SECTION 12 WATER DISTRIBUTION SYSTEM MATERIALS

12.1 ALL MATERIALS SHALL BE DOMESTICALLY MADE

12.1.1 These material specifications are intended to set a standard of quality and design for all materials used in the construction of water mains and appurtenances. Materials shall be of types listed in these specifications. Materials not specifically authorized in these specifications are forbidden for use in the system unless prior approval is obtained in writing from the DEPARTMENT prior to construction.

12.1.2 The DEPARTMENT must approve all material prior to installation. All materials shall meet AWWA specifications.

12.2 PIPE

12.2.1 All pipe furnished shall be designed for the distribution of potable water. Lubricant furnished for lubricating joints shall be non-toxic, shall not support the growth of bacteria, shall have no deteriorating effects on the gasket or pipe material, and shall not impart taste or odor to water. The lubricant container shall be labeled with the manufacturer's name. The DEPARTMENT will determine type and size of pipe to be installed within the water distribution system during plan review.

12.2.2 In areas where the static operating water pressure is 150psi or greater or installation of water mains are within 10' of any permanent structure the DEPARTMENT reserves the right to require ductile iron water piping be installed. Request and approval will be made in the plan review process.

12.3 POLYVINYL CHLORIDE (PVC) WATER PIPE (4" – 12") (14" - 48")

12.3.1 PVC pipe in sizes 4" – 12" shall meet the requirements of AWWA C-900 DR-14 and comply with ASTM D1784 pressure classification rated class 305. Pipe joints shall be integrally molded bell ends in accordance with ASTM 3034 with factory supplied elastomeric gaskets and lubricant. Pipe to bear NFS-61 seal of approval for potable water. The pipe shall be approved by the Underwriter's Laboratories (UL) for use in underground fire protection service. The pipe shall be extruded from PVC meeting the requirements of cell classification 12454-B as defined in ASTM-D-1784, PVC compounds. The pipe shall be manufactured to cast iron size (C.I.) outside dimensions. Pipe shall bear identification markings that will remain legible during normal handling, storage and installation. Marking on pipe shall include the following and shall be applied at intervals of not more than 5':

(a) Nominal size and OD (DR-14)
(b) PVC
(c) Dimension ratio (DR-14)
(d) AWWA pressure class (for example PVC1120 or PC200)
(e) AWWA designation numbers (AWWA C-900)
(f) Manufacturer's name or trademark and production code
(g) Seal (mark) of the testing agency that verified the suitability of the pipe Material for potable water service. (for example NSF-61 or ULFM)

12.3.2 PVC pipe in sizes 14" – 60" shall meet the requirements of AWWA C-900 DR-21 and comply with ASTM D 1784 pressure classification rated class 200.

12.4 **DUCTILE IRON PIPE (DI)**

12.4.1 The pipe shall have a cement mortar lining and seal coat in accordance with ANSI/AWWA C104 A21. The pipe and flanges shall conform to ANSI/AWWA C111/A21, Class 50 rated at 350 psi unless otherwise specified. Tapping DI pipe shall conform to ANSI/AWWA C600.

12.5 **DUCTILE IRON PIPE 4" - 54"**

12.5.1 DI pipe shall conform to ANSI/AWWA C104/A21 and shall have a cement mortar lining and seal coat conforming to ANSI/AWWA C104/A21. Joints shall conform to ANSI/AWWA C111/A21 and may be mechanical joint or push-on joint unless otherwise specified. The minimum thickness class shall be Class 50 rated at 350 psi unless otherwise specified.

~~12.6 POLYETHEYLENE PIPE (PE)~~

~~12.6.1 All Polyethylene pipe shall conform to ANSI/AWWA C901-17 with a MINIMUM pressure class rating of 200 psi and a DR rating of 9. All service line pipes will be 1" unless otherwise specified by the DEPARTMENT.~~

~~12.6.2 In no case shall stainless steel inserts be used with the installation of poly tubing service lines. If inserts are needed, the use of a plastic insert will be acceptable and approved at product submittal. In no case shall the insert extend passed the compression cap of the corporation stop when fully tightened.~~

12.6 **POLYETHYLENE PIPE**

12.6.1 Polyethylene Pressure Pipe and Tubing (PE) shall conform to ANSI/AWWA C901 with a MINIMUM pressure class rating of 200 psi and a DR rating of 9.

12.6.2 Crosslinked Polyethylene Pressure Tubing (PEX) shall conform to ANSI/AWWA C904 with a MINIMUM pressure class rating of 200 psi and a DR rating of 9.

12.6.3 All service line pipes will be 1" unless otherwise specified by the DEPARTMENT. In no case shall stainless steel inserts be used with the installation of poly tubing service lines. If inserts are needed, the use of a plastic insert will be acceptable and approved at product submittal. In no case shall the insert extend passed the compression cap of the corporation stop when fully tightened.

12.7 **COPPER PIPE**

12.7.1 Copper service pipe shall be 1" Type "K", soft tempered, seamless, for underground installation, in accordance with ASTM B88 and Federal Specifications WW-T-799.

12.8 **ENCASEMENT PIPE**

12.8.1 Smooth Wall Steel Encasement Pipe - Pipe shall conform to ASTM A-139, ASTM A-21.11 or AWWA C200. The metal thickness shall be as shown in the Proposal or Plans.

12.8.2 Casing spacer systems shall be manufactured in two pieces, made from heavy gauge T-304 stainless steel with Polymer Plastic Runners (Teflon). Spacers shall be a Cascade Casing Spacer manufactured by Cascade Waterworks Manufacturing Company or equal conforming to ASTM ratings, approved by AWWA and the DEPARTMENT. Casing and utility pipes shall be sealed with synthetic rubber end seals. **Detail GWS01**.

12.8.3 Any bell located within an encasement pipe shall be restrained by an approved method.

12.9 FITTINGS

12.9.1 DI fittings shall be designed for working pressure of at least 350 psi, shall be DI and shall conform to ANSI/AWWA C153 A21. Joints shall be mechanical joint conforming to ANSI A21.11. All fittings shall be furnished with gaskets and mechanical joint fittings shall be furnished with bolts, nuts and retainer glands. All fittings shall be ANSI/AWWA C550 AND C116 6-8 mil Nominal Thickness Fusion Bonded Epoxy Coated inside and out. Fittings shall be manufactured by U.S. Pipe "TRIM TYTE", Tyler, Star Pipe Products, or approved equal. Any alternate manufacturer shall require DEPARTMENT approval prior to installation.

12.9.2 Mechanical Joint Retainer Glands shall be installed on all water line valves bends and couplings. Mechanical Joint Retainer Glands for DI shall be made from DI and shall be designed for a working pressure of at least 200 psig. The set screws shall be extended through the outer most part of the gland. Glands shall be designed to standard mechanical joint fittings (AWWA C111). The minimum number and minimum size set screws shall be as follows, or approved equal. Any alternate manufacturer shall require Department approval prior to installation:

Size Gland	Size Set Screw	Number of Set Screws
4"	1/2"	4
6"	5/8"	6
8"	5/8"	9
10"	5/8"	16
12"	5/8"	16
16"	5/8"	24
20"	5/8"	28
24"	5/8"	32

DESCRIPTION	SIZE	CATALOGNUMBER	MANUFACTURER
Gland Retainer (Series 1400)	18"	UFR1400-D18	Ford
Gland Retainer (Series 1100)	18"	1118	EBBA
Gland Retainer (Series 1400)	12"	UFR1400-D12	Ford
Gland Retainer (Series 1100)	12"	1112	EBBA
Gland Retainer (Series 1400)	8"	UFR1400-D8	Ford
Gland Retainer (Series 1100)	8"	1108	EBBA
Gland Retainer (Series 1400)	6"	UFR1400-D6	Ford
Gland Retainer (Series 1100)	6"	1106	EBBA
Gland Retainer (Series 1400)	4"	UFR1400-D4	Ford
Gland Retainer (Series 1100)	4"	1104	EBBA

12.9.3 Mechanical Joint Retainer Glands for PVC shall be made from DI and shall be designed for a working pressure of at least 200 psi. The set screws shall be extended through the outer most part of the gland. Glands shall be designed to standard mechanical joint fittings (AWWA C111).

DESCRIPTION	SIZE	CATALOG NUMBER	MANUFACTURER
Gland Rtnr.C900 Circle-Lock	18”	UFR1500-C-18	Ford
Gland Retainer (Series 2000 PV)	18”	2018	EBBA
Gland Retainer C900 Circle-Lock	16”	UFR1500-C-15	Ford
Gland Retainer (Series 2000 PV)	16”	2016	EBBA
Gland Retainer C900 Circle-Lock	12”	UFR1500-C-12	Ford
Gland Retainer (Series 2000 PV)	12”	2012	EBBA
Gland Retainer C900 Circle-Lock	8”	UFR1500-C-8	Ford
Gland Retainer (Series 2000 PV)	8”	2008	EBBA
Gland Retainer C900 Circle-Lock	6”	UFR1500-C-6	Ford
Gland Retainer (Series 2000 PV)	6”	2006	EBBA
Gland Retainer C900 Circle-Lock	4”	UFR1500-C-4	Ford
Gland Retainer (Series 2000 PV)	4”	2004	EBBA

12.9.4 Swivel hydrant adapters, anchor couplings, and Tees shall be designed for a working pressure of at least 250 psig and to fit standard mechanical joint fittings (ANSI/AWWA C111 A21). One end of the straight anchor coupling and the branch of the tee shall be provided with a gland that may be rotated 360° on the fitting. Lengths of swivel adapter shall be as specified on plans and conform to standard manufactured lengths.

12.10 TAPPING SLEEVES (4" TAP & LARGER)

12.10.1 Tapping Sleeves shall be stainless steel. They shall be designed for a working pressure of at least 200 psig. Steel sleeves shall be stainless steel or coated with high build, Thermo-Set Epoxy. A test plug shall be furnished through the body for hydrostatic pressure testing. The outlets shall conform to ANSI B16.1, Class 125 flanges designed to accept tapping valves described herein. All bolts shall be of corrosion resistant alloy. Sleeves may be designed for a water tight seal by the use of mechanical followers or by the use of a gasket placed in a recess between the sleeve body and the pipe barrel. Only sleeves with mechanical followers or full circle gaskets may be used. If the known working pressure of the pipe to be tapped is greater than 200 psig the DEPARTMENT may require a MUELLER H-615 Series Tapping Sleeve.

DESCRIPTION	SIZE	CATALOG NUMBER	MANUFACTURER
Tapping Sleeves: Stainless Steel w/Carbon Steel Flange for AC			
Sleeve	16 x 6	Fast-1900-6A 18.60-1900 OD Rough Barrel AC	Ford Meter
Sleeve	16 x 8	Fast-1900-8A 18.60-1900 OD Rough Barrel AC	Ford Meter
Sleeve	16 x 12	Fast-1900-12A 18.60-1900 OD Rough Barrel AC	Ford Meter
Sleeve	12 x 12	FAST-1440-12A	Ford Meter
Sleeve	12 x 8	FAST-1440-8A	Ford Meter

Sleeve	12 x 6	FAST-1440-6A	Ford Meter
Sleeve	8 x 8	FAST-945-8A	Ford Meter
Sleeve	8 x 6	FAST-945-6A	Ford Meter
Sleeve	6 x 6	FAST-750-6A	Ford Meter

Tapping Sleeves: Stainless Steel w/Carbon Steel Flange for CI/C900

Sleeve	24 x 4	Fast-2600-4A	Ford Meter
Sleeve	24 x 6	Fast-2600-6A	Ford Meter
Sleeve	24 x 8	Fast-2600-8A	Ford Meter
Sleeve	24 x 12	Fast-2600-12A	Ford Meter
Sleeve	18 x 6	Fast-1992-6A	Ford Meter
Sleeve	18 x 8	Fast-1992-8A	Ford Meter
Sleeve	18 x 12	Fast-1992-12A	Ford Meter
Sleeve	16 x 8	FAST-1780-8A	Ford Meter
Sleeve	16 x 6	FAST-1780-6A	Ford Meter
Sleeve	12 x 12	FAST-1350-12A	Ford Meter
Sleeve	12 x 8	FAST-1350-8A	Ford Meter
Sleeve	12 x 6	FAST-1350-6A	Ford Meter
Sleeve	8 x 8	FAST-945-8A	Ford Meter
Sleeve	8 x 6	FAST-945-6A	Ford Meter
Sleeve	6 x 6	FAST-730-6A	Ford Meter
Sleeve	4 x 4	FAST-620-44A	Ford Meter

Tapping Sleeves: Stainless Steel

Sleeve	4”	SST OR SSTIII	Romac
Sleeve	6”	SST OR SSTIII	Romac
Sleeve	8”	SST OR SSTIII	Romac
Sleeve	10”	SST OR SSTIII	Romac
Sleeve	12”	SST OR SSTIII	Romac
Sleeve	16”	SST OR SSTIII	Romac
Sleeve	18”	SST OR SSTIII	Romac
Sleeve	24”	SST OR SSTIII	Romac

12.11 SLEEVES OR COUPLINGS

12.11.1 Sleeves shall be iron with mechanical joint followers. Couplings shall be steel or iron with gasketed ends. They shall be designed for a working pressure of at least 200 psig and sized to properly fit the type and class of pipe specified. All bolts shall be of corrosion resistance alloy. Steel couplings shall be coated internally and externally with high build, high strength, Thermo-Set epoxy coating. The Thermo-Set epoxy coating shall be 8 - 10 mils DFT and free of voids. Or approved equal, prior to construction.

DESCRIPTION	SIZE	CATALOG NUMBER	MANUFACTURER
Transition Couplings:			
Comp Coup AC/CI	16 x 12	442-19201780-400	Smith-Blair
Comp Coup AC/CI	12 x 12	442-14401350-400	Smith-Blair

Comp Coup AC/CI	8 x 12	442-09850945-400	Smith-Blair
Comp Coup AC/CI	6 x 12	442-07650722-400	Smith-Blair

12.12 **TAPPING SADDLES OR SLEEVES (FEMALE IRON PIPE OR AWWA CC OUTLET)**

12.12.1 Tapping Saddles/Sleeves shall be made from iron, bronze, steel or stainless steel and designed for a working pressure of at least 200 psig. Outlets shall be ANSI B16.1, Class 125 flanged tapping outlets, or as specified. Watertight seal shall be accompanied by the use of a gasket placed in a recess between the sleeve body and pipe barrel. The use of these Strap Saddle/Sleeves is restricted to taps where the branch is at least one size smaller than the run. Coatings on steel sleeves/saddles shall be as specified in **Paragraph 12.10** above.

DESCRIPTION	SIZE	CATALOG NUMBER	MANUFACTURER
Service Saddle, C.I., D.I., A.C.			
Saddle	24 x 2 IP Double Strap	FC202-2650xIP7	Ford Meter
Saddle	18 x 2 IP Double Strap	FC202-2050xIP7	Ford Meter
Saddle	16 x 2 IP Double Strap (CI)	FC202-1840xIP7	Ford Meter
Saddle	16 x 2 IP Double Strap (AC)	FC202-1925xIP7	Ford Meter
Saddle	12 x 2 IP Double Strap	FC202-1438xIP7	Ford Meter
Saddle	12 x 2 PVC Only	FC202-1320-IP7 FOR C900	Ford Meter
Saddle	8 x 2 IP Double Strap	FC202-979xIP7	Ford Meter
Saddle	8 x 2 PVC Only	FC202-905-IP7 FOR C900	Ford Meter
Saddle	6 x 2 IP Double Strap	FC202-760xIP7	Ford Meter
Saddle	6 x 2 PVC Only	FC202-690-IP7 FOR C900	Ford Meter
Saddle	4 x 2 IP Double Strap	FC202-526xIP7	Ford Meter
Saddle	24 x 1 CC Double Strap	FC202-2650xCC4	Ford Meter
Saddle	18 x 1 CC Double Strap	FC202-2050xCC4	Ford Meter
Saddle	6 x 1 CC Double Strap (CI)	FC202-1840xCC4	Ford Meter
Saddle	16 x 1 CC Double Strap (AC)	FC202-1925xCC4	Ford Meter
Saddle	12 x 1 CC Double Strap	FC202-1438xCC4	Ford Meter
Saddle	12 x 1 PVC Only	FC202-1320-CC4 FOR C900	Ford Meter
Saddle	8 x 1 CC Double Strap	FC202-979xCC4	Ford Meter
Saddle	8 x 1 PVC Only	FC202-905-CC4 FOR C900	Ford Meter
Saddle	6 x 1 CC Double Strap	FC202-760xCC4	Ford Meter
Saddle	6 x 1 PVC Only	FC202-690-CC4 FOR C900	Ford Meter
Saddle	4 x 1 CC Double Strap	FC202-526xCC4	Ford Meter
Saddle	3 x 1 CC Double Strap	FC202-425xCC4	Ford Meter
Saddle	2 x 1 CC Double Strap	FC202-250xCC4	Ford Meter
Service Saddle with nylon coating:			
Saddle	4 x 2 CC Double Strap	202NS	Romac
Saddle	6 x 2 CC Double Strap	202NS	Romac
Saddle	8 x 2 CC Double Strap	202NS	Romac
Saddle	10 x 2 CC Double Strap	202NS	Romac
Saddle	12 x 2 CC Double Strap	202NS	Romac
Saddle	16 x 2 CC Double Strap	202NS	Romac

Saddle	18 x 2 CC Double Strap	202NS	Romac
Saddle	24 x 2 CC Double Strap	202NS	Romac
Saddle	4 x1 CC Double Strap	202NS	Romac
Saddle	6 x1 CC Double Strap	202NS	Romac
Saddle	8 x1 CC Double Strap	202NS	Romac
Saddle	10 x1 CC Double Strap	202NS	Romac
Saddle	12 x1 CC Double Strap	202NS	Romac
Saddle	16 x1 CC Double Strap	202NS	Romac
Saddle	18 x1 CC Double Strap	202NS	Romac
Saddle	24 x1 CC Double Strap	202NS	Romac

12.13 SERVICE FITTINGS

12.13.1 Water service fittings shall be those manufactured by the following companies, listed below, or approved equal. The screws and/or nuts shall be of corrosion resistant alloy and shall be of Hex Head configuration. Any deviation must have approval from the DEPARTMENT prior to installation.

12.13.2 Corporation and curb stops shall conform to AWWA C800 (curb stops shall have 360° rotation of Tee Head) and shall be those manufactured by the company specified, or approved equal, as follows:

DESCRIPTION	SIZE	CATALOG NUMBER	MANUFACTURER
300 Ball Type Corporation Valve	1”	B-25008N	Mueller
		74701BQ 1	A.Y. McDonald
300 Ball Type Corporation Valve	¾ ”	B-25008N	Mueller
		74701Q ¾	A.Y. McDonald
Valve Ball	1”	FB11-444NL	Ford
		76101 1	A.Y. McDonald
Valve Ball	2”	B-11-777SWM-NL	Ford
		76101W 2	A.Y. McDonald

12.13.3 PE and Copper pipe fittings shall conform to AWWA C800 and shall be those manufactured by the Mueller Company, or approved equal, as follows:

DESCRIPTION	SIZE	CATALOG NUMBER	MANUFACTURERS
Adapter, Female	¾”	C-14-33-NL	Ford
		74754Q ¾	A.Y. McDonald
Adapter, Female	¾” x 1”	C-14-43-NL	Ford
		74754Q ¾ X1	A.Y. McDonald
Adapter, Female	1”	H-15451N	Mueller
		74754Q 1	A.Y. McDonald
Adapter, Female	1” x ¾”	C-14-34-NL	Ford
		74754Q 1 X ¾	A.Y. McDonald
Adapter, Male	¾”	H-15428N	Mueller
		74753Q ¾	A.Y. McDonald
Adapter, Male	1”	H-15428N	Mueller

		74753Q 1	A.Y. McDonald
Adapter, Male	1" x ¾"	H-15428N	Mueller
		74753Q 1 X ¾	A.Y. McDonald
Coupling, Straight	¾" x 1"	C-44-34-NL	Ford
		74758Q ¾ X 1	A.Y. McDonald
Coupling, GALV/PVC	¾" x 1"	C-45-43NL	Ford
		74758Q-55 1 X ¾	A.Y. McDonald
Coupling, GALV/PVC	¾"	C-45-33-NL	Ford
		74758Q-55 ¾	A.Y. McDonald
Coupling, GALV/PVC	1"	C-45-44NL	Ford
		74758Q-55 1	A.Y. McDonald
Coupling, 110 Comp	¾"	H-15403N	Mueller
		74758Q ¾	A.Y. McDonald
Coupling, 110 Comp	1"	H-15403N	Mueller
		74758Q 1	A.Y. McDonald
Ell Brass, 110 Comp	¾"	H-15526N	Mueller
		74761Q ¾	A,Y. McDonald
Ell Brass, 110 Comp	1"	H-15526N	Mueller
		74761Q 1	A.Y. McDonald
Tee Pack Joint	1"	T444-444NL	Ford
		74760Q 1	A.Y. McDonald
Tee, 110 Comp	¾"x¾"x1"	H-15381N	Mueller
		74760Q ¾ X 1	A.Y. McDonald
Tee, 110 Comp	¾"	H-15381N	Mueller
		74760Q ¾	A.Y. McDonald
U-Branch	1"x¾"x7-½"	H-15363N	Mueller
		7084QM	A.Y. McDonald

*Brass Nipples, Tees, Bell Reducers, Ells, Collars, etc. will be 150# SCH-40 Red Brass Domestic Fittings with Iron Pipe Threads.

12.13.4 The following meter setters and meter connection fittings shall conform to AWWA C800 and be those manufactured by the following companies, or approved equal:

DESCRIPTION	SIZE	CATALOG NUMBER	MANUFACTURER
Meter Set w/o Dual Check	5/8"x¾"x7"	B-2404FN	Mueller
		20-207WXLL 33	A.Y. McDonald
Meter Set w/o Dual Check	1" x 10"	B-2404FN	Mueller
		20-410WXDD 44	A.Y. McDonald

*All meter sets will be installed with Mueller End Connection # H-14222N and Mueller End Connection # H-14227N or A.Y. McDonald equal. A Fiber Washer Mueller # H-48234 or A.Y. McDonald equal shall be set in each end connection of the meter set.

12.14 GATE VALVES

12.14.1 GATE VALVES - 4" THROUGH 18" WITH RESILIENT SEAT

12.14.2 Resilient seat gate valves 4" through 18" shall be designed for a working pressure of 250 psig. Valves shall conform to AWWA C515 (Thin Wall or Lightweight Ductile Spec) with non-rising stem, O-ring stem seals and 2" square operating nut. Valves shall open when the operating nut is turned to the left (counterclockwise). Valve ends shall be as specified. The resilient seat may be bonded or mechanically attached to the gate. All interior metal surfaces shall be coated with a two-part thermosetting epoxy. Gate valves larger than 18" need to be submitted to the DEPARTMENT for approval prior to installation.

12.14.3 Epoxy Coating shall be 8-mils DFT and free of voids.

12.14.4 Tapping valves shall have full size flow way accepting standard size shell cutter.

12.14.5 Valves conforming to these specifications will be accepted from the following manufacturers:

American Flow Control Model # 2500
Clow Valve Company, Model 2638
Mueller Company, Model A2361

12.15 BUTTERFLY VALVES

12.15.1 Butterfly valves shall conform to AWWA C504, having the following features and be approved by the DEPARTMENT prior to installation:

12.15.2 Class 150B

12.15.3 Suitable for complete buried service. Exterior of valve shall be epoxy coated.

12.15.4 Disc may be made from any of the materials as specified in AWWA C504. However, discs made from material other than bronze or stainless steel shall be coated with epoxy material in accordance with **Section 12.15.9**. All other interior surfaces which are not stainless steel or bronze shall also be coated with epoxy material.

12.15.5 Valve resilient seats shall be BUNA-N bonded into a self-retaining recess in the body or a natural rubber molded to an 18-8, Type 304 stainless steel retaining ring secured to the disc by self-setting screws. If the set is attached to the disc, the mating surface to the resilient seat shall be 304 or 316 stainless steel.

12.15.6 Stainless steel shafting. "O-Ring" or split-V shaft seals. Bronze, nylon or Teflon bearings and a "Manual Operator" totally enclosed for buried service shall include the following:

12.15.7

(a) 2" x 2" operating nut
(b) Open counter-clockwise
(c) Operators of the traveling nut type shall not have u-joints on the rods.
(d) On operators composed of worm gears; worm gears may be either bronze or DI and the worms shall be composed of hardened steel.
(e) The operator shall satisfy the valve operating torque requirements for Class 150B valves and the operator input requirements of AWWA C504.

12.15.8 Valve ends shall be as specified. If flange ends are specified, they shall conform to Class 125, ANSI B16.1.

12.15.9 Epoxy Coating for Valve Disc. Before application of coating material, all surfaces of the disc shall be thoroughly cleaned to remove dirt, grease, oil and any other substances; all sharp angles, protrusions or irregularities which would interfere with proper coating coverage shall be removed; and the entire surface grit blasted to white metal in accordance with SSPC Specification SP5 resulting in an anchor pattern of at least 1 mil. Thermo-set epoxy material shall be applied to the sand-blasted surfaces before the white metal begins to oxidize (darken in color). The thermoset epoxy shall be approved for exposure to fluids for human consumption by the Federal Food and Drug Administration. The final DFT shall be at least 8 mils DFT and free of voids. The disc shall be post-cured for a sufficient period of time to assure full polymerization. Polymerization shall be checked by a direct impact test at 60-inch-lb. with no cracking or chipping of the coating. The DFT shall be checked using an accurate magnetic DFT gauge. The entire coated surface shall be checked for voids using a wet sponge type holiday detector. Any area where the DFT is found to be less than 8 mils or where voids were detected shall be re-coated and re-checked. Valves shall be packed for shipment in such manner that the disc coating is protected from damage.

12.16 AIR RELEASE VALVES

12.16.1 Air Release Valves shall be APCO No. 200-A, or approved equal, or as specified.

12.17 VALVE BOXES, LIDS AND EXTENSIONS

12.17.1 Valve boxes shall be Tyler 6850 series or equal with 5 ¼" shafts. Length variable 10 ¼" OD bottom flange, 8" ID Bottom, 7 3/16" OD top, 6 ¾" ID top of 2 section valve box.

12.17.2 Valve box lids shall have a 7 5/16” outside diameter with 6 ½” inside diameter for 5 ¼” valve boxes. The lids shall be marked with “WATER” unless located at the tap for a fire line where a post indicator may not be installed. In this case the lid shall be marked “FIRE” and be painted safety red. The “FIRE” lid shall be locking and require only a wrench to open.

12.17.3 Extension shaft shall be required on any valve that exceeds 4’ in depth. Valve stem extensions shall be adequate to transmit full torque required to open valve, and shall be secured to the valve operating nut by set screws not clips. The top of the extension shaft shall be a 2" square AWWA nut. Extensions shall be provided to bring the operating nut to within 4' of grade and have disc attached to hold operating nut in the center of valve box and shall be firmly attached to the valve.

12.18 METER BOXES, VAULTS AND LIDS

12.18.1 Water meters 5/8” and 1” shall be installed in 18" Brook’s type 22HFX1802KS round plastic meter boxes that are domestically manufactured or as approved by the DEPARTMENT.

12.18.2 Water meters 5/8” and 1” that are installed in non-deliberate and incidental traffic shall be installed with a load bearing meter tile. Water meter installations that fit this criteria will use the DFW Plastics #DFW1800F-18-1ET load rated meter tile. Prior approval for water meters installed in potential traffic loaded areas shall be obtained from the DEPARTMENT during the plan review process.

12.18.3 2” meters are to be installed by City of Bentonville at OWNER/DEVELOPER’S expense. 2" meters shall be installed in 30"x 36” diameter Mid-States MSP 30”X36” meter boxes.

12.18.4 All meter vault plans and installations shall be approved by the DEPARTMENT prior to the start of construction. Meter vaults shall not be subject to flooding and shall be water tight to prevent intrusion of water and dirt. The walls of the vault shall extend above the finished grade a minimum of 3" to prevent intrusion of water or dirt. Vault to be installed by CONTRACTOR at OWNER'S expense. **Detail W12.**

12.19 **FIRE HYDRANTS**

12.19.1 All fire hydrants furnished shall be dry barrel hydrants in conformance with AWWA C502, latest revision, for "Dry Barrel Fire Hydrants", and shall be designed for a 250 psig maximum working pressure. All fire hydrants shall be equipped with a safety stem coupling and flange, which are intended to fail upon vehicle impact without damage to the stem or main valve. All fire hydrants shall conform to AWWA C502, the following specifications, and shall be the Traffic Model Fire Hydrant:

Maximum Working Pressure	250 psig
Size of Valve Opening	Minimum 5"
Diameter of Inlet Connection	6"
Type of Inlet Connection	Mechanical Joint
Number & Size of Hose Connections	2 - 2 1/2", 1 - 4 1/2"
Nozzle Arrangement	All in same place
Nozzle Thread ASA	Standard
Nozzle Cap Chains	Three
Nozzle Cap Washers	Rubber
Barrel	Ductile Iron Pipe
Operating Threads	Oil or Grease Lubricated Seals
Lubrication Chamber	Oil or Grease
Seat Rings	Bronze to Bronze
Direction to Turn to Open	Left (Counter-Clockwise)
Shape & Size of Operating & Nozzle Cap Nut	5-Sided, 1 1/2" from flat to point
Operating Nut	Bronze
Hydrant Shoe	Epoxy Coated
Color above ground - barrel and dome	Industrial Safety Yellow
Color, Nozzle Caps & Top Nut, including shield	Industrial Safety Yellow

12.19.2 Seat must be removable, using a short, lightweight wrench which will fit all depths of bury.

12.19.3 The hydrant shall have a 6" mechanical joint inlet in conformance to the dimensions shown in ANSI/AWWA C110 A21, latest revision. The lead pipe from the valve to the fire hydrant shall be an approved Mechanical Joint Swivel Anchor Coupling 6" x 13" Tyler 084150A CL 153 or approved equal for direct connections, or retainer glands as specified by type throughout these specifications. A fire hydrant anchor tee will be required for new main installation as indicated by the DEPARTMENT.

12.19.4 All fire hydrants shall be equipped with a two-piece barrel having a flange at the required elevation to meet the height requirement (18" to 24" from final grade) designated in **Detail WO4**.

12.19.5 All fire hydrant installations shall have 6" gate valve with tracer wire, valve boxes and valve box pads meeting all provisions specified elsewhere in these specifications. Auxiliary gate valves are necessary for fire hydrant leads longer than 50'.

12.19.6 All concrete used for fire hydrant blocking shall be in conformance with the concrete **Section 12.24** of these specifications.

12.19.7 Fire hydrants conforming to these specifications will be accepted from the following manufacturers:

Mueller Super Centurion 250
Clow Medallion.

12.19.8 If a fire hydrant needs to be raised only 1 extension will be approved and all parts shall be manufactured by the same company as the fire hydrant. Generic extension parts shall not be used.

12.20 POLYETHYLENE TUBING MATERIAL FOR PIPE ENCASEMENT

12.20.1 Polyethylene material for the encasement of cast IP (gray or ductile) shall conform to ANSI A21.5 (AWWA C105).

12.20.2 Tape for field application shall be Polyken #900, or Scotchrap #50, or equal, at least 2" wide.

12.21 LOCATOR WIRE

12.21.1 All water mains and sewer force mains, including DI pipe, PE water services or other appurtenances installed shall have single #10 gauge type TW (single strand) insulated copper locator wire, on top of pipe and fastened securely with tape every 10' and buried with it. This locator wire shall be installed in conjunction with the main at the same depth as the water main or service.

12.21.2 Locator wire shall not be connected in any way to main or any other underground metal (except other tracer wires). Installation of locator wire shall be tested 1 time before the 1st acceptance inspection. Tracer wire shall be tested after curbs are installed and prior to asphalt. **Section 8**

12.21.3 Wire shall be accessible at all valve boxes and meter boxes and shall extend a minimum of 6" above the valve or meter box, at the main or service, connect all locator wires together so that a continuous electrical path is ensured. Tracer wire shall be installed through the outside of the valve box bottom section then inserted through the inside of the top section of the valve box. A minimum of 6" to maximum of 12" of tracer wire is required to be extended beyond the top of the valve box. **Detail W07.**

12.21.4 To connect locator wires, the wires shall be spliced using a split bolt connector (Blackburn 9H or Kearney KS90) or equal, then covered with electrical plastic tape (Type 3M Scotch 33) so that a waterproof joint is made.

12.22 CONCRETE MATERIAL SPECIFICATIONS

12.22.1 Concrete shall have a 28-day compressive strength of at least 4,000-psi and shall contain not more than six (6) gallons of water per sack of cement, including the water in the aggregates, and

not less than six (6) sacks of cement per cubic yard of concrete. A copy of all tickets from concrete company shall be presented to the DEPARTMENT.

12.22.2 Portland cement conforming to ASTM C150, Type 1, shall be used unless the DEPARTMENT approves the use of other types.

12.22.3 Water used shall be clean and free from injurious amounts of oil, acids, alkalis, salt, organic matter, or other deleterious substances.

12.22.4 Fine aggregate shall consist of clean, sound, properly graded sand conforming to ASTM Standard C33 uniformly graded from 100% passing the 3/8" sieve to not more than 8% passing the Number 100 sieve.

12.22.5 Coarse aggregate shall consist of crushed stone, gravel, or other inert material of similar characteristics, having clean, hard, strong, durable, uncoated particles with not more than 5% by weight of soft fragments, ¼ % by weight of clay lumps, and 1% by weight of material removed by decantation, except that when the material removed by decantation consists essentially of crushed dirt the maximum amount permitted may be increased to 1 ½ % by weight. Aggregate shall conform to ASTM Standard D289. Coarse aggregate may be either of two sizes, 1 ½" and smaller or ¾" and smaller, and shall be graded within the following requirements.

12.23 **PERCENT RETAINED BY WEIGHT**

Maximum size mesh screen (sq. mesh)	0 - 3
Half-Maximum size mesh screen (sq. mesh)	30 - 65
No. 4 Sieve	94 - 100

12.23.1 In no case shall the maximum size aggregate exceed 1/3 of the design thickness of any part of a structure. Coarse aggregate for exposed aggregate surfaces shall be as follows:

Total Retained on 1 1/2" Sieve	- 0 %
Total Retained on 3/4" Sieve	25 - 60%
Total Retained on 3/8" Sieve	70 - 90%
Total Retained on #4 Sieve	95 - 100%

12.24 **CONCRETE PROPORTIONS AND CONSISTENCY**

12.24.1 The proportions of the concrete shall produce a mixture that will work readily, with the placement method most used, into the corners and angles of the forms and around reinforcement. Segregation of materials in the mixture shall not be permitted nor the collection of excess free water on the surface.

12.24.2 The slump of the concrete shall be the minimum that is practicable. When vibrators are used to consolidate the concrete, the slump shall not exceed 4"; otherwise, the slump shall not exceed 6".

12.24.3 The methods of measuring concrete materials shall be such that the proportions can be accurately controlled and easily checked. Measurement of materials for ready-mixed concrete shall conform to Specifications for Ready-Mixed Concrete (ASTM C94).

12.24.4 Ready-mix concrete shall be required and shall conform to ASTM Standard C94 and to applicable portions of these specifications for on-site mixing. The concrete shall be delivered and placed

within 1-hour after all materials, including mixing water, shall have been placed in the mixing drum. The CONTRACTOR shall obtain from the supplier of the ready-mixed concrete, the supplier's agreement to inspection by the DEPARTMENT, to the full extent deemed necessary by the DEPARTMENT.

12.25 CONCRETE TESTING

12.25.1 As the placement of concrete progresses, the DEPARTMENT may take samples of the concrete for testing. The CONTRACTOR shall provide whatever assistance required by the DEPARTMENT in collecting and preparing samples for testing. Sampling shall be in accordance with ASTM Standard C172.

12.25.2 An independent laboratory in accordance with ASTM Standard C143 shall conduct slump tests.

12.25.3 Compression test specimen shall be prepared and cured in accordance with ASTM Standard C31. Specimens shall be tested in accordance with ASTM Standard C39.

12.25.4 All reinforcing bars shall be "Billet-Steel Concrete Reinforcement Bars" conforming to ASTM Designation A15 or "Rail-Steel Concrete Reinforcement Bars" conforming to ASTM Designation A16. Billet-Steel bars shall be intermediate grade with minimum yield point of 60,000 psi.

12.25.5 All reinforcing bars shall be deformed bars. Deformation shall comply with "Minimum Requirements of the Deformation of Deformed Steel Bars for Concrete Reinforcement - ASTM Designation A305".

12.25.6 When the volume of concrete required at the work site is less than 1/3 cubic yard, mixing may be accomplished by hand tool methods. The concrete shall be mixed in a clean, watertight vessel to the extent necessary to assure that the cement; aggregate and water are thoroughly integrated. The mix shall be at least 1 part Portland cement to 2 parts coarse aggregate, as specified in **Section 12.22.5** and 2 parts sand, as specified in **Section 12.22.4**. Only that amount of water required to provide a stiff, workable mix shall be used. The strength requirements specified in **Section 12.22.1** herein, apply.