for design operating pressures of up to 150 psig, installed in Class 2 Trenching conditions. Increase pressure class or bedding class as required by AWWA C151 for surface loads greater than indicated above or operating pressures greater than 150 psi. DIP shall be constructed with push-on joints using rubber gaskets in accordance with AWWA Standard C111. Other methods of joint construction, such as mechanical, flanged, or ball-and-socket, may be required in special applications as appropriate. DIP shall be lined in accordance with AWWA Standard C104, unless otherwise specified and approved.

Diameter	Class	Max. Depth of Bury
3-inch & 4-inch	350	32 feet
6-inch & 8-inch	350	28 feet
10-inch & 12-inch	350	14 feet
14-inch thru 20-inch	250	10 feet
24-inch thru 64-inch	200	8 feet

#### Markings

Each ductile iron pipe section shall be marked to indicate the weight class or nominal thickness, and casting period. The manufacturer's mark, country where cast, year in which the pipe was produced, and the letters DI or DUCTILE shall be cast or stamped on the pipe. All required markings shall be clear and legible, and all cast marks shall be on or near the bell. All letters and numerals on pipe sizes 14-inch and larger shall be not less than 0.5-inch in height.

#### Soil Corrosion Protection Encasement

When required, DIP shall be encased in plastic sheet material in accordance with AWWA Standard C105 as stated on project plans/specifications if applicable.

### 2.3.3 Polyethylene Pipe (PE)

The pipe supplied under this specification shall be high performance, high molecular weight, high density polyethylene pipe and shall conform to ASTM D 1248 (Type III C, Class C, Category 5, p34). Minimum cell classification values shall be 345434C as referenced in ASTM D 3350 - latest edition. All pipe resin shall be manufactured by the same company that manufactures the pipe itself in accordance with these specifications to insure complete resin compatibility and total product accountability. The fittings shall be molded or manufactured from a polyethylene compound having a cell classification equal to or exceeding the compound used in the pipe. To insure compatibility of polyethylene resins, all fittings supplied under this specification shall be of the same manufacturer as the pipe being supplied.

Property	Test Method	Unit	Value
Density	ASTM D1505	gms/cc	0.957
Melt Flow	ASTM D 1238 (190/21.60)	gms/ 10 min.	1.5
Environmental Stress Cracking Resistance Condition A, B & C, F <sub>0</sub> Compressed Ring, F <sub>0</sub>	ASTM D1693 Proposed ASTM	hrs. hrs.	>5000 >5000

Tensile Strength, Ultimate Type IV Specimen	ASTM D 638 (2"/min.)	psi	5000
Tensile Strength, Yield Type IV Specimen	ASTM D 638 (2"/min.)	psi	3500
Elongation at Break Type IV Specimen	ASTM D 638 (2"/min.)	%	>600
Impact Strength Specimen Thickness 0.125 inch	ASTM D 256 Method A	ft.lbs./inch notch	>12
Vicat Softening Temperature	ASTM D 1525	°F	257
Brittleness Temperature	ASTM D 746	°F	<-180
Flexural Modulus	ASTM D 3350	psi	125,000
Hardness	ASTM D 2240	Shore D	65
Coefficient of Linear Thermal Expansion Molded Specimen Extruded Pipe	ASTM D 696	in./in./ °F	8.3x10 <sup>-5</sup> 1.2x10 <sup>-4</sup>
Thermal Conductivity	Dynatech-Colora Thermoconductor	TRU, in./ ft. <sup>2</sup> /hrs./ °F	2.7
Long Term Strength 73°F 140°F	ASTM D 2837	psi psi	1600 800
Material Cell Classification	ASTM D 3350		355434C
Material Designation	PPI		PE 3408

### 2.3.3.1 Quality Control

The resin used for manufacture of the pipe shall be manufactured by the pipe manufacturer, thus maintaining complete control of the pipe quality. The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same specification and from the same raw material. The pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, or other deleterious defects, and shall be identical in color, density, melt index, and other physical properties.

Approved manufacturers shall be Driscopipe, Plexco and CPS; others as approved by ECUA in writing.

The engineer may request, as part of the quality control records submittal, certification that the pipe produced is represented by the quality assurance testing. Additionally, test results from manufacturer's testing or random manufacturer's representation, may be cause for rejection of pipe represented by the testing. These tests may include density and flow rate measurements from samples taken at selected locations within the pipe wall and thermal stability determinations according to ASTM D 3350, 10.1.9.

#### 2.3.3.1.1 Verification

The owner or the specifying engineer may request certified lab data to verify the physical properties of the materials supplied under this specification or may take random samples and have them tested by an independent laboratory.

#### 2.3.3.1.2 Rejection

Polyethylene pipe and fittings may be rejected for failure to meet any of the requirements of this specification.

2.3.3.1.3 Pipe Dimensions

Pipe supplied under this specification shall have a nominal DIPS (Ductile Iron Pipe Size) O.D. unless otherwise specified. Pipe shall have a SDR (Standard Dimension Ratio) of 11 unless otherwise specified.

2.3.3.2 Color-Coding

HDPE water pipe shall be color-coded with blue striping or have an integral, extruded blue coating.

2.3.4 Alternate Pipe Materials

ECUA may consider other pipe materials as appropriate for the needs of the Project. Alternate pipe materials identified during design and approved for use on the Project shall be noted on the Construction Plans, and a detailed Technical Specification shall be prepared and included in the Contract Documents.

**2.4 WATER MAIN APPURTENANCES**

2.4.1 Water Main Fittings

Water main fittings shall include Tees, Wyes, Bends, Reducers, and other appurtenances commonly used in pipe construction. Fittings shall meet AWWA Standard C110 or C153 with pressure ratings of not less than that specified for adjacent pipe. Fittings shall be constructed with mechanical joints, unless otherwise specified, and shall be supplied complete with low alloy bolts and nuts, EPR gaskets and other necessary parts required for field assembly. Fittings shall be cement-mortar lined in accordance with AWWA Standard C104/A21.4.

2.4.1.1 Pipe Couplings

Pipe couplings shall be solid sleeve type with mechanical joints at each end containing a compression gasket. Couplings shall be ductile iron, 12 inches minimum in length, with low alloy bolts and nuts, and EPR gaskets. Rings and gaskets shall be sized to conform exactly to the requirements of the pipe manufacturer.

2.4.1.2 Pipe Cut-in Sleeves

Cut-in sleeves shall be solid ductile iron, one end plain for insertion to female fitting, the other end flanged mechanical joint, furnished with loose attaching flange and fastener, nominal length of 20-21 inches. Specify pipe main size and type of pipe fabrication.

Approved Manufacturers

Manufacturer	Model	Application
Clow	F-1220	for centrifugally cast or sand cast pipe (special)
Clow	F-3459	for all classes of centrifugally cast pipe
Union Foundry	21-4520 21-4610 24-4800	MJ X PE FLG X PE MJ X FLG
Clow	F-3459	for all classes of centrifugally cast pipe
Others as approved by ECUA in writing.		

### 2.4.1.3 Repair Clamps

Repair clamps shall not be used in the installation of new pipe except with the written permission of the Engineer. Repair clamps shall be full circle and selected based on Table 2.4.1.3 below.

TABLE 2.4.1.3 - REPAIR CLAMP SIZES	
Pipe Diameter	Maximum Sections
Up to 12-inch	Single Section
14-inch to 24-inch	Double Section
26-inch and above	Triple Section

Repair clamps shall be composed of stainless steel bands and bolts, DI lugs and full gridded virgin EPR compounded gasket.

Repair clamps shall be sized so that the OD of the existing pipe being repaired falls within the designated range for the clamp size. Repair clamps shall have ample length to give full gasketing at both ends.

#### Approved Manufacturers

Manufacturer	Model
Ford	F1, FS1 (all SS), Fordflex (SS-DI Lugs)
Smith Blair	2XX*
JCM	101,102,103,104,131,132,133,134
Mueller	520, 530
Others as approved by ECUA in writing.	

\*XX: See Mfr.'s catalog to complete model numbers by size.

### 2.4.1.4 Pipe Restraints

Joint restraints shall be used in conjunction with all water line pipe, fittings and appurtenances. Joint restraints shall be used on pipe and fittings in each direction in accordance with ECUA Standard Detail D-43 and D-44. Restraints shall have set or anchor screws used to secure body to pipe with torque limit break away head design. Stainless steel all-thread tie rods may be used at flanges with permission of the Engineer.

#### Approved Manufacturers

Manufacturer	Model
Ebaa Iron Works	MegaLug Series 1100, 1500, 2000, 2500, 3000, 3600, 6500
Ford	UNI-Flange UAI, UBI, UI, 1300, 1340, 1390, 1400
JCM Industries	Sur-Grip Restrainers No. 620, 621
Others as approved by ECUA in writing.	

### 2.4.1.5 Expansion Joints

Expansion joint fittings shall be used where specified on the Construction Plans. They shall be of the rigid or flexible type as specified, and manufactured of ductile iron in accordance with 2.4.1 above. They shall be capable of expanding or contracting to the extent shown on the plans, but in no case less than 4-inch axially, and designed to prevent separation beyond the maximum extension without the use of external tie rods.

Fittings shall be flanged or provided with restrained mechanical joints, individually pressure tested to a minimum of 350 psi against their own restraints, and internally coated on all exposed surfaces with a minimum of 15 mils. of fusion bonded epoxy conforming to AWWA C213. They shall be capable of deflecting not less than 15° by means of an integral ball at each joint in the case of flexible types.

#### Approved Manufacturers

Type	Manufacturer	Model
Rigid	EBAA Iron, Inc.	EX-TEND 200
Flexible	EBAA Iron, Inc.	Flex-Tend
Others as approved by ECUA in writing.		

#### 2.4.1.6 Tapping Sleeves

Tapping sleeves shall be designed for a working pressure of 200 psig without leakage. Tapping sleeves shall be stainless steel. The outlet branch connection shall have a recessed flanged face for connection of tapping valve with standard dimensions in accordance with MSS SP-60. A complete set of neoprene or other elastomer gaskets shall be furnished. Sleeves shall be furnished to fit cast iron, cement-asbestos, or Class 160 or C900/905 PVC pipe with side connection as shown on plans or specifications in standard pipe sizes of 4-inch X 4-inch through 16-inch X 12-inch. Sleeves shall be furnished with all necessary installation parts such as mechanical joint loose flange ends, bolts, fasteners, seals and gaskets. Refer to Section 2.4.1.6 for Tapping Valve requirements.

#### Approved Manufacturers

Manufacturer	Main Material	Model
Clow	CI & C900 PVC Class 50, 100, 150, 200 10-inch & 12-inch Class 50, 100	F-5205 F-5207 4 F-5205
American Darling	CI & C900 PVC CI & CA	2800C 2800A
Ford		FAST A
Mueller	CI, DI - 4-inch - 12-inch CA - 4-inch - 8-inch CI Class C & D - 10-inch - 14-inch CA - 4-inch-12-inch	H615 H615 H616 H619
JCM Industries		432
Smith-Blair		662
Others as approved by ECUA in writing		

Note: To specify exact fitting when ordering, state line diameter and line material.

#### 2.4.1.7 Pipe Hangers and Supports

Hangers and supports shall be in compliance with Federal Specification WW-H-171E, or Manufacturer's Standardization Society SP-69, or UL listed. Materials of construction shall be in accordance with the requirements outlined in Table 2.4.1.7 below.

TABLE 2.4.1.7 - PIPE HANGERS AND SUPPORTS MATERIALS OF CONSTRUCTION	
Part I.D.	Material
Clamps	Steel - Epoxy Coated or Galvanized Cast Iron – Galvanized Malleable Iron

Hanger Rods	Steel - Electro Galvanized Steel - Stainless 304
Roller Bases/Roller Stands	Cast Iron
Fasteners/Fittings	Galvanized Steel Stainless
Hanger Rod Inserts	Steel: Cadmium Plated Steel: Galvanized Universal Concrete Insert - Cast Iron - Galvanized
Rod Attachments	Clevis - Forged Steel Turnbuckle: 1) Forged Steel, 2) Malleable Iron Sockets, Eye Nuts, Extension - Malleable Iron
Roller Bases/Roller Stands	Cast Iron
Rollers	Steel or Iron Core, Insulated from Structure

### Approved Manufacturers

Manufacturer	Part I.D.	Model No.
Utility Pipe Products	Clevis Hanger	590
	Socket Clamp	224 246
	<u>Concrete Inserts:</u>	
	CB-Universal	282
	Screen Insert	152
	<u>Rod Attachments:</u>	
	Eye Nut	290
	Forged Clevis	299
	Forged Turnbuckle	230
	Carbon Steel	233
	Couplings	136
	Socket Eye	110R
	Extension	157
	<u>Pipe Rolls:</u>	
Adjustable Swivel	174	
Adjustable Steel Yoke	181	
Pipe Roll with Base	274	
Pipe Roll and Plate	277	
Others as approved by ECUA in writing.		

## 2.4.2 Valves

All valves shall be manufactured in accordance with the current appropriate AWWA Standard and shall be NSF approved for use in potable water.

### 2.4.2.1 Resilient Seated Gate Valves

Resilient seated gate valves shall be designed and fabricated in accordance with the current AWWA Standards. The basic design of the gate valves shall have an iron body, elastomer encapsulated iron disc, bronze stem and operating nuts with non-rising stem design. Valves 16-inches and larger shall be equipped with right angle gears (bevel gearing) for horizontal installation, and shall be equipped with rollers, tracks and scrapers.

The valve working pressure for all sizes shall be a minimum of 200 psig with a test pressure of 400 psig.

#### 2.4.2.1.1 General Materials and Construction

Valves shall open counterclockwise with a 2-inch square iron operating nut secured to the valve stem by a corrosion resistant nut to threads on the valve stem. The valve stem

shall be made of high tensile strength bronze and shall be of one piece construction sealed by O-Rings. The thrust collar shall be secured in place by a stuffing box or bonnet cover with a thrust washer located above the thrust collar. Valve construction shall be so that upper O-Rings can be replaced with the valve in service. The disc shall be cast iron encapsulated with an elastomer material bonded in accordance with ASTM D429 and shall be secured to the threaded stem by a bronze nut. The disc shall effect a seal that is bubble-tight at 200 psig.

#### 2.4.2.1.2 Body - Disc - Bonnet - Operating Nut Material

Cast iron construction in accordance with current AWWA Standard C-509; (or) Cast ductile iron construction in accordance with current AWWA Standard C-515 and AWWA Standard C-153.

#### 2.4.2.1.3 Corrosion Resistant Coatings

All interior and exterior cast iron surfaces shall be coated with fusion bonded epoxy in accordance with AWWA Standard C-550.

#### 2.4.2.1.4 Body Sizing

Valve body length shall be per ANSI Standard B16.2 for the type of end connections specified. In the full open position, the valve internal bore shall be smooth and obstruction-free without cavities or projections that could accumulate solids. The internal cross-sectional area of the valve shall be approximately equal to the nominal cross-sectional area for Schedule 40 PVC pipe of the same nominal internal diameter.

#### 2.4.2.1.5 End Connections

Valves shall be furnished with mechanical joint end connections, complete with flange kits, unless otherwise specified on the plans or purchase order.

When flanged ends are specified they shall be flat face nominal 125# ANSI B16.1 Standard with bolt holes straddling the vertical center line.

#### Approved Manufacturers

VALVE BODY CONNECTIONS				TAPPING VALVE
Manufacturer	MJ x MJ	MJ x FLG	FLG x FLG	MJ x SF
American Darling (Cast Iron)	4-inch - 12-inch CSR-80X	4-inch - 12-inch CSR-80X	CSR-80X Specify Ends	4-inch - 12-inch No. 862
(Ductile Iron)				16-inch - 24-inch*
			4-inch - 24-inch Series 2500 (See Manufacturer's Catalog)	
Clow (Cast Iron)	2-inch - 12-inch F6100	4-inch - 12-inch F-6106	4-inch - 12-inch F-6102	4-inch - 12-inch F-6114
				14-inch - 24-inch F-5093*
Kennedy (Cast Iron)	3-inch - 12-inch F-1571-XNRS	3-inch - 12-inch F-1572-XNRS	3-inch - 12-inch F-1561-XNRS	3-inch - 12-inch F-950X

M & H (Cast Iron)	4-inch - 12-inch S-4067-01		4-inch - 12-inch S-4067	2-inch - 12-inch H-667 200 PSI  14-inch - 24-inch H-667 150 PSI
Others as approved by ECUA in writing - Cast iron or ductile iron construction.				

\*Metal seated only, specify bypass if required  
14-inch and larger valves specify special appurtenances.

2.4.2.2 Resilient Seated Tapping (Gate) Valves

Resilient seated gate valves shall be designed and fabricated in accordance with the current AWWA Standard C-509 or C515. The basic design of the gate valves shall have a cast iron body, elastomer encapsulated cast iron disc, bronze stem and operating nuts with non-rising stem design. The valve working pressure shall be a minimum of 200 psig with a test pressure of 400 psig.

2.4.2.2.1 Materials and Construction

Valves shall open counterclockwise with a 2-inch square iron operating nut secured to the valve stem by a corrosion resistant nut to threads on the valve stem. The valve stem shall be made of high tensile strength bronze and shall be of one piece construction sealed by O-Rings. The thrust collar shall be secured in place by a stuffing box or bonnet cover with a thrust washer located above the thrust collar. Valve construction shall be so that upper O-Rings can be replaced with the valve in service. The disc shall be iron encapsulated with an elastomer material bonded in accordance with ASTM D429 and shall be secured to the threaded stem by a bronze nut. The disk shall effect a seal that is bubble-tight at 200 psig.

2.4.2.2.2 Corrosion Resistant Coatings

All interior and exterior cast iron surfaces shall be coated with fusion bonded epoxy in accordance with AWWA Standard C-550

2.4.2.2.3 Body Sizing

Valve body length shall be per ANSI Standard B16.1 for tapping valves. Tapping valves shall conform to Specification AWWA C509, latest revision, covering gate valves except as modified for passage and clearance of tapping machine cutters. The opening through the valve shall be at least 1/4-inch larger than nominal valve diameter. Tapping valves shall allow full size shell cutters to be used.

2.4.2.2.4 End Connections

Valves shall be furnished with one end of the body with projecting face flange in accordance with specification MSS SP-60 for tapping valve/saddle connections to bolt to a standard tapping sleeve and the other end for mechanical joint.

Approved Manufacturers

See Section 2.4.2.1 above.

### 2.4.2.3 Butterfly Valves

All butterfly valves shall be of the rubber-seated, tight-closing type. They shall meet or exceed AWWA Standard C504. All valves must use full AWWA C504 Class 150B valve shaft diameter, and full Class 150B underground service operator torque rating throughout entire travel, to provide capability for operation in emergency service.

#### 2.4.2.3.1 Valve Construction

Valve body shall be high-strength cast iron ASTM A126 Class B with 18-8 Type 304 stainless steel body seat. Valve vane shall be high-strength cast iron ASTM A48 Class 40, having rubber seat mechanically secured with an integral 18-8 stainless steel clamp ring and 18-8 stainless steel self locked screws. Shaft shall be one piece ANSI 304 stainless steel. Bearings shall be sleeve-type, self lubricated with O-Ring seals.

#### 2.4.2.3.2 Operators

Operator shall be of the traveling-nut type, sealed, gasketed, and lubricated for underground service. It shall be capable of withstanding an overload input torque of 450 ft. lbs. at full-open or closed position without damage to the valve or valve operator. Operator shall have operating nut or post indicator as specified.

#### 2.4.2.3.3 End Connection

End connections shall be mechanical joint, wafer-type with flange meeting ANSI B16.1-125#, and furnished as specified.

Approved Manufacturers

Manufacturer	Model
Dresser	450
American Darling	Class 150
Clow	F-53XX*
M & H	450, 1450, 4500
Others as approved by ECUA in writing.	

\*XX: See Mfr.'s catalog to complete model numbers by size.

### 2.4.2.4 Valve Boxes

Valve boxes shall be provided for all direct buried valves. Use nominal 6-inch cast-iron sliding-type pipe shaft with cover and base casting. The box top shall be set at finished grade and encased with a concrete ring in unpaved areas. Each valve box shall be furnished with a drop-in cover marked "WATER". See ECUA Standard Detail D-34.

### 2.4.3 Line Stops

Line stops are to be used where specified to temporarily stop water line water flow without depressurizing the entire line. The line stop parts and installation equipment are to be rated at a minimum of 150 psig working pressure unless otherwise specified.

#### 2.4.3.1 Materials and Construction

Tapping saddles shall have 360° clamping on the main. Main sizes 4-inch - 8-inch to be fabricated of 304 Stainless Steel; 10-inch and greater to be fabricated Carbon Steel with

epoxy coating. All bolts and fasteners are to be 304 Stainless Steel, and the saddle shall be installed with Buna-N or neoprene rubber full facing gasket.

The stopping device attaching nozzle to be vendor's standard with connecting threads or flange face, and the nozzle I.D. to be machine with a shelf to provide a position stop for the closure plug.

The closure plug is to be fabricated carbon steel, ductile iron, or malleable iron with at least one Buna-N or neoprene O-Ring seal on the outside diameter.

2.4.3.2 Corrosion Resistant Coatings

Non-stainless steel permanently installed parts to have manufacturer's standard red or black water base epoxy coating.

2.4.3.3 Connection

Tapping saddle shall be fabricated with dimensions to fit on concrete, steel, CA, PVC, CI, DI main as specified.

2.4.3.4 Installation

Temporary line stops shall only be installed by vendor personnel or contractor personnel trained and certified for stop by the vendor.

Approved Manufacturers (Main Sizes 3/4-inch - 42-inch)

Manufacturer	Contact
Hydra-Stop, Inc.	Phone: 800-538-7867 FAX: 708-389-5125
International Piping Services Co. (IPSCO)	Phone: 708-343-1333 FAX: 708-343-1435
JCM 440	Phone: 800-527-8482 FAX: 800-874-9524
Others as approved by ECUA in writing.	

2.4.4 Location Aids

All new water main and service line installations shall include an approved method for locating lines from the ground surface after completion.

2.4.4.1 Tracer Wire

Tracer wire for water lines shall be minimum 12 gauge copper with blue PVC insulation. Tracer wire systems shall be electrically continuous covering all mains and services within the project. Wire-to-wire connectors shall be made with silicone-filled wire nuts. Wire-to-appurtenance attachments shall be made with lug-type terminals. Wire shall be secured to the top of each pipe joint with nylon ties or PVC tape placed on 10-foot intervals. Wire shall be secured to pipe with blue colored PVC Tape.

Approved Manufacturers (Tracer Wire Silicone-filled Wire Nut Connectors)

Manufacturer	Model
Ideal Industries	Twister® DB Plus
King Technology, Inc.	Failsafe™
Others as approved by ECUA in writing.	

#### 2.4.4.2 Pipeline Markers

Markers shall be of a passive electronic type that reflects a signal back to an electronic hand-held transmitter/detector. Electronic components shall be enclosed in a blue waterproof polyethylene housing. Markers shall have a different response frequency for each service line type.

Markers shall be ScotchMark® products manufactured by 3M Telecom Systems Group, Austin, Texas. Alternate manufacturers by ECUA in writing.

Application	Usable Depth	Dimension/ Configuration	Service	Model
Near Surface	2 feet	3½" L X 5/8" Ø Cylinder	Water	1434
Medium Depth	4 feet	4" Ø Ball	Water	1403
Deep	6 feet	8" Ø X 1" Thick Disc	Water	1257

## 2.5 **HYDRANTS AND FLUSHING EQUIPMENT**

### 2.5.1 Fire Hydrants

Fire Hydrants shall be current design in compliance with the AWWA Standard C-502, with rated working pressure of 200 psig. The basic design of the fire hydrant shall be of the dry barrel type of breakaway traffic design.

#### 2.5.1.1 Hydrant Construction

The hydrant inlet connection shall be 6-inch mechanical joint type complete with flange kit.

The hydrant shall be designed with a traffic breakaway feature incorporating a flanged design using breakable bolts and breakaway shaft coupling. Split ring retainer-type breakaway design with pinch bolts is not acceptable. The hydrant design shall allow the upper barrel to be rotated 360 degrees in order to assure proper nozzle orientation.

The drain valve shall assure quick and complete drainage of the hydrant and the drain hole shall be bushed with bronze if passing through cast iron. The drain valve sealing facing shall be made of Buna N, nylon or urethane. If the valve top plate comes in contact with the bronze seat ring to facilitate draining of the hydrant, the valve top plate shall be made of bronze.

#### 2.5.1.2 Main Hydrant Valve

The main hydrant valve shall be compression type, opening counterclockwise against system pressure and closing clockwise with system pressure. The main valve connection opening shall not be less than 5¼-inches. The main valve shall have a resilient seat.

The hydrant shall be designed such that the operating threads on the stem are prevented from coming in contact with potable water and shall be enclosed in an operating chamber and sealed by O-Rings at the top and bottom of the chamber. The

chamber shall be constructed for grease or oil lubrication with an installed grease fitting for maintenance.

The operating nut shall be 1½-inches in size and pentagon in shape and of one-piece construction.

The hydrant shall have one 4½-inch pumper nozzle, and two 2½-inch pumper nozzles having National Standard Hose coupling threads. The nozzles shall be field replaceable utilizing either a threaded or quarter-turn fitting with an O-Ring seal.

2.5.1.3 Operation and Maintenance Features

The hydrant shall not incorporate parts requiring field adjustment for proper operation.

The hydrant shall be designed to permit the removal of all working parts from the hydrant through the barrel without disturbing the earth around the hydrant.

Removal of the working parts of the hydrant shall be accomplished by use of a seat. Hydrants requiring other special tools to perform removal of interior parts will not be accepted.

2.5.1.4 Materials

All operating parts including operating nut, hold-down nut, drain ring and seat ring shall be bronze. The valve seat ring shall thread into a bronze insert or drain ring to provide bronze-to-bronze seating. Breakaway stem coupling is to have bronze or stainless steel bolts or pins.

2.5.1.5 Markings

The fire hydrant shall have permanent markings identifying the manufacturer by name, initials or insignia, the size of the main valve opening, and the year of manufacture.

Approved Manufacturers

Manufacturer	Model No
Kennedy	81-A
Mueller	A423
American Darling	B84B
Clow	Medallion
M & H	129T
Others as approved by ECUA in writing.	

2.5.2 Fire Hydrant Appurtenances

2.5.2.1 Extension Kits

When specified, hydrants shall be installed using original manufacturer hydrant extension kits as necessary to position the hydrant breakaway above finish grade per ECUA Standard Detail D-35.

Stand extension shall be in standard lengths of 12, 24, 36, 48, and 60 inches.

2.5.2.2 Hydrant Connectors

Hydrant connector spools shall be ductile iron per AWWA C151 used for connection between the hydrant and lead valve, and shall incorporate joint restraints. One end of the connector spool shall have swivel flange. See ECUA Standard Detail D-35.

Standard hydrant connector sizes shall be as follows:

1. 6-inch X 12-inch long
2. 6-inch X 24-inch long
3. 6-inch X 36-inch long
4. 6-inch X 48-inch long
5. 6-inch X 60-inch long

Hydrant Offset Connectors

When a connector between the hydrant and lead valve specified to adjust hydrant height or to offset the hydrant from the valve, an offset connector shall be used. Material to be ductile iron per AWWA C153/ANSIA2153. Sizes shall be as follows:

1. 6-inch X 18-inch long with 6-inch offset
2. 6-inch X 30-inch long with 12-inch offset
3. 6-inch X 41-inch long with 24-inch offset

Approved Manufacturers

Manufacturer	Straight Hydrant Connector	Offset Connector
Assured Flow Sales, Inc.	N/A	GRADELOK
Clow	✓	N/A
Others as approved by ECUA in writing.		

2.5.3 Flushing Hydrants

Flushing hydrants shall be current design and in general compliance with AWWA Standard C-502, with rated working pressure of 200 psig.

2.5.3.1 Hydrant Construction

Flushing hydrants shall meet the requirements of Section 2.5.1, except breakaway feature is not required.

2.5.3.2 Main Valve

Generally the same as Section 2.5.1, except main valve opening shall be not less than 2-1/8 inches and the flushing hydrant shall have one (1) 2½-inch nozzle having national standard hose coupling threads.

2.5.3.3 Operation and Maintenance Features

Unless otherwise specified, the hydrant bury length shall be 36 inches. The bury length is the distance measured to the nearest 1/2 foot, from the bottom of the connecting pipe to the ground line of the hydrant.

2.5.3.4 Materials

All operating parts including operating nut, hold-down nut, drain ring and seat ring shall be bronze. The valve seat ring shall thread into a bronze insert or drain ring to provide bronze-to-bronze seating.

2.5.3.5 Markings

Flushing hydrant markings shall meet the requirements of Section 2.5.1 for fire hydrants.

Approved Manufacturers

Manufacturer	Model
Clow	F-4764
M & H	Style 33
Mueller	A-411
Others as approved by ECUA in writing.	

**2.6 WATER SERVICE LINES**

2.6.1 Polyethylene (PE) - Tubing

Polyethylene service tubing for water supply shall conform to AWWA C901. PE tubing dimensions shall conform to ASTM D2737 with Copper Tubing OD base. Refer to Section 2.3.3 for service lines greater than 2 inches in diameter.

2.6.1.1 Materials

PE tubing material shall conform to ASTM D3350, Standard Code PE 3408.

2.6.1.2 Pressure Rating

PE tubing shall be Pressure Class 200 psi with a minimum working pressure of 150 psig, and comply with ASTM D1598, D1599, D1693, D3350 and AWWA 901.

Dimensions and acceptable standard sizes

NOM	OD	WALL	ID
1	1.125	.137	.851
1½	1.625	.200	1.225
2	2.125	.250	1.625

2.6.1.3 Markings

1. Nominal Size
2. Standard PE Code: 3408
3. Tubing: DR-9
4. Pressure Class: PC200
5. Manufacturer's Name or Trademark
6. Blue Markings and Stripes

Approved Manufacturers

Manufacturer	Model
Phillips	Driscopipe 5100 Ultra-line

Others as approved by ECUA in writing.
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## 2.6.2 Copper Water Service Tubing

Copper water service tubing shall be Type K suitable for underground potable water services. Tracer wire is not required with copper tubing.

### 2.6.2.1 Material

Tubing is to be supplied in conformance with ASTM B88 for dimension and materials.

### 2.6.2.2 Pressure Rating

Test Pressure: 200 PSIG

Operating Pressure: 150 PSIG

TABLE 2.6.2 - COPPER WATER TUBING DIMENSIONS (ASTM B88)		
Size (inches)	Nominal OD	Wall Thickness
1	1.125	.065
1½	1.625	.072
2	2.125	.083

### 2.6.2.3 Pipe Markings

1. Nominal Size
2. Type K
3. ASTM B88
4. Manufacturer's name or logo
5. NSF seal

## 2.7 **SERVICE LINE APPURTENANCES**

### 2.7.1 Fittings and Valves

Fittings and valves shall be manufactured in accordance with AWWA C-800 and be listed and approved by NSF for underground use in potable water service.

#### 2.7.1.1 Material

Fitting and valve bodies, plugs, and compression nuts shall be bronze, copper alloy No. C83600 and meet chemical and mechanical requirements of ASTM B62 or ASTM B584.

Component parts such as fasteners, seals, and packings may be of other materials selected for adequate endurance, corrosion resistance and strength in accordance with AWWA C-800.

#### 2.7.1.2 Pressure

Fittings and valves shall be high pressure type for maximum allowable pressure of 150 PSIG, nominal operating pressure 100 PSIG.

#### 2.7.1.3 Thread Specifications

Fittings and valves shall be of materials and fabricated in accordance with appropriate specification:

TABLE 2.7.1 - THREAD SPECIFICATIONS	
Thread Type	Standard
Unified Inch	ANSI/ASME B1.1
General Purpose Pipe	ANSI/ASME B1.20.1
Dryseal	ANSI/ASME B1.20.3

Fittings and valves shall be marked as appropriate with the following information: manufacturer's name or logo; pressure rating; direction of flow; and size.

Pack Joint Couplings - Acceptable Manufacturers		
Type	Manufacturer	Model
Joint Couplings Copper or Plastic Tube X MPT	Ford Mueller	C84-XX H-15428-X
Copper or Plastic Tube X FPT	Ford Mueller	C14-XX H-15451-X
Copper or Plastic Tube to Tube	Ford Mueller	C44-XX H-15403-X
Female Copper Pipe (replaces flare nut) X Copper or Plastic Tubing	Ford Mueller	CO4-XX H-15071-X
Others as approved by ECUA in writing.		

[X, XX: See Mfr.'s catalog to complete model numbers by size]

#### 2.7.1.4 Tapping Saddles

Tapping saddles shall be either bronze or cast or ductile iron with shop coat. Saddles used to tap Class 160 PVC pipe shall be designed with mechanical features or stops to prevent over-tightening.

##### Saddle Sizes

1. Main Pipe: 2-inch - 16-inch
2. Tapping valve connections: 1-inch, 1½-inch, 2-inch

##### Acceptable Manufacturers

Manufacturer	Application	Model
Ford	1-inch tap on PVC/steel OD pipe 1-inch tap on DI and CI Pipe	S-70 and S-90 F-101 and F-202
Mueller		H-105
Smith Blair		313
Others as approved by ECUA in writing		

#### 2.7.1.5 Water Tubing Couplings

Water tubing couplings in sizes 1-inch, 1½-inch, and 2-inch only shall be bronze compression-type, inlet and outlet for PE or copper tubing. Crimp-type couplings are not acceptable.

##### Acceptable Manufacturers

Manufacturer	Model
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Ford	C44-XX*
Mueller	H-15403-XX*
Others as approved by ECUA in writing	

\*XX: See Mfr.'s catalog to complete model numbers by size.

2.7.1.6 Meter Couplings

Meter couplings shall be bronze and sized as appropriate to accommodate the relevant meter. Inlet shall have male pipe thread.

Acceptable Manufacturers

Manufacturer	Model
Ford	C84-XX*
Mueller	H-15428-XX*
Others as approved by ECUA in writing	

\*XX: See Mfr.'s catalog to complete model numbers by size.

2.7.2 Service Line Valves

2.7.2.1 Corporation Stops

Corporation stops shall be brass, high-pressure class, ball type, with inlet taper CC thread. Outlet shall be compression-type for PE or copper tubing. Corporation stops shall be sized for 1-inch, 1½-inch or 2-inch tubing as appropriate.

Acceptable Manufacturers

Manufacturer	Model
Ford	F-1000 and FB-1000
Mueller	300, Ball-type
Others as approved by ECUA in writing.	

2.7.2.2 Curb Stops

Curb stops shall be brass, high pressure, ball-type with locking wings. Inlet shall be compression-type for PE tubing. Outlet shall be female iron pipe threads. Curb stops shall be sized for 1-inch, 1½-inch or 2-inch tubing as appropriate.

Acceptable Manufacturers

Manufacturer	Size	Model
Ford	1-inch	B41 - 444W
	1½-inch	B41 - 666
	2-inch	B41 - 727
Others as approved by ECUA in writing.		

2.8 **BACKFLOW PREVENTION DEVICES**

Backflow prevention devices shall be manufactured in accordance with AWWA C-506, and shall also be approved by ASSE and/or approved by NSF for use in potable water systems with a maximum continuous operating pressure of 150 psig, and capable of sustaining a hydrostatic test pressure of 300 psig. Backflow prevention devices shall be located

## Materials and Construction

The body shall be cast iron with hot dip galvanized coating or fusion bonded epoxy on the interior and exterior, or cast bronze with a maximum lead content 5%. Working parts and springs shall be bronze or stainless steel; valve discs shall be sili cone rubber; diaphragms shall be fabric reinforced neoprene, and O-rings shall be Buna-N, neoprene, or silicone rubber. Check valve enclosures shall be glass-filled nylon or Teflon, or bronze or stainless steel. Other working parts shall be bronze or stainless steel.

### 2.8.1 Double-check Device

Double-check backflow preventers shall have two independent check valve assemblies. The body may consist of one or more castings, and shall be equipped with ports and valves as necessary to allow testing in place.

### 2.8.2 Reduced Pressure Principle Device

Reduced pressure principle backflow preventers shall have two independent check valves with an intermediate relief valve incorporating a pressure diaphragm valve assembly that maintains a minimum 2 psig differential pressure across the assembly.

### 2.8.3 End Connections

Devices shall be manufactured with standard female pipe thread, size 3/4-inch, 1-inch, 1-1/2-inch, or standard ANSI B16.2 125# flanged, sizes 2-inch and greater.

### 2.8.4 Appurtenances

All back flow devices shall be provided and installed as a complete assembly with all necessary fittings to enable testing in place. Tapped test ports shall be fitted with test petcocks in each body cavity. Inlet and outlet gate or ball valve shall be of the same line size as that of the body.

#### Acceptable Manufacturers

Manufacturer	Type Device		
	Double Check	Double Check Detector	Reduced Pressure
Ames	2000 DCA OSY 2000 DCA NRS 2000 DCA OSY Epoxy 2000 DCA NRS Epoxy	3000 DCDA OSY 3000 DCDA NRS 3000 DCDA OSY Epoxy 3000 DCDA NRS Epoxy	4000 RP OSY 4000 RP NRS
Febco	850 NRS 850 OSY		860 NRS 860 OSY
Watts	709 OS&Y/BV	709 DDC	909 909 DDC (Detector)
Hersey	3/4" - 2" FDC 3" - 10" No. 2	3" - 10" DDC II	3/4" - 2" FRP II 2½" - 10" 6CM
Others as approved by ECUA in writing.			

## 2.9 **METER BOX ASSEMBLIES**

Meter box assemblies for 5/8-inch meters shall be cast iron open bottom per ASTM A-48 with cast iron lid with ECUA imprint. The box assembly shall include a ball valve with locking nuts, pack joint coupling for copper or PE tubing with expansion connection and gaskets as needed. Meter box and cover for meters 2-inch and larger shall be constructed in accordance with ECUA Standard Details D-25 and D-26.

## Acceptable Manufacturers

Manufacturer	Model	Meter Size
Ford	G148-133 (Modified) w/ 1" pack joint for copper or PE Tubing	5/8"
Others as approved by ECUA in writing.		

**PART 3: EXECUTION****3.1 GENERAL**

The contractor shall provide all labor, equipment and materials as required to install all pipes, valves, fittings, and other appurtenances as indicated on the construction plans or as specified in the contract documents.

**3.2 POTABLE WATER LINE SEPARATION FROM SANITARY SEWER LINES**

- A. When a gravity sewer line must cross under a water line with less than 18-inch vertical clearance, one of the following methods may be used.
1. Fully encase sewer line with a minimum of 4 inches of concrete (2500 psi) for a minimum distance of 10 feet either side of the point of crossing, which must be at least 5 feet from a water line joint. If the crossing is other than at right angles, increase the length of encasement so that the end of the encasement will be at least 12 feet from a water line joint.
  2. Use equally rated pressure pipe for the sewer lines with no joints closer than 12 feet apart and at least 6-inch vertical clearance.
  3. Install sewer pipe into at least a 20-foot section of steel casing (casing I.D. slightly larger than sewer pipe bell O.D.) and center over crossing so that end of casing will be at least 12 feet from water line joint. Seal the ends of the casing with non-shrink grout. Refer to Section 2224 – Pipe Boring, Drilling and Jacking, for casing and boring requirements.
- B. When a gravity sewer line must cross over a potable water line, regardless of clearance, because the water line cannot be relayed above sewer, use method 2 or 3 in subsection A. Concrete encasement will not be allowed.
- C. When a sanitary force main must cross under a potable water line with less than an 18-inch vertical clearance, or over the water line, use a higher rated pressure pipe as in method 2 or 3 in subsection A.
- D. When the water line being crossed in A, B or C is a house or building service lateral, 2-inch or smaller and the service lateral is a continuous piece of PE DR9 or copper tubing, then the above rules do not apply; but locate so that the distance to a sewer or force main joint is as great as possible.
- E. When a gravity sewer line must run parallel to and less than 18 inches below a potable water line and:
1. 6 to 10 feet apart for less than 40 feet, use method 1, 2 or 3 in subsection A.

2. 6 to 10 feet apart for over 40 feet, use method A2 and stagger joints.
  3. 3 to 6 feet apart for any distance, use a higher rated pressure pipe as in method A2.
- F. When a sanitary force main must run parallel to and less than 18 inches below a potable water line and:
1. 6 to 10 feet apart for any distance, use a higher rated pressure pipe as in method A2.
  2. 3 to 6 feet apart, use a higher rated pressure pipe for both water and force main. Example: If force main is PC160 PVC DR26, and water line is C-900 DR25; then force main should be PVC DR21 and water line should be DR21, using extreme care to have both properly color-coded.

### 3.3 PIPE INSTALLATION

The contractor shall utilize equipment and methods in accordance with pipe manufacturer's requirements and sound construction practices to insure pipe installation to line and grade as indicated.

#### 3.3.1 Trench Excavation

Refer to Section 2221: Trench Excavation Backfill and Compaction. Maintain minimum of 30 inches and maximum of 36 inches of cover below finished grade unless shown otherwise on the construction plans.

#### 3.3.2 Alignment

Pipe shall be installed along the alignment indicated by the construction plans. Accomplish horizontal and vertical changes in alignment of pipe with bends or other appropriate fittings. Limit joint deflection as recommended by the pipe manufacturer.

#### 3.3.3 Pipe Preparation

The contractor shall clean the interior of all pipes, fittings, and joints prior to installation. Pipes shall be inspected for defects prior to installation. Damaged pipe shall be rejected and removed from the project.

#### 3.3.4 Pipe Installation

Install pipe only when weather and trench conditions are suitable. Do not lay pipe in water. Join pipe in accordance with manufacturer's recommendations.

Provide initial backfill or anchoring as necessary to prevent displacement and preserve alignment after establishing final position.

Encase water pipe in steel casing or use ductile iron pipe when crossing under pipe, conduit, or structure when a 6-inch separation distance cannot be maintained. This protection shall extend a minimum of 5 feet beyond crossed structure. (See Section 2556.3.2.D for Sanitary Sewer Lines.)

#### 3.3.5 Protection

Prevent the introduction of foreign matter into the pipe at all times. Close open ends of pipe with water tight fitting closures or plugs. Do not let water fill trench, but include provisions to prevent flotation should water control measures prove inadequate. Remove water, sand, mud and other undesirable materials from trench before removal of pipe closure piece.

### 3.3.6 Cutting

PVC or PE pipe shall be cut in a neat workmanlike manner, and the spigot end shall be beveled per manufacturer's recommendation. Ductile iron pipe shall be cut in accordance with manufacturer's recommendation. Do not allow excessive heat to develop. Smooth and bevel cut end as per manufacturer's recommendation. Use of pipe with damaged lining is unacceptable.

### 3.3.7 Service Lines

Service lines shall be constructed where shown on plans and in accordance with ECUA Standard Detail Drawing D-21.

### 3.3.8 Closure Pieces

Closure pieces shall only be used where called for on plans, or with written permission of the ECUA. Closure may be accomplished with sleeve coupling as long as its length is such that gaskets are not less than 3 inches from pipe ends.

### 3.3.9 Restraints and Thrust Blocking

Mechanical joint restraints shall be furnished and installed for all water line fittings and appurtenances. Reference ECUA Standard Drawing D-44. Restraints and thrust blocks shall also be installed for 45° and 90° bends, tapping sleeves, tees and main dead ends. Reference ECUA Standard Drawings D-43 and D-44.

## 3.4 **APPURTENANCE INSTALLATION**

### 3.4.1 Valves

Valves shall be installed with operating stems vertical when installation is direct burial. Valves shall be installed on a suitable bearing surface so as to prevent vertical displacement.

### 3.4.2 Valve Boxes

Valve boxes shall be centered on the valve. The earth shall be compacted around each valve box to a distance of 4 feet on all sides of box, or to undisturbed trench face if less than 4 feet. An 18-inch diameter by 4-inch thick collar shall be constructed and sloped to direct water away from the valve box. In lieu of the constructed collar, a 24-inch by 4-inch thick pre-cast, sloped, concrete collar may be used.

### 3.4.3 Tracer Wire

Tracer wire shall be installed on all new water mains and on water service lines installed in conjunction with new water mains. The tracer wire shall be placed directly above the pipe and electrically continuous throughout the project. Tracer wire shall be secured to the pipe with PVC tape the same color as the wire insulation, at a maximum of 10-feet on center between tapings. The tracer wire shall be brought to the ground surface at

each valve location in accordance with ECUA Standard Detail D-34. Splices and/or connections in the tracer wire shall be installed with silicone-filled wire nuts designed for direct burial.

### **3.5 FIRE HYDRANT FLUSHING EQUIPMENT INSTALLATION**

#### **3.5.1 Hydrants**

Hydrants shall be installed in accordance with ECUA Standard Detail D-35.

#### **3.5.2 Flush Stands and Valves**

Flush stands shall be installed as shown on ECUA Standard Detail D-41, depending on line size.

### **3.6 SERVICE LINE INSTALLATION**

#### **3.6.1 General**

The contractor shall install individual services with tracer wire from the new main to a convenient point on the right-of-way or property line for each house, building or unit that is to be served through an ECUA meter. This section will deal with service line tubing 2-inches in diameter and smaller, to serve 5/8-inch, 1-inch, 1-1/2-inch, and 2-inch meters. The installation of service lines for 3-inch meters and larger shall be in accordance with the requirements for water main installation. (See Section 3.3)

#### **3.6.2 Service Line Connections**

Service lines shall be installed in accordance with ECUA Standard Detail D-21. Tubing shall be installed in one continuous length from corporation stop to curb stop with no intermediate fittings. Service lines damaged after initial installation but before acceptance may be repaired by means of a single splice, except that no repair fittings will be permitted under any paving. The tap location shall be not less than 10 feet from any sanitary sewer joint with less than 18 inches vertical clearance. Potable water taps shall be made with a tapping machine designed for the pipe material being tapped. Other makes of tapping machine may be used upon prior approval of the ECUA Inspector or Engineer.

### **3.7 TAPS ON PRESSURIZED LINES**

The contractor shall perform taps on pressurized lines for the installation of pipes other than service lines of 2-inch and smaller PE tubing in accordance with these requirements:

#### **Materials**

All materials used for taps on pressurized lines shall meet the requirements of these specifications. Tapping sleeves shall be properly sized for the pipe being tapped. (See Sec. 2.4.1.6) Resilient seated tapping valves shall be furnished with special end connections. (See Sec. 2.4.2.2) All other material used to accomplish the tap shall meet the standards set forth by the AWWA for potable water construction.

#### **Procedure**

The contractor shall notify the ECUA Inspector three working days in advance of work. The contractor shall in the presence of an ECUA inspector:

- A. Expose the existing pipe at the location shown on the plans, and clean the section of the pipe to receive the tapping sleeve.
- B. Check the tapping sleeve and valve for defects and make sure the gate fully retracts in the valve to allow the shell cutter free passage.
- C. Assemble the tapping sleeve on the pipe, then install the tapping valve.
- D. Hydrostatically pressure test the tapping sleeve and valve after it has been assembled on the water main using the test plug on the sleeve. The test shall be 150 psi minimum. The duration of the test shall be 15 minutes.
- E. Pour a thrust block behind the tapping sleeve sufficient to withstand the pressure of the new line. Also, provide a concrete pad sufficient to support the weight of the sleeve, valve, and tapping machine. Refer to Section 3.3.9 and ECUA Standard Detail D-43. Concrete shall be in place a minimum of 24 hours prior to testing the main installation.
- F. Assemble an approved tapping machine and proceed to make the necessary cut in accordance with the recommendation of the tapping machine manufacturer. Approved tapping machines shall be:
  - 1. In good working condition.
  - 2. Designed for and have a cutting bit for the pipe material to be cut.
  - 3. Equipped with a depth of cut gauge.
  - 4. Designed to capture the coupon.
  - 5. Equipped with the manufacture’s recommended diameter shell cutter for the tap to be made.
  - 6. Tapping machine power head to be hydraulic or pneumatic drive; use of electric motor drives expressly prohibited.
  - 7. Tapping machining shall be disinfected prior to each use for potable water taps.

Nominal Main Size	Tapping Valve ID AWWA Standard	Tapping Machine Shell Cutter OD
2-inch	2 1/8-inch	1½ -inch
3-inch	3 1/8-inch	2½ -inch
4-inch	4 1/4-inch	3½ -inch
6-inch	6 1/4-inch	5½ -inch
8-inch	8 1/4-inch	7½ -inch
10-inch	10 1/4-inch	9½ -inch
12-inch	12 1/4-inch	11½ -inch
14-inch	14 1/4-inch	Per Manufacturer’s Recommendation. Contractor shall submit shop drawings for valves and tapping machine for approval, prior to use. Per Manufacturer’s Recommendation.
16-inch	16 1/4-inch	
18-inch	18 1/4-inch	
20-inch	20 1/4-inch	
24-inch	24 1/4-inch	

- G. Tap coupon shall be given to the ECUA Inspector. If the coupon is lost in the main, contractor shall, at his expense, dismantle main to retrieve the coupon. Main will be reassembled, pressure tested and bacteriological tests retaken as required at contractor’s expense.

## **PART 4: ACCEPTANCE REQUIREMENTS**

### **4.1 INSPECTION**

Upon completion of the installation, the system shall be inspected to ascertain that valves, fittings, fire hydrants, flush hydrants, etc. are located in conformance with the plans, and confirm that all 'as-built' measurements have been accurately taken. The ECUA Inspector shall observe all appropriate activities related to properly placing the line in service including flushing, pressure and leakage testing, disinfection, and bacteriological sampling. Final connections and testing of fire hydrants shall be accomplished after final clearance of lines. Tracer wire shall be tested for continuity by the contractor with the ECUA Inspector present. The contractor, with the ECUA Inspector, shall make sure all main valves and hydrant valves are open.

### **4.2 FLUSHING**

All newly installed water lines shall be flushed with potable water to remove any sediment, solids and/or foreign matter prior to testing. ECUA will make water available to the contractor. Flushing shall be conducted at a sufficient velocity to clear the pipe. Discharge of flushing water must be through a 2-inch diameter pipe (or larger) and must be controlled so as not to cause any property damage. Flush water source connection shall incorporate backflow preventor when required by the ECUA Inspector or Engineer.

### **4.3 PRESSURE/LEAKAGE TEST**

#### **4.3.1 General**

All newly installed water lines and appurtenances shall be pressure/leak tested to assure the strength of materials and quality of workmanship of the installation. Testing shall be conducted in accordance with ECUA Standard Detail D-12 and the requirements of AWWA Manual 23 for PVC and other flexible pipe or AWWA C600 for Ductile Iron Pipe. Leakage testing may be conducted concurrently with the pressure test.

#### **4.3.2 Procedure**

Contractor shall notify the ECUA Inspector three ECUA working days prior to a scheduled test. Tests are to be conducted in segments not to exceed three thousand (3,000) feet of pipe. Water in the new line shall be pumped up to a pressure of 150 psi minimum. This pressure shall be maintained for a minimum of one (1) hour by pumping a quantifiable amount of water into the line and record the amount of water added during the test period. This represents the leakage.

Pressure/leakage tests shall be deemed acceptable when leakage does not exceed that determined by the following formula:

$$L = \frac{SD\sqrt{P}}{133200} \text{ (or 11.65 gpd/mi/inch/dia)}$$

$$\text{or } L = \frac{ND\sqrt{P}}{7400} \text{ for DI pipe 18' lengths}$$

$$\text{or } L = \frac{ND\sqrt{P}}{6600} \text{ for PVC pipe 20' lengths}$$

where: L = Maximum leakage, in gallons per hour.  
 S = Length of pipe under test, in feet.  
 N = Number of pipe joints in segment under test.  
 D = Nominal internal diameter of pipe, in inches.  
 P = Average actual leakage test pressure, psig.

Record all data for submission with as-built plans.

An ECUA Construction Inspector shall be present during test.

Refit and replace all pipe not meeting the leakage requirements. Repair clamps are not permitted.

Repair all visible leaks regardless of the amount of leakage.

When a satisfactory pressure/leakage test has been completed, reduce the pressure at or below normal line pressure, and continue on with line disinfection.

#### **4.4 DISINFECTION**

##### **4.4.1 General**

The contractor shall provide all equipment, materials and testing apparatus required to perform disinfection in accordance with AWWA 651, ECUA Standard Detail D-12, or as modified herein.

##### **4.4.2 Procedure**

- A. Prior to beginning disinfection, the contractor shall submit information to the engineer for approval of proposed materials and methods. ECUA will determine the number and location of all sampling points. Temporary sampling taps may be required consisting of a corporation cock with copper tube.
- B. Add chlorine to attain an initial concentration of 25 mg/l chlorine with 10 mg/l remaining after 24 hours.
  1. Initial concentration is to be obtained by mixing proper amount of HTH granules (65% Cl) into auxiliary tank, then pump/meter into regulated flow into or through the pipe section.
  2. Alternate methods of disinfection by use of granular or tablet forms of chlorine will not be allowed. The "SLUG" method as described in AWWA 651 will not be allowed.
  3. Check the chlorine concentration at all sampling points after the line has been filled and air expelled.
  4. Check residual chlorine concentration at the end of 24 hours to confirm that 10 ppm (minimum) is present.
- C. ECUA shall supply water for testing from the nearest available source. Flush main until chlorine concentration is 2 mg/l or less prior to taking bacteriological samples. Contractor shall provide a backflow preventor device as required by the ECUA Inspector or Engineer.

1. Check concentration at all sample point locations.
  2. Disposal of chlorinated water shall be the contractor's responsibility and shall be done without damage to public or private property. Chlorinated water disposal shall meet all State, Federal and local regulations.
- D. Contact ECUA for collection of samples. Two (2) satisfactory bacterial sample sets taken 24 hours apart must meet State requirements before placing the main into service.
- E. Repeat flushing and disinfection procedure should initial disinfection fail to yield acceptable bacteriological results at no additional cost to the Owner.

#### **4.5 OTHER CONNECTIONS**

After new system piping has been satisfactorily tested and cleared for use, make any approved additional connections to the pre-existing distribution system. Exercise care in making connection and disinfect as needed. When total system is approved for use, an ECUA Inspector shall verify that the contractor has opened all interior valves as required. Valves connecting new installations to ECUA's existing distribution system shall then be opened by an ECUA Inspector.

#### **4.6 TESTING FIRE HYDRANTS**

All newly-installed fire hydrants shall be flow tested by ECUA prior to final acceptance in accordance with established procedures. (Refer to AWWA-M17 and AWWA C502.) Static Leak Test of hydrant shall be done in conjunction with Section 4.3 with hydrant valve open.

Hydrant flow tests not meeting the minimum requirements of ECUA's Design Standards shall be immediately reported to the Engineer-of-Record. The system shall not be placed into service until the system meets the minimum requirements.

### **PART 5: MEASUREMENT AND PAYMENT**

#### **5.1 GENERAL**

Measurements shall be made to the nearest tenth of units and rounded to the nearest whole unit when totaled. Payments shall be for providing all labor, tools, equipment and materials as needed for: 1) furnishing, handling, and installing the required materials, fittings or fixtures; 2) excavation, backfill and compaction, including shoring, bracing and dewatering as required; 3) temporary removal and replacement of existing obstacles, including minor relocation and repair of other utilities; and 4) all required testing, disinfection and flushing. Payment for water main installations shall include the installation of tracer wire.

## 5.2 WATER MAINS

Water mains shall be measured in lineal feet by the specified pipe size along the pipe centerline with no deduction for fittings. Payment shall be based on the contract unit price per lineal foot.

## 5.3 APPURTENANCES

Water main appurtenances include fittings and valves as outlined in Section 2.4 of the specifications. Incidental appurtenances such as joint restraints, couplings, tracer wire, etc. are not considered separate pay items and their cost should be included in the unit price of the installed pipe.

### 5.3.1 Fittings

Water main fittings including bends, reducers, tees, wyes, tapping sleeves, expansion joints, pipe hangers/supports, and cut in sleeves shall be measured and paid for on a unit (per each) basis. Fittings shall be listed by size and type.

### 5.3.2 Valves

Water main valves inclusive of any required valve boxes or other appropriate appurtenances shall be measured and paid for on a unit (per each) basis. Valves shall be listed by size and type.

### 5.3.3 Line Stops

Line stops shall be measured and paid for on a unit (per each) basis.

## 5.4 HYDRANTS AND FLUSHING EQUIPMENT

Hydrants and flushing equipment shall be measured and paid for on a unit (per each) basis to include a complete installed assembly.

### 5.4.1 Fire Hydrants

Fire hydrant assemblies shall include the installed water main tee or tapping sleeve, lead valve and box, connectors (up to 10 feet of lateral distance), gravel pack, and hydrant.

### 5.4.2 Fire Hydrant Appurtenances

Fire hydrant appurtenances including extensions and off-site connectors shall be measured and paid for on a unit (per each) basis.

## 5.5 WATER SERVICE LINES

### 5.5.1 Service Lines (up to 2-inch diameter)

Water service lines shall be measured and paid for on a unit (per each) basis. Each service line installation shall include the main tap, corporation stop, service tubing, and curb stop. Service lines shall be listed by tubing size and nominal length. Nominal length shall typically be categorized as "short" (for services on the same side of the street as the water main), and "long" (for services on the opposite side of the street from the water main).

5.5.2 Large Service Lines (3-inch diameter and larger)

Large service lines, including fire lines, shall be measured and paid for in accordance with the requirements for water mains (see 5.2 and 5.3 above).

**5.6 TAPS ON PRESSURIZED LINES**

Taps on pressurized lines shall be measured and paid for on a unit price (per each) basis to include tapping sleeve, tapping valve, and valve box complete, in-place. Taps shall be listed by main and branch diameters.