Special Specification 7261
Water Mains and Service Lines

1. DESCRIPTION

Provide and install a complete water main system in accordance with the plans and specifications and in compliance with the City of Grandview's policies, if any, and the Department's Utility Accommodation Policy (UAP) (Title 43, T.A.C., Sections 21.31–21.55). The water mains must be of the sizes, materials and dimensions shown on the plans and must include all pipe, all joints and connections to new and existing pipes, all valves, fittings, fire hydrants, pipe joint restraint systems, and blocking, as may be required to complete the work.

The following abbreviations are used in this Specification:

- AWWA – American Water Works Association,
- ASA – American Standards Association,
- ASTM – American Society for Testing and Materials,
- ANSI – American National Standards Institute, and
- NSF – National Science Foundation.

Where reference is made to specifications of the above organizations, it must be construed to meet the latest standard in effect on the date of the proposal.

2. MATERIALS

Where specific products or manufacturers are mentioned in this Specification, approved equals may be used.

2.1. **Ductile-Iron Pipe and Fittings.**

2.1.1. **Ductile-Iron Pipe: 3 in. through 64 in.**

All ductile-iron pipe must be manufactured by process of centrifugal casting and in accordance with AWWA Standard C-151, “American Standard for Ductile-Iron Pipe Centrifugally Cast with push-on or mechanical joints for Water or Other Liquids,” unless otherwise modified or supplemented herein.

Pipe must conform to the pressure classes, based on Type 3 bedding conditions, a depth of bury of 6 ft. and a working pressure of 150 psi in accordance to Table 1.

Table 1
Ductile Iron Pressure Classes for Pipe Sizes

Size	Pressure
3 in. through 12 in.	350 psi
16 in. through 20 in.	250 psi
24 in.	200 psi
30 in. through 64 in.	150 psi

Dimensions and tolerances for each nominal pipe size must be in accordance with Table 51.5 (push-on) or Table 51.5 (mechanical joint) of AWWA Standard C 151 for pipe with a nominal laying length of 20 ft.

All pipe must have a standard water works cement mortar lining in accordance with AWWA Standard C-104 with outside coating per Section 51.8.1 of AWWA Standard C-151.

Exterior coating must consist of a nominal 1 mil thick asphaltic material applied to the outside of the pipe as described in Section 51.8 of AWWA Standard C-151.

Rubber joint gaskets used on ductile-iron pipe must be in accordance with AWWA Standard C-111. Each length of pipe must bear identification markings in accordance with Section 51.10 of AWWA Standard C-151.

Contractor must use a manufacturer that takes adequate measure during pipe production to assure compliance with AWWA Standard C-151 by performing quality-control tests and maintain results of those tests as outlined in Section 51.14 of that standard.

Engineer will, at no cost to the Contractor, subject random lengths of pipe for testing by an independent laboratory for compliance with this Specification. Any visible defects or failure to meet quality standards will be grounds for rejecting the pipe.

2.1.2. **Fittings for Ductile-Iron Pipe.**

Unless otherwise modified or supplemented, WWA Standard C-110 for Ductile-Iron Fittings, 3 in. through 48 in. for water and ther Liquids and AWWA Standard C-153 for Ductile-Iron Compact Fittings, is to govern the design, manufacture, and testing of all fittings under this Specification.

For 3 in. through 24 in. size range, the pressure rating of all fittings must be a minimum of 250 psi. The working pressure for all fittings of size greater than 24 in. must be a minimum of 150 psi, unless a change in pressure rating is shown on the plans or as directed.

Fittings must be furnished with the type of end combination specified.

Mechanical joint fittings and anchor type fittings must be furnished complete, with glands, gaskets, and bolts. Bolts for mechanical joints must be ASTM A-536 specially alloyed and heat treated ductile iron in accordance with ANSI/AWWA Standard CIII/A21.IL.

Flanged fittings must be faced and drilled in accordance with ASA Specifications B 16.1, Class 125. Anchor fittings must be furnished in size and type or length as specified.

The exterior of all fittings must be provided with a petroleum asphaltic coating in accordance with AWWA Standard C-110. The interior of flanged fittings supplied under this Item must be either cement-mortar lined in accordance with AWWA Standard C-104 or lined with a petroleum asphaltic material in accordance with AWWA Standard C-110 as specified. The interior of all other fittings supplied under this Item must be cement-mortar lined in accordance with AWWA Standard C-104.

Fittings for 2 in. size must be manufacturer’s standard design, designed in accordance with applicable design standard of AWWA Standard C-110.

2.2. **Steel Pipe, Fittings and Flanges.**

2.2.1. **Steel Casing Pipe.**

The component materials, manufacture, and testing of all steel pipe must be in accordance with AWWA Standard C-200 for “Steel Water Pipe 6 in. and Larger.” The specified pipe size must be the actual inside diameter of the pipe, special or fitting in inches. The diameter and wall thickness of all steel pipe must conform to those shown on the plans.

Pipe must be either Grade A or Grade B, in accordance with ASTM Designation A-53.

Pipe ends must be beveled and suitable for field butt welding unless otherwise specified.

Pipe must receive a protective coating in accordance with AWWA Standard C-203, “Coal-Tar Protective Coatings and Linings for Steel Pipelines – Enamel and Tape Hot Applied.”

Pipe length must be nominal 40 ft. lengths except for specials or as otherwise specified on the plans. Standard and specials must be within 1/16 in. (plus or minus) of the specified or theoretical lengths.

2.2.2. **Stainless Steel Casing Spacer.**

The casing spacers must be constructed of T-304 stainless steel segments which bolt together forming a shell around the carrier pipe. The spacers must be designed with risers (when needed) and runners to support the carrier within the casing and maintain a minimum clearance of 0.50 in. between the casing ID and the spacer OD. On carrier pipes with an OD less than 16 in., each spacer must have four riser and runner combinations, two on each segment. On carrier pipes with an OD of 16 in. and larger, each spacer must contain six riser and runner combinations, four on the bottom segment and two on the top segment. T-304 stainless steel bolts and nuts must be supplied with the spacers.

The band must be manufactured of 8 in. wide, 14 gauge, T-304 stainless steel material. The risers must be constructed of 10 gauge, T-304 stainless steel with a minimum length of 6 in.

Abrasion resistant runners, with a minimum length of 7 in. and a minimum width of 1 in. must be attached to each riser to minimize friction between the casing pipe and the carrier pipe as it’s installed. Runner material must be of glass reinforced plastic with compression strength of 25,000 psi, flexural strength of 32,000 psi and tensile strength of 22,000 psi. The ends of all runners must be beveled to facilitate installation over rough weld beads or the welded ends of misaligned or deformed casing pipe.

Interior surfaces of the circular steel shell must be lined with PVC or EPDM with a minimum thickness of 0.090 in. with a hardness of durometer "A" 85-90.

Spacers must be placed a maximum of 1 ft. on each side of the bell joint and every 8 ft. to 12 ft. apart thereafter.

Spacers should have the following physical properties:

- band and risers,
  - band -14 gauge, T-304 stainless steel, and
  - riser - minimum 14 gauge, T-304 stainless steel.
- liner - EDPM or polyvinyl chloride,
  - thickness - 0.090 in. minimum,
  - hardness - Durometer "A" 85-90,
  - dielectric strength - 1/8 in. thick,
  - 60,000 VPM,
  - water absorption - 1% maximum, and
  - overlap edges.
- studs, nuts and washers,
  - T-304 stainless steel - 5/16: - 18 in. x 2 in. studs,
  - 5/16 in. hex nuts, and
  - 5/16 in. washers SAE 2330.
- runners – 1 in. wide or 2 in. wide glass filled polymer runners,
- sizes available:
  - length – 7 in., and
  - effective heights (all lengths) – 1 in. and 1 1/2 in.
- materials specifications:
  - tensile strength (ASTM D-638) - 22,000 psi,
  - flexural strength (ASTM D-790) - 32,000 psi,

- compression strength (ASTM D-695) - 25,000,
- deflection temperature @ 264 psi (ASTM D-648) - 435°F (224°C),
- deformation under load, @ 122°F (50°C) – 4,000 lb.,
- load, - (ASTM D-648) 1.2 %., and
- welding, all risers must be welded by MIG welding and must be fully passivated.

2.2.3. **Quality Assurance Commercial Standards.**

All manufacturing tolerances referenced in the below standards apply unless specifically excluded.

- ANSI/AWWA C-200 Standard for Steel Water Pipe 6 in. and Larger.
- ANSI/AWWA C-205 Standard for Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 in. and Larger-Shop Applied ANSI/AWWA C-206 Standard for Field Welding of Steel Water Pipe. ANSI/AWWA C-207 Standard for Steel Pipe Flanges for Water Works Service, 4 in. – 144 in.
- ANSI/AWWA C-208 Standard for Dimensions for Fabricated Steel Water Pipe Fittings.
- ANSI/AWWA C-209 Standard for Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.
- ANSI/AWWA C-210 Standard for Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.
- ANSI/AWWA C-214 Standard for Tape Coating Systems for the Exterior of Steel Water Pipelines.
- ANSI/AWWA C-216 Standard for Heat-Shrinkable Cross-Linked Polyolefin Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.
- ANSI/AWWA C-218 Standard for Liquid Coating the Exterior of Aboveground Steel Water Pipelines and Fittings.
- ANSI/AWWA C-219 Standard for Bolted Sleeve-Type Couplings for Plain-End Pipe.
- ANSI/AWWA C-222 Standard for Polyurethane Coatings for the Interior and Exterior of Steel Water Pipelines and Fittings.
- AWWA M-11 Steel Pipe - A guide for Design and Installation.
- ASTM A-106 Standard Specification for Seamless Carbon Steel Pipe for High- Temperature Service.
- ASTM A-53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
- ASTM E-165 Method for Liquid Penetrant Examination. ASTM E-709 Guide for Magnetic Particle Examination. ASME Section V Nondestructive Testing.

2.2.4. **Examination.**

ASME Section IX Welding and Brazing Qualification. AWS B2.1 Standard for Welding Procedure and Welding Qualifications.

2.2.5. **Qualifications.**

The pipe and fittings must be designed, constructed, and installed in conformance with the best practices and methods and must comply with these specifications as applicable.

Pipe must be the product of one manufacturer. All pipe manufacturing, including cylinder production, lining, coating, and fittings must be produced by one manufacture. The pipe manufacturer must have a certified quality assurance program. This certified program must be ISO 9001: 2,000 or other equivalent nationally recognized program.

2.2.6. **Polyvinyl Chloride Pipe and Fittings.**

2.2.6.1. **Polyvinyl Chloride Pipe, 4 in. through 12 in. (C-900).**

Four in. through 12 in. polyvinyl chloride (PVC) pressure pipe must be made from Class 1245A or 1245B compounds in accordance with ASTM Standard D-1784 and providing for a hydrostatic test basis (HBD) of 4,000 psi.

All PVC pipe must be in accordance with to AWWA Standard C-900. Contractor must supply the Engineer a manufacturer's affidavit that the materials supplied comply with all applicable requirements of AWWA.

All AWWA C-900 PVC pipe must have a pressure rating of 150 psi and a dimension ratio of 18 with cast iron equivalent outside diameters unless otherwise specified. It must have a sustained pressure requirement of 500 psi and a minimum burst pressure of 755 psi. AWWA C-900 PVC pipe installed in high pressure.

Zones must have a pressure rating of 200 psi and a dimension ration of 14, a sustained pressure requirement of 650 psi, and a minimum burst pressure of 985 psi. It must be furnished in nominal 20 ft. lengths, and must be self-extinguishing.

Dimensions and tolerances for each nominal pipe size must be in accordance with Section 2.2, Table 1 of AWWA C-900.

2.2.6.2. **AWWA C-900 and C-905 Requirements.** Below are requirements for AWWA C-900 and C-905 pipe.

- Bundle pipe in pallets for ease of handling and storage. Package pipe bundles to provide structural supports to ensure weight of upper units does not cause deformation to pipe in lower units.
- Pipe bundles showing evidence of ultra violet radiation "sunburn" on exposed pipe as may be caused from extended unprotected storage conditions will not be accepted.
- The pipe must be in accordance with AWWA Standards C-900 or C-905-97, as applicable by performing quality control-control test and maintaining results of those test in accordance with Section 3 of that standard. Submission of product constitutes certification of compliance with standard.
- Pipe is intended for use as an underground, direct bury pressure pipe for transport of potable water. The expected life of pipe system after installation is 25 to 50 yr.
- Provide a 1 yr. warranty for all material sold and delivered for use and incorporation into water system. Warranty takes effect on the date that pipe is accepted by the Department.
- Test.
    - For both C-900 and C-905, water system at no cost to the Contractor, subject random lengths of pipe for testing by an independent laboratory for compliance with this Specification. Any visible defects of failure to meet quality standards will be grounds for rejecting entire order.

2.2.6.3. **References.** The documents listed below are referenced in this Specification.

- AWWA C-900-07; Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 in. through 12 in., For Water Transmission and Distribution.
- ASTM D-1784; Standard Specification for Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Polyvinyl Chloride (CPVC) Compounds.
- ASTM D-2122; Standard Method of Determining Dimensions of Thermoplastic Pipe and Fittings.
- ASTM D-3139; Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
- ASTM F-477; Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- Bends and Fittings for PVC Pipe 4 in. through 36 in. All bends and fittings must conform to the same requirements subparagraphs 2.A.2 Fittings for Ductile- Iron Pipe.
- Joint Restraint System for PVC C-900/C-905.
    - **Scope.** This Specification covers pipe joint restraint systems used on domestic water mains for PVC C-900 pipe sizes 4 in. through 12 in. diameter and PVC C-905 pipe sizes 16 in. through 24 in. diameter, and for ductile iron pipe sizes from 4 in. through 24 in. diameter.

Joint restraint systems are classified as “compression,” “mechanical joint,” or “non-metallic restrained joint” for the specific type of pipe joint to be restrained.

- **General Requirements.**
  - Underwriter Laboratories (UL) and Factory Mutual (FM) certifications are required on all restraint systems.
  - Unless otherwise noted, restraint systems must be used on PVC C-900 and C-905 pipe must meet or exceed ASTM Standard F1674-96, “Standard Test Methods for Joint Restraint Products for Use with PVC Pipe,” or the latest revision. Restraint systems used on ductile pipe must meet or exceed UL Standard 194.
  - Non-metallic restrained joint pipe and couplings must be used specifically for C-900 PVC pipe and fittings in sizes 4 in. through12 in.
  - Each restraint system must be packaged individually and include installation instructions.

2.2.7. **Specific Requirements.**

2.2.7.1. **Restrainer for PVC C-900/C-905 and Ductile Iron Push-on Type Connections.**

- Pipe restraints must be used to prevent movement for push-on D.I. or PVC (C-900&C-905) (compression type) bell and spigot pipe connections or where a transition or flexible coupling has been used to join two sections of plain-end pipe D.I. or PVC (C-900&C-905). The restrainer may be adapted to connect a plain end D.I. or PVC pipe to a ductile iron mechanical joint (MJ) bell fitting. The restrainer must not be directionally sensitive.
- The pipe must be restrained by a split retainer band. The band must be cast ductile iron, meeting or exceeding ASTM A-536-80, Grade 65-45-12. The inside face or contact surface of the band must have enough width to incorporate cast or machined non-directionally sensitive serration to grip the outside circumference of the pipe. The serration must provide full (360°) contact and maintain pipe roundness and avoid any localized points of stress. The split band casting must be designed to “bottom-out” before clamping bolt forces (110 ft. per pound minimum torque) can over-stress the pipe but must provide full non-directionally sensitive restraint at the rated pressures.
- Bolts and nuts used to attach the split retainer ring must be in accordance with ANSI B-18.2/18.2.2, SAE Grade 5. Tee-bolts, nuts, and restraining rods must be fabricated from high-strength, low-alloy steel in accordance with AWWA C-111-90, ANSI/AWWA C-111/A-21.11.
- The split ring type non-directionally sensitive restrainer system must be capable of a test pressure twice the maximum sustained working pressure listed in Section D, and be for both D.I. and PVC C-900.
- Restraint systems sizes 6 through 12 in. must be capable of use for both ductile iron and PVC C-900.
- The restraint system may consist of two types: the two split retainer rings and for new construction use only the one split and one solid cast backup ring.
  - Compression Ring Fitting Restrainer for Ductile Iron Pipe & PVC C-900.
    - Compression ring with follower gland type of restrainer must be used in conjunction with mechanical joint (MJ) bell end ductile iron pipe fittings for restraining PVC C-900 and ductile iron pipe.
    - The system must use a standard MJ gasket with a color-coded compression ring and replacement gland in accordance with ASTM A-536-80, Grade 65-45-12.
    - Standard MJ fitting tee-bolts and nuts must be fabricated from high strength steel in accordance with ANSI AWWA C-111/A-21.11 and AWWA C-153/A-21.53-88.
    - Standard MJ gasket must be virgin SBR in accordance with ASTM D-2000 3 BA 715 or 3 BA 515.
    - The restraint system must be capable of a test pressure twice the maximum sustained working pressure in accordance with Table 2.
- Non-metallic restrained joint pipe and couplings for PVC C-900 type connections.

- Gasketed restrained coupling connections must join two sections of factory grooved PVC (C- 900) pipe. The restrainer coupling must not be directionally sensitive.
- The coupling must incorporate twin elastomeric sealing gaskets in accordance with ASTM F-477 and must be DR-14 Class 200 C-900 PVC in all applications, meeting or exceeding the performance in accordance with of AWWA C-900, latest revision. The inside face or contact surface of the coupling connection must have enough width to incorporate a factory machined non-directionally sensitive groove in both pipe and coupling to grip the outside circumference of the pipe. The couplings must provide full (360°) contact and maintain pipe roundness and avoid and localized points of stress. The coupling must be designed with an internal stop to align the precision-machined grooves in the coupling and pipe before installation of a non-metallic thermoplastic restraint spleen and must provide full non- directionally sensitive restraint at the rated pressures.
- High-strength flexible thermoplastic spleens must be inserted into mating precision–machined grooves in the pipe and coupling to provide full non-directional restraint with evenly distributed loading.
- The non-metallic restrained joint pipe and couplings for PVC C-900 type non-directionally sensitive restrainer system must be capable of a test pressure twice the maximum sustained working pressure listed in Section D and be for PVC (C-900) pipe sizes 4 through 12 in.
- Non-metallic restrained joint pipe and couplings for PVC C-900 restrained systems sizes 4 through 12 in. must be capable of use for both Class 150 (DR 18) and 4 through 8 in. for Class 200 (DR 14) PVC C-900 pipe.
- The non- metallic restrained joint pipe and couplings for PVC C-900 restraint system must consist of a pipe and couplings system produced by the same manufacturer meeting the performance qualifications of Factory Mutual (FM) and Underwriters Lab (UL).

■ Retainer Gland for Ductile Iron Pipe (only).

- Radial bolt type restrainer systems must be limited to ductile iron pipe in conjunction with mechanical joint (MJ) bell end pipe of fittings. The system must use a standard MJ gasket with a ductile iron replacement gland in accordance with ASTM A-536-80. The gland dimensions must conform to standard MJ bolt circle criteria.
- Individual wedge restrainers must be ductile iron heat treated to a minimum hardness of 370 BHN. The wedge screws must be compressed to the outside wall of the pipe using a shoulder bolt and twist-off nuts to ensure proper actuating of the restraining system.
- Standard MJ fitting tee-bolts and nuts must be high strength steel conforming to AWWA C111/A21.11 and C153/A21.53-88.
- Standard MJ gasket must be virgin SBR meeting ASTM D-2000 3 BA 715 or 3 BA 515.

■ Maximum Sustained Working Pressure Requirement.

Table 2
Maximum Sustained Working Pressure Requirement

Nominal Diameter	PVC C-900 / C-905	Ductile Iron
4 in. & 6 in.	150 psi (DR18) / 200 psi (DR14)	350 psi
8 in.	150 psi (DR18) / 200 psi (DR14)	250 psi
10 in. & 12 in.	150 psi (DR18) / 200 psi (DR14)	200 psi

2.2.8. **Tests.** Engineer will, at no cost to the Contractor, subject random joint restraint system products to testing by an independent laboratory for compliance with these standards. Any visible defect of failure to meet the quality standards will be ground for rejecting the entire order.

2.2.8.1. **Product List.** Other approved equal products from other manufacturers meeting these specifications may be submitted for review, in accordance with Tables 3, Table 4, Table 5, Table 6, and Table 7.

Table 3
Approved Products List: Slip on Joint Restraint Systems

Manufacturer	PVC C-900/C- 905	Ductile Iron (D.I.)
Ford/Uni-Flange Corporation	Series 1390C	Series 1390C
EBBA Iron Sales, Inc.	1500	1700
Romac Industries, Inc. 4-8 in.	Model 611	Model,611
Star Pipe Products	1100	1100

Table 4
Approved Products List: Compression Ring Systems

Manufacturer	PVC C-900	Ductile Iron
Romac Industries, Inc.	Grip Ring-DI	Grip Ring-DI
Tyler Corporation	MJR Gland	MJR Gland
Star Pipe Products	Ring Lock 3500 Series	

Table 5
Approved Products List: Non-metallic restrained joint pipe and couplings for PVC C-900 RJ Type

Manufacturer	PVC C-900	Ductile Iron
CertainTeed Corporation, Certa-Lok C-900/RJ	4 in. – 12 in.	Class 150 (DR-18)
	4 in. – 8 in.	Class 200 (DR-14)

Table 6
Approved Products List: Retainer Gland MJ

Manufacturer	PVC C-900	Ductile Iron
EBBA Iron Sales, Inc.	2000 PV	MEGALUG 1100
Romac Industries, Inc.	Not Approved	Not Approved
Ford/UniFlange	UFR-1500-C 4 in. – 24 in.	Series 1400
StarPipe Products	Stargrip 4000	Stargrip 4000
Sigma Corporation	One Lok SLC	One Lok SLD

Table 7
Approved Products List: Restrained Flange Adapters

Manufacturer	PVC C-900	Ductile Iron
EBBA Iron Sales, Inc.	2100 Megaflange	2100 Megaflange
Ford/UniFlange	900	200, 400, 420

2.2.9. **Copper Tubing and Brass Fittings for Copper Service Lines.**

2.2.9.1. **Copper Tubing.**

All 3/4 in., 1 in., 1-1/2 in. and 2 in. copper tubing for underground service must be of the type commercially known as Type “K” soft and conform to ASTM Designation B-88 and NSF Standard 61.

All 3/4 in. and 1 in. copper tubing must be furnished in 60 ft. coils or 100 ft. coils as specified, 1-1/2 in. must be furnished in 20 ft. lengths, 40 ft. coils or 60 ft. coils as specified, and 2 in. must be furnished in 20 ft. lengths or 4 ft. coils as specified.

2.2.9.2. **Brass Fittings.**

Unless otherwise modified, water works brass goods consisting of corporation stops, curb stops, couplings, connectors, nipples, etc., must be required in underground installations of service lines in the water distribution system.

The brass composition must be in accordance with ASTM Designation B-62 and the threads must be in accordance with AWWA Standard C-800-01 for “Threads for Underground Service Line Fittings.”

All casting must have a natural, clean uniform and smooth surface, and be free from internal porosity. All machining must be in a workmanlike manner and within the acceptable tolerances.

Unless otherwise specified, each fitting must be furnished with a 1/16 in. thick fiber gasket.

All curb stop, corporation and angle valves must be ball valves. “Inverted and Ground Key,” type angle valves will not be accepted.

Ball angle valves must not have a stop.

Laying dimensions, the same as present inverted key style or equal to Mueller H-14258.

Reduced port design will be acceptable provided there is no compromise on flow capacity compared to the “Inverted and Ground Key” type angle valve.

Pack joints will not be acceptable.

Brass fittings must be provided in accordance to Tables 8, 9, 10, and 11.

Table 8
Approved Manufacturers and Models: In Line 2 INCH FIP X FIP

Manufacturer	Model
Ford Meter Box	B11777WR
A.Y. McDonald	6111W
Mueller	B-20200-3
James Jones	J1900

Table 9
Angle Curb Stop Meter Coupling x Compression Approved Manufacturers and Models

Size				
Manufacturer	**3/4 in.**	**1 in.**	**1.5 in.**	**2 in.**
A.Y. McDonald	4652BQ	4652BQ		4612BQ
Ford Meter Box	BA43-232WRQ	BA43- 344WRQ	BFA43- 666WRQ	BFA43777WRQ
Mueller	B24258-R3	B24258-3	B24276-3	B24276-3
James Jones	J1963WSG	J1963WSG	J1975WSGLS	J1975WSGLS
Hays	2520CGJ-R			

Table 10
F.I.P. X METER SWIVEL NUT/COUPLING Approved Manufacturers and Models

Size	
Manufacturer	**3/4 in.**
A.Y. McDonald	4654B
Ford Meter Box	BA13232WR
Mueller	B24265-R3
James Jones	J-1966WLS
Hays	2521-R

Table 11
Ball Corporation Valve Approved Manufacturers and Models

Manufacturer	**CC X CMP**	**IP X CMP**
A.Y. McDonald	4701BQ	4704BQ
Mueller	B-25008	B-25028
James Jones	1937SG	1935SG
Ford Meter Box	FB- 1000Q	FB- 1100Q

2.3. **Gate Valves.**

2.3.1. **General Requirements.**

Except as otherwise modified or supplemented, AWWA Standard C-509-01 or the latest revision, must govern the design, component materials, construction; manufacture and testing of all resilient seated gate valves. Valves must be suitable for frequent operation as well as service involving long periods of inactivity. Valves must be NSF-61 certified.

Gates valves must be provided in accordance to Table 12.

Table 12
Gate Valves Approved Manufacturer List

Sizes 3 in. through 12 in.	
Manufacturer	**Model**
American Flow Control	Series 500
Clow Valve Company	2640
Kennedy Valve	Ken-Seal II
M&H Valve Company	4067
Mueller Company	2360 Series Gate Valve
United States Pipe & Foundry Company	Metroseal 250

The minimum design working water pressure for gate valves with nominal diameters of 3 in., 4 in., 6 in., 8 in., 10 in., and 12 in. must be 200 psi unless otherwise specified.

Valves must be resilient-seated types, bronze mounted with non-rising stems. The closure member must be fully encapsulated by an elastomer without thin spots or voids. When open, the valve must have a clear, full-port, unobstructed waterway.

Gray iron, ductile iron, steel, brass, and bronze materials must meet or exceed the material requirements of Section 2: Materials of AWWA C- 509-01.

Gaskets, O-rings, coatings, and elastomers must meet or exceed the material requirements of Section 2: Materials of AWWA C-509-01.

The gate valves must be designed and constructed for installation in either a horizontal or vertical position. Valves must be designed for buried installation with stem in the vertical position and must be furnished for mounting in a horizontal pipeline, unless otherwise specified.

Valve components of brass or bronze must be manufactured in accordance with ASTM recognized alloy specifications of low zinc content bronze, as shown in Table 1 of Section 2.2.4. of ANSI/AWWA Standard C-509-01 or the latest revision. Materials for the stem have minimum yield strength of 40,000 psi. A minimum elongation in 2 in. of 12% and must be made of bronze in accordance with ASTM B763, alloy number UNS C99500. A maximum zinc content of 2% as shown in Table 2 Chemical Requirements of ASTM B763-96 or the latest revision. Stem nut material must be in accordance with ASTM B- 62 UNS C83600 or ASTM B-584 UNS C84400. The stem must have a visible external marking at the top to indicate low-zinc, high strength material. The marking must include a red plastic or neoprene washer placed around the top of the stem under the operating nut.

Valve ends must be either flanged, tapping valve, mechanical joint, push-on joint, or any combination, as specified. All mechanical joint valves must be supplied with glands, bolts, and gaskets. Valve body bolts and nuts must meet the strength requirements in accordance with ASTM A-307 with dimensions in accordance with ANSI B18.2.1. The size of the bolt head must be equal to the size of the nut and must be stainless steel in accordance with ASTM 276.

All gate valves must open left (counter-clockwise), unless otherwise specified.

The following parts of the valve must be made of either gray or ductile iron:

- body,
- yoke,
- wrench nut,

- O-ring packing plate or seal plate, and
- gland follower.

The gate may be made of gray or ductile iron.

If glands and bushings are used for NRS valves they must be made of ASTM B-763 bronze UNS C99500. The stem must be made of cast, forged, or rolled ASTM B-763 bronze UNS C99500. The stem nut material must be ASTM B-62 bronze UNS C83600 or ASTM B-584 bronze UNS C84400. The gate may be made of bronze ASTM B-763 bronze UNS C99500. Stem seals must be O-ring type. The seals must be designed for dynamic applications. The design must be such that the seal above the stem collar can be replaced with the valve under full pressure in the fully open position.

Materials for the O-ring packing plate must be in accordance with Section 4.8.3 of the ANSI/AWWA C509-01 Standard or the latest revision.

Enclosed and buried valves must be coated inside and outside with a fusion bonded epoxy with a nominal 8 mils dry film thickness, which meets or exceeds AWWA C-550-01 and to the maximum extent possible, must be free of holidays. All coatings in contact with the potable water must be approved for potable water immersion service in accordance with ANSI/NSF Standard 61.

Contractor must submit three sets of certified drawings showing the principal dimensions, general construction, and material specification of the valve proposed. The number of turns to open (close) must be clearly noted on the valve information. The number of turns to open or close the valve must be consistent for each valve size for each approved manufacturer.

Valves furnished under this Specification must be supplied from the approved manufacturer list. To be included on the qualified product list, the manufacturer must provide an Affidavit of Compliance in accordance with the Section 1.5 of the ANSI/AWWA C-509-01 Standard or latest revision. Records of all tests performed in accordance with Section 6.1 and Section 6.2 of the ANSI/AWWA C-509-01 Standard or latest revision must be made available or provided. These records must be representative test results for Section 6.1 and certificate of testing for Section 6.2. An affidavit of testing for the valve assembly as outlined in Section 6.2.2 of the ANSI/AWWA C-509-01 Standard, (350 ft. per pound) must also be provided. A copy of the manufacturer's Quality Assurance Program must be submitted. Blueprints and parts list for the valve must also be provided.

All gate valve parts must be designed to withstand the following two pressure requirements, without being structurally damaged. First, an internal test pressure of twice the rated design working pressure of the valve. Second, the full rated internal working pressure when the closure member is cycled once from a fully open to a fully closed position against the full rated unbalanced working water pressure. In addition to these pressure requirements, the valve assembly and mechanism must be capable of withstanding an input torque of 200 ft. per pound for a 3 in. nominal diameter, 200 ft. per pound for a 4 in. nominal diameter, 300 ft. per pound for a 6 in. nominal diameter, 300 ft. per pound for a 8 in. nominal diameter, 300 ft. per pound for a 10 in. nominal diameter, and 300 ft. per pound for a 12 in. nominal diameter. For sizes larger than a 12 in. nominal diameter, refer to the manufacturer's specifications.

Resilient seats must be applied to the gate and must seat against a corrosion resistant surface. The non-metallic seating surface must be applied in a manner to withstand the action of line fluids and the operation of the sealing gate under long-term service. A metallic surface must have a corrosion resistance equivalent to or better than bronze. A non-metallic surface must be in accordance with ANSI/AWWA C-550. The gate must be fully encapsulated by an elastomer without thin spots or voids. Resilient seats must be bonded. ASTM D-429 either method A or method B must prove the method used for bonding or vulcanizing. For method A, the minimum strength must be at least 250 psi. For method B, the peel strength must be 75 lb. per inch.

Flanged Ends. The end flanges of flanged valves must be in accordance with dimensions and drillings of ANSI/AWWA C-110/A21.10 or ANSI B-16.1, Class 125.

Mechanical Joint Ends. Mechanical joint bell dimensions must be in accordance with ANSI/AWWA C-111/A21.11.

Push-on Joints. Push-on joints must be in accordance with the requirements of ANSI/AWWA C-111/A21.11.

The tapping valves must be mechanical joints with tapping flange on the other end. The tapping valves must be furnished complete with glands, bolts, and gaskets. The tapping valve must have a clear unobstructed waterway.

The seat rings must be of a large diameter to permit entry of the full diameter tapping machine cutters. The valve end which mates with the tapping sleeve must have an alignment lip to fit the recess in the tapping sleeve flange for proper alignment. The lip must be dimensioned in accordance with MSS SP-60 for valves 20 in. nominal pipe size and smaller.

All interchangeable parts must conform to their required dimensions and must be free from defects that could prevent proper functioning of the valve. When assembled, valves manufactured in accordance with this standard must be well fitted and operate smoothly. All like parts of valves of the same model and size produced by the same manufacturer must be interchangeable.

All castings must be clean and sound, without defects that will weaken their structure or impair their service. Plugging, welding, or repairing of cosmetic defects is allowed. Repairing of structural defects is not allowed. Repaired valves must comply with the testing requirements of this Specification after repairs have been made. Repairs within the bolt circle of any flange face are not allowed.

All gate valves must be hydrostatically tested with twice the specified rated pressure applied to one side of the gate and zero pressure applied to the other side. The test must be made in each direction across the gate. All tests must be performed at the manufacturer's plant.

All gate valves must be operated through a complete cycle in the position for which it was designed to ensure free and proper functioning of all parts in the intended manner. Any defects in workmanship must be corrected and the test repeated until satisfactory performance is demonstrated. All tests must be performed at the manufacturer's plant.

A hydrostatic test pressure equal to twice the rated working pressure of the valve must be applied to all assembled valves with the gates in the open position. The test must show no leakage through the metal, pressure containing joints, or stem seals. All tests must be performed at the manufacturer's plant.

A test must be made from each direction at rated working pressure to prove the sealing ability of each valve from both directions of flow. The test must show no leakage through the metal, pressure containing joints, or past the seat. All tests must be performed at the manufacturer's plant.

Markings must be cast on the bonnet or body of each valve and must show the manufacturer's name or mark, the year the valve casting was made, the size of the valve, and the designation of working water pressure, for example "200 W."

Engineer will, at no cost to the Contractor, subject random valves to testing by an independent laboratory for compliance with these standards. Any visible defect or failure to meet the quality standards will be grounds for rejecting the entire order.

2.3.2. **Workmanship.**

All parts of the resilient seat gate valve must be designed and manufactured to the tolerances specified in ANSI/AWWA C-509-01 or latest revision and this Specification.

All parts of the resilient seat gate valve manufactured by a given manufacturer must be interchangeable with like parts from another resilient seat gate valve of the same model and size and by the same manufacturer.

All interchangeable parts must conform to their required dimensions and must be free from defects that could prevent proper functioning of the valve.

All castings must be clean and sound, without defects that will weaken their structure or impair their service. Plugging, welding, or repairing of cosmetic defects is allowed. Repairing of structural defects is not allowed. Repaired valves must comply with the testing requirements of this Specification after repairs have been made. Repairs within the bolt circle of any flange face are not allowed.

The resilient seat gate valves must be well fitted. Operation of the resilient seat gate valve must be smooth. All parts must be free of structural defects.

The resilient seat gate valve must be watertight.

2.3.3. **Painting.**

All exterior and interior surfaces of the valve must be coated with epoxy.

N.S.F. 61 certified. The epoxy must have a nominal dry film thickness of 8 mm, and must be in accordance with AWWA C-550, latest revision.

Coating must be as close to holiday free as is technologically possible.

2.3.4. **Testing.**

Hydrostatic Test. Hydrostatic test must be performed on the valve in accordance with Section 6.1 “Proof of Design Testing” of ANSI/AWWA C- 509-01 or latest revision.

Torque Test. Torque test for prototype valves must be performed on the valve in accordance with Section 6.1 “Proof of Design Testing” of ANSI/AWWA C-509-01 or latest revision.

Leakage Test. Leakage test must be performed on the valve in accordance with Section 6.1 “Proof of Design Testing” of ANSI/AWWA C-509-01 or latest revision.

Pressure Test. Pressure test must be performed on the valve in accordance with Section 6.1 “Proof of Design Testing” of ANSI/AWWA C-509-01 or latest revision.

Operation Test.: Operation test must be performed on the valve in accordance with Section 6.2 “Production Testing” of ANSI/AWWA C-509- 01 or latest revision.

Shell Test. Shell test must be performed on the valve in accordance with Section 6.2 “Production Testing” of ANSI/AWWA C-509-01 or latest revision.

Seat Test. Seat test must be performed on the valve in accordance with Section 6.2 “Production Testing” of ANSI/AWWA C-509-01 or latest revision.

An Affidavit of Compliance certifying that all required tests have been performed must be provided in accordance with Section 6.3 “Affidavit of Compliance” of ANSI/AWWA C-509-01.

The Affidavit of Compliance, the results of ASTM testing procedures, and requirements for materials, Manufacturer's Quality Assurance Program, and the records of all tests performed on the valve must be kept and provided by the supplier and manufacturer in one hard cover bound notebook with the bid or with the shipping documents and must be approved by the Engineer.

2.3.5. **Quality Assurance.**

Manufacturers must have an ASME or I.S.O. 9001 registered commercial quality system. Noncompliance to this registered commercial quality system requirement will result in removal of the manufacturer's product from the approved manufacturer's list shown in Table 12 of this Specification. If on receipt of resilient seat gate valves, they are found to be non-compliant the Contractor must replace the defective resilient seat gate valves according to resilient seat gate valve size with a resilient seat gate valve that meets these specifications at no cost to the Department.

2.3.6. **References**.

American National Standards Institute and American Water Works Association Standard C-509-01 (ANSI/AWWA C-509-01).

Manufacturers Standardization Society MSS SP-60.

2.4. **Valve Boxes.**

All valve box assemblies are to conform to the details shown on the plans. Each valve box assembly must be of cast-iron and must consist of a base, top section, and lid.

Valve boxes must be of one size with a nominal diameter of 6 in.

The valve box lid must be labeled “water” and must be designed to remain firmly seated in place when subjected to vehicular traffic.

The valve box assembly must have enough toughness and strength to withstand impact loads and shock resulting from vehicular traffic.

The valve box assembly must be coated with a standard bituminous coating of either coal tar or asphalt base applied to all inside and outside surfaces.

2.5. **Meter Boxes.**

For non-traffic bearing locations, the meter box assembly for 5/8 in. through 1 in. meters box and lid must be black and constructed of modified polyethylene material for maximum durability and corrosion resistance. The black material is for maximum UV protection and must be uniform throughout meter box and lid for maximum longevity and not have a foaming agent that creates air pockets within the plastic wall. The body and lid must withstand a 20,500 lb. loading in a non-deliberate and incidental traffic.

“Water Meter” and “City of Grandview” must be molded into the lid, or as directed by Owner and as noted on the plans. It must seat securely and evenly inside the meter box and must not overlap the top edge of the meter box.

A diamond pattern for skid resistance and an AMR Slide Mount molded into the lid on the underneath side and off center for placement for an AMR transponder, if specified on the plans, to help in the protection of the radio antenna.

A brass worm gear lock is required to secure the existing cast iron meter box of like dimensions and secure the plastic meter box.

A molded receptacle for placement of key. One piece of 1/2 in. rebar secured in lid.

Plastic body must have the following:

- crush resistant ribbing along the outside of box,
- flange around the top opening to prevent setting and aide in adjustment to grade, and
- designed to accommodate all plastic lids.

For traffic bearing locations, the meter box assembly for 5/8 in. through 2 in. meters must consist of cast-iron rectangular boxes box and a steel checkered plate rectangular with raised lug pattern as shown on the plans.

The castings must be dipped in coal tar at a temperature of 350ºF and the metal must be at a temperature of 300ºF before dipping. The casting must be dipped and cured independently and the coating must have ceased to be “tacky” within 72 hr. after dipping.

The steel checkered plate rectangular cover must be hot dip galvanized after fabrication. The meter box must have an ultimate tensile strength of 25,000 psi and must not be brittle.

The casting must have an “as cast” clean smooth surface and be free from internal porosity; castings that are made smooth by grinding are unacceptable.

2.5.1. **Quality Assurance.** If on receipt of meter boxes or lids, are found to be non-compliant, Contractor must replace defective product at no cost to the Department and the City of Grandview. Any visible defect of failure to meet specification will be grounds for rejecting entire order.

Approved Plastic Meter Box and Lid Manufacturer (or equal):

DFW Plastics Inc. Model Numbers: D-1218-RWSBSM-Complete Box D-1218-RWSBSM-lid D-1218 – body.

2.6. **Fire Hydrants.**

2.6.1. **General Requirements.**

Engineer reserves the right to limit the purchase of fire hydrants from manufacturers and to the models specified, in accordance with Table 13.

Each hydrant must be designed for a minimum working pressure of 200 psi.

All parts of the hydrant must be designed to withstand, without being functionally impaired or structurally damaged, a hydrostatic test of at least 400 psi or twice the rated working pressure, whichever is greater, with the hydrant completely assembled and pressurized with the nozzle caps in place, the main valve open, the hydrant inlet capped, and the test pressure applied to the interior of the hydrant and with the main valve closed, the hydrant inlet capped, and the test pressure applied at the hydrant inlet.

The design safety factor of the operating mechanism must be at least five and must be based on the feet per pound of torque required for the closing and opening of the hydrant at a working pressure of 200 psi. Hydrants must be functional and capable of being opened or closed without difficulty following an application of an operating torque of 200 ft. per pound at the operating nut in the opening direction with the hydrant fully opened and the closing direction with the hydrant fully closed. The torque requirements apply only to hydrants of 5 ft. bury or less.

The length of bury must be as specified.

The fire hydrant must have two hose nozzles and one pumper nozzle. The nominal inside diameter of the hose nozzle must be 2-1/2 in. The nominal inside diameter for the pumper nozzle must be 4 in.

The outlet-nozzle threads must conform to the National Fire Protection Association (NFPA) 2003, Standard for Fire Hose Connections.

The nominal diameter of the main valve opening must be 5-1/4 in.

The hydrant shoe must be provided with a 6 in. mechanical joint connection to fit the connecting pipe. The fire hydrant must open on left turn (counter-clockwise).

The color of the finish paint above the ground line must be red. The fire hydrant must have a non-rising stem.

No more than one 6-in. stem extension is allowable to be provided if required to make the base of the fire hydrant grade level.

The bonnet section must be designed so all bearing surfaces and stem threads are sealed in a lubricant reservoir. If oil is used as a lubricant, the reservoir must be designed to allow for easy filling through a fitting or plug. Where grease is used as a lubricant, the reservoir must be sealed. The reservoir must be adequately sealed with O-rings or other suitable sealing system approved by the Engineer.

The fire hydrant must have a safety flange or breakaway flange at the ground line as stipulated in Section 3.1 “General Design” of ANSI/AWWA C-502-05 or latest revision.

Fire hydrant nozzle cap chains are required and must be attached permanently to the fire hydrant as stipulated in Section 3.2 “Detailed Design” of ANSI/AWWA C-502-05 or latest revision.

Parts that require lubrication, and come into contact with water, must be lubricated with a non-toxic food grade lubricant that does not pose a health hazard to the public if consumed.

2.6.2. **Workmanship.**

All foundry and machine work must be performed in conformance with good standard practice for the class of work involved and with accepted drawings, if required. When assembled, hydrants manufactured in accordance with this Specification must be well fitted and must operate smoothly. The body and shaft must be watertight.

All parts must conform to the required dimensions and must be free from defects that could prevent proper functioning of the hydrant.

All castings must be clean and sound without defects that will weaken their structure or impair their service.

2.6.3. **Paint.**

The exterior surface of the hydrant must be coated with a coating that must meet or exceed the requirements of Federal Specification TT-C-494b. A second coat of water based or oil based enamel paint aluminum in color must then be applied from the top of the hydrant to a point 18 to 20 in. below the center line of the pumper nozzle or down to the traffic safety flange connection at the ground line.

All interior surfaces, machined surfaces, such as the threaded portion of the stem or stem nut, which must fit closely with the adjacent parts, must be coated with a coating meeting or exceeding Federal Specification TT-C-494b. Stem surfaces contained within a lubricant reservoir and not in contact with potable water may be free of coating.

The interior and exterior of the hydrant shoe must be coated with a fusion-bonded epoxy with a nominal dry film thickness of 8 mm, in accordance with ANSI/AWWA C-550-05, and certified to NSF 61.

Coating must be as close to holiday free as is technologically possible.

2.6.4. **Testing and Inspection.**

Each assembled hydrant must be subjected to two shop tests under a hydrostatic pressure of 400 psi or twice the rated working pressure, whichever is greater. One test must be made with the entire interior of the hydrant under pressure and another test made with the main valve closed and the base under pressure from the inlet side. Under the test procedure, there must be no leakage through the main valve or seals or through the castings or the joints of the assembled hydrant. Under the test conditions, the leakage through the drain valves must not exceed 5 fl. oz. per minute. Other leakage or other imperfections found in either test must be

corrected or the hydrant retested. The tests must be conducted for enough time to allow a check of all points of possible leakage and for a minimum of 30 sec. after all air has been exhausted.

Each assembled hydrant must be operated through a full open-close cycle when not under pressure. The torque required for performing this operation must not exceed 200 ft. per pound.

All fire hydrant tests and inspections must be in accordance with ANSI/AWWA C-502 Section 5.1 “Production Testing,” ANSI/AWWA C-502 Section 5.2 “Prototype Testing.” and ANSI/AWWA C-502-05 Section 5.3 “Inspection and Rejection.”

The manufacturer must provide an Affidavit of Compliance in accordance with Section 1.7 “Affidavit of Compliance” of ANSI/AWWA C-502-05 or latest revision.

2.6.5. **Quality Assurance.**

Manufacturers must have an ASME or I.S.O. 9001 registered commercial quality system. Noncompliance to this registered commercial quality system requirement will result in removal of the manufacturer's product from the approved manufacturer’s list in accordance with Table 13. Fire hydrants found to be noncompliant, must be replaced by the Contractor with a fire hydrant that meets this Specification, according to the hydrant size, at no cost to the Department or Owner.

2.6.6. **References.**

American National Standards Institute and American Water Works Association Standard C-502-05 (ANSI/AWWA C-502-05).

American National Standards Institute and American Water Works Association Standard C-550-05 (ANSI/AWWA C-550-05).

Use approved fire hydrant manufacturers in accordance with Table 13.

The City of Grandview will use fire hydrant maintenance kits, in accordance with Table 14.

Table 13
Approved Manufacturers: Fire Hydrants

Manufacturer	Model
American Darling	B84B 5-1/4 in. (w / metal weather cap)
Clow Valve Company	Medallion
Kennedy Valve Company	Guardian
M & H Valve Company	Reliant Model 929
Mueller Company	Super Centurion 250
United States Pipe and Foundry, Inc.	Metropolitan
Waterous	Pacer 100
American AVK Company	Model 2780

Table 14
Approved Manufacturers: Fire Hydrant Maintenance Kits

Manufacturer	Model
American Darling	B84B 5 1/4 in. (w / metal weather cap)
Clow Valve Company	Medallion
Kennedy Valve Company	Guardian
M & H Valve Company	Reliant Model 929
Mueller Company	Super Centurion 250
United States Pipe and Foundry, Inc.	Metropolitan
Waterous	Pacer 100
American AVK Company	Model 2780 Dry

2.7. **Polyethylene Wrapping Material.**

Polyethylene wrapping material must be used to encapsulate all ductile and cast-iron pipe.

Polyethylene wrapping for ductile and cast-iron water mains must consist of a 4 mm tubular section of cross-laminated high-density polyethylene, which has a high dielectric and tensile strength, for use in insulating cast-iron and ductile-iron pipe from the electrolytic action encountered in highly active soils.

Polyethylene wrapping must consist of opaque cross-laminated high-density polyethylene sheet continuously thermally bonded to form a tubular section. The tubes may be supplied in bulk length on rolls or in individual pre-cut lengths. See Table 15 for size and length chart, in accordance with AWWA C-105 (Table 1) for minimum requirements. When supplied in specific pipe lengths, the tubes must contain a minimum of 4 ft. over the actual pipe length to allow for overlap.

The polyvinyl sheet of film for the tubular wrapping is to be of virgin resins meeting raw and physical properties in accordance with ASTM D-1248 and AWWA C-105, latest edition. The material must be 4 mm cross-laminated high-density polyethylene of uniform film thickness and be free of imperfections such as pin holes, etc., after being thermally seamed into tubular form. The finished product must have a nominal thickness of 4 mm, with tolerances of minus10%.

The material must have no volatile constituents, the loss of which may affect ductility. The material must also have the following properties:

2.7.1. **Mechanical.**

The polyethylene film must have a tensile strength per latest ASTM D-882 test, of 6,300 psi minimum. The film must have an elongation of at least 100% of the test strip per latest ASTM D-882 test. The film must have an impact resistance 800 g minimum in accordance with ASTM D-1709 Method B. The film must have a propagation tear resistance of 250 gf minimum in machine and transverse direction in accordance with ASTM D1922.

2.7.2. **Dielectric.**

The film must have a dielectric strength of 800 V per millimeter thickness in accordance with ASTM D-149.

2.7.3. **Marking Requirements.**

The polyethylene film supplied must be clearly marked, at a minimum of every 2 ft. along its length, containing the following information:

- manufacturer's name or trademark,
- year of manufacture,
- ANSI/AWWA C-105/A21.5,
- minimum film thickness and material type,
- applicable range of nominal pipe diameter sizes, and
- Warning-Corrosion Protection-Repair any Damage.

The Engineer may at no cost to the Contractor, subject random testing by an independent laboratory for compliance with this Specification. Any visible defect of failure to meet the quality standards will be grounds for rejecting the entire order.

Table 15
4 mil Polyethylene Wrapping Materials

Size and Length (All sizes lay flat size)	
Pipe Size	**Product Size Width x Length**
4 in., 6 in. & 8 in.	20 in. x 200/500
8 in., 10 in. &12 in.	27 in. x 200/500

Table 16
Approved Manufacturers: Polyethylene Wrapping Material

Manufacturer	Product
Van Leer Flexibles Inc.	Valeron
Manufactured Plastics and Distribution Inc.	Cross Tuff 450 Black

2.8. **Mechanical Couplings.**

Mechanical coupling of Dresser or similar type must be used to connect plain ends of concrete steel cylinder pipe and plain ends of steel and ductile-iron pipe and to connect new and existing ductile iron water main in conjunction with casing installation in conformance with the details shown on the plans.

The mechanical coupling must consist of a cylindrical steel middle ring, two steel follower rings, two rubber compound gaskets, and a set of steel bolts. The middle ring must be flared at each end to receive the wedge-shaped gasket, which is compressed between the middle ring flare and the outer surface of the pipe by pressure exerted on the follower rings through the bolt circle.

The flexible and transition couplings must be manufactured to fit the type size and class of pipe specified. Bolts must be high strength low alloy steel in accordance with AWWA Standard C-111.

2.9. **Blow-off Assemblies and Jumper Connections.**

The materials required for both permanent and temporary 2 in. and 4 in. blow-off assemblies and 4 in. jumper connections are shown on the plans.

2.10. **Backfill.**

Where services 3/4 in. through 2 in. copper are installed, initial backfill must be sand conforming to the following requirements:

- natural sand or sand produced from crushed gravel or crushed rock maximum 1/4 in.,
- 95% must pass No. 4 sieve,
- free from clay and organic material,
- a maximum 8% passing the No. 200 sieve, and

- larger services utilizing ductile iron pipe or PVC (C-900) pipe must be backfilled the same as mains.

2.10.1. **Bedding and Initial Backfill for Water Mains.**

2.10.1.1. Well graded gravels or crushed stone meeting the following requirements of modified grade 5 gravel:

- retained on 1/2 in. sieve: 0%,
- retained on 3/8 in. sieve: 0 – 5 %,
- retained on No. 4 sieve: 20 - 80%,
- retained on No 10 sieve: 75 - 100 %, and
- retained on No 20 sieve: 98 - 100%.

The quantity and thickness of lifts and compaction of initial backfill materials must be in accordance with Section 3.5., “Pipe Laying.”

2.10.2. **Secondary Backfill for Water Mains.**

Secondary Backfill must consist of approved materials excavated from the trench and free of brush, debris, large rock or stones, and earth clods 6 in. or larger. Secondary backfill material must be primarily composed of compactable soil materials.

2.11. **Asphalt.**

Asphaltic concrete used in the replacement of pavement over the trench line must be in accordance with Item 341, “Dense-Graded Hot-Mix Asphalt” (QC/QA), Type “C,” except when the use of 6 in. of asphalt treated base is directed, unless otherwise specified on the plans, or as directed.

2.12. **Concrete.**

Concrete used as the trench cap and in sidewalks and blocking mains must be in accordance with Item 421, “Hydraulic Cement Concrete.” Class “A” concrete must be used on sidewalks and for blocking concrete steel cylinder mains; Class “D” concrete must be used for the trench cap and for blocking all other types, unless otherwise specified on the plans, or as directed.

2.13. **Reinforcing Steel.**

Bar reinforcement must be Grades 40 or 60, that meets Item 440, “Reinforcement for Concrete.”

2.14. **Affidavit of Compliance.**

Unless otherwise directed, Contractor must furnish a manufacturer's Affidavit of Compliance for each of the materials used in this project. The affidavit must certify factory inspection and specified tests have been made and the material furnished complies with the requirements outlined.

3. CONSTRUCTION METHODS

3.1. **Excavation.**

Excavation (trenching) as required to complete the water main installation must be performed in accordance with Item 400, “Excavation and Backfill for Structures,” as shown on the plans, or as directed.

3.1.1. **Trenches.**

Trench walls must be vertical. The practice of undercutting at the bottom or flaring at the top is not permitted except where it is justified for safety or as directed. In special cases where trench flaring is required, the trench walls must remain vertical to a depth of at least 1 ft. above the top of the pipe.

The trench bottom must be square or slightly curved to the shape of the trenching machine cutters. The trench must be accurately graded along its entire length to provide uniform bearing and support for each section of pipe installed upon the bedding material. Bell holes and depressions for joints must be dug after the trench bottom has been graded and bedding installed. The pipe must rest upon the new bedding material for its full length.

Where over-excavation occurs, the under-cut trench must be restored to grade at no cost to the Department and replaced with a material conforming to the requirements of the bedding material or a material approved by the Engineer.

The depth of cut indicated on cut sheets, as furnished by the Engineer, is from the off-set or cut hub elevation to the invert.

3.1.1.1. **Width of Trench.**

3.1.1.1.1. **Minimum Width of Trench.** The minimum width of pipe trenches, measured at the crown of the pipe, must be at least 12 in. greater than the exterior diameter of the pipe, exclusive of bells. The minimum base width of such trench must be at least 12 in. greater than the exterior diameter of the pipe, exclusive of special structures or connections. Such minimum width must be exclusive of trench supports and not greater than the width at the top of the trench.

3.1.1.1.2. **Maximum Width of Trench.** The maximum allowable width of trench for pipelines measured at the top of the pipe must be the outside diameter of the pipe (exclusive of bells or collars) plus 24 in. A trench wider than the outside diameter plus 24 in. may be used without special bedding if the Contractor, at his expense, furnishes pipe of the required strength to carry additional trench load. Such modifications must be submitted to the Engineer and approved in writing. Whenever such maximum allowable width of trench is exceeded, except as provided for on the drawings, or in the specifications, or by the written approval of the Engineer, the Contractor, at his expense, must encase the pipe in concrete from trench wall to trench wall, or other pipe bedding material approved by the Engineer. Any excavation wider than this maximum width or subsequent surface or paving work, must be at the Contractor's expense.

3.1.2. **Classification of Excavated Materials.**

No classification of excavated materials will be made. Excavation and trench work must include the removal and subsequent handling of all materials excavated in accordance with Item 400, "Excavation and Backfill for Structures."

3.1.3. **Grade of Trench Bottom.**

The trench must be over-excavated to a depth of 6 in. below the grade line established for the bottom of the pipe, regardless of the type of pipe. The grade line of the pipe must be met by the addition of a layer of approved bedding material as directed.

3.1.4. **Excavation Below Grade.**

Any part of the bottom of the trench excavated below the limits specified in 3.1.3., "Grade of Trench Bottom," must be corrected with approved material and compacted as directed. Should excessive over excavation occur, except at bell holes, the grade must be restored in accordance with the methods described in Section 3.1.5., "Unstable Conditions at Grade," at no cost to the Department.

3.1.5. **Unstable Conditions at Grade.**

Where the bottom of the trench at grade is found to be unstable or to include ashes, cinders, any type of refuse, vegetable or other organic material, or large pieces of fragments or inorganic materials, which in the judgment of the Engineer, must be removed. Contractor must excavate and remove such unsuitable material to a depth at least 6 in. below pipe. Before the pipe is laid the grade must be restored by backfilling with an approved material in layers of 3 in. before compaction. The layers must be slightly moistened and thoroughly compacted to provide a uniform and continuous bearing and support for the pipe at every point between bell or collar holes. The finished grade must be accurately graded to provide uniform bearing and support for each section of pipe at every point along its entire length, except for the portions of the pipe sections where it is necessary to excavate for bell holes and for the proper seating of pipe joints.

3.1.6. **Trench Excavation Protection.**

All trench excavation required on this project must be accomplished in accordance with the provisions of Item 402, “Trench Excavation Protection.”

3.1.7. **Caution in Excavation.**

Contractor must proceed with caution in the excavation and preparation of the trench so the exact location of underground structures and utilities may be determined whether shown on the plans or not. Machine excavation is not permitted closer than 12 in. on either side of other existing underground utilities. Contractor must be responsible for the repair of such structures and utilities when broken or damaged. Contractor is also responsible for adjusting alignment and trench grades with reference to such structures to obtain specified clearance for the water main construction.

Whenever the Engineer determines it is necessary to explore and excavate to determine the location of existing underground structures and utilities, Contractor must make explorations and excavations for such purposes at Contractor’s expense.

3.1.8. **Protection and Restoration of Underground Structures and Facilities.**

Contractor must furnish temporary support, adequate protection, and maintenance of all underground and surface structures, drains, sewers, and other obstructions encountered in the progress of the work. Underground structures and utilities which are disturbed must be restored at the Contractor’s expense. Materials and methods used for restoration must be in conformance with the local city codes, of the local municipality, for building, electrical and plumbing, and the requirements of the utility agency involved.

If a sanitary sewer is broken by the Contractor's operations, the release of sewage into the trench must be immediately intercepted by the insertion of a section of sheet metal tubing known as a “tin- horn” between the broken ends of the sewer. All leakage at the ends of the “tin-horn” must be effectively stopped. The “tin-horn” must remain in place until permanent repairs can be made. It is the responsibility of the Contractor to determine, well in advance of his trenching operations, the size of all sanitary sewer lines and services which will require this treatment.

All sanitary sewer lines crossing the excavation, whether bridged or replaced, must have proper support consisting of sound timber supports with a minimum 2 in. nominal thickness and a minimum 6 in. nominal width placed with the width horizontal and extending a minimum of 12 in. into the trench wall on either side.

In all cases where a sewer pipe is replaced or bridged, the backfill material must be thoroughly compacted to the bottom of the pipe and compacted by hand from this point to a distance of 6 in. above the top of the sewer line being replaced.

The locations of all sewer lines crossing excavations, whether replaced or bridged must be properly marked, and care must be taken to avoid damage to the pipe by a hydra-tamping machine or other mechanical equipment. Contractor must be liable for the failure of such lines due to negligence or poor workmanship.

3.1.9. **Backfill Material Derived from Excavation.**

All excavated materials which the Engineer determines are suitable for reuse as trench backfill must be separated where practicable from the general excavation material, or as directed.

3.1.10. **Trench Restoration.**

The surface of the backfilled trench must be restored to match the previous existing conditions. This includes final grading, placement of topsoil and seeding, placement of sod (such as at homes or businesses that had maintained lawns), or other unprepared and prepared surfaces. Trenches in alleys actively being used by vehicles (such as trash pickup, vehicle parking, etc.) must be restored by grading and compacting to 98% or higher with a minimum of 4 in. of flex base materials for the entire width of the alley. Alleys not actively used by vehicles must be graded and compacted to 98% or higher, then spread grass seed for entire width of the alley.

3.2. **Pavement.**

Contractor must remove pavement and surfaces as a part of the trench excavation. The removal of pavement and surfaces and their restoration must be based on the minimum trench widths as specified, plus 6 in. either side or as directed. Contractor must use such methods as sawing, drilling, or chipping to assure the breaking of the pavement along straight lines.

If the Contractor removes or damages pavement or surfaces beyond the limits specified above, such pavement and surfaces must be restored at the expense of the Contractor.

Where water line construction necessitates cutting through existing streets outside the limits of new street construction, said streets must be replaced in kind as directed.

Where, in the opinion of the Engineer, it is necessary to maintain traffic across a trench, Contractor must install temporary metal bridges as necessary to facilitate the movement of traffic.

The street surface adjacent to the trench must be kept free of surplus spoil. Construction materials must be placed at locations that will minimize interference with the traveling public.

3.3. **Concrete Sidewalks, Driveways, Etc.**

All concrete sidewalks, driveways, etc., must be cut with a concrete saw. When transverse expansion or “dummy” joints are encountered, the concrete must be removed to the nearest transverse joint on each side of the trench and restored. The depth of cut must be such that upon removal of the concrete, the sides of the cut must be straight and square.

Existing reinforcing wire fabric or bars must be cut and removed to permit completion of trench excavation, pipe laying, and backfill operations. When the backfill operations have been completed, the existing reinforcement must be replaced in its original position and satisfactorily spliced before the replacement of concrete over the new trench alignment.

Transverse “dummy” joints must be made by a jointing tool or other means acceptable and must match in depth and thickness in the existing transverse joints.

Expansion joint material must be provided where new construction abuts the existing curb or driveway if the Engineer deems it necessary.

Concrete must be spaded, tamped, and thoroughly compacted until mortar entirely covers the surface and has a monolithic finish. The top surface must be floated, troweled, and finished to match the existing concrete surface.

Immediately after finishing, the concrete surface must be protected by a membrane compound curing agent, or by wetted cotton or burlap mats. Either method is to be subject to approval.

3.4. **Dewatering.**

Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding areas.

Contractor must not allow water to accumulate in excavations or at subgrade level. Remove water to prevent softening of foundation bottoms and soil changes detrimental to stability of subgrades and foundations. Provide and maintain dewatering system components necessary to convey water from excavations.

Convey water removed from excavation and rainwater to collecting or runoff areas away from buildings and other structures. Establish and maintain temporary drainage ditches and other diversion outside excavation limits. Do not use trench excavations as temporary drainage ditches.

Dewatering devices must be provided by the Contractor with filters to prevent the removal of fines from the soil.

Should the pumping system draw fines from the soil, the Engineer will order immediate shutdown, and remedial measures are the responsibility of the Contractor.

Upon completion of the dewatering work, the Contractor must remove all equipment and leave the construction area in a neat, clean, condition that is acceptable to the Engineer.

Contractor must maintain ground water table at least 12 in. below the finished excavation subgrade.

3.4.1. **Dewatering Performances.** Performances of the dewatering system for lowering ground water must be measured by observation wells on piezometers installed in conjunction with the dewatering system, and these must be documented at least daily. Contractor must maintain a log of these readings and submit them to the Engineer.

No direct payment will be made for costs associated with dewatering. All costs in connection will be included in the applicable Contract price for the item to which the work pertains.

3.5. **Pipe Laying.**

3.5.1. **General Requirements.**

All water mains must be constructed in accordance with the specifications outlined and in conformance with the required lines, grades, and details shown on the plans, or as directed. Successful passage of the pressure testing and disinfection, as described under 30 TAC 290.44, must be required for the acceptance of the mains.

3.5.1.1. **Water Main Crossings.** Where water mains are constructed, in the vicinity of sanitary sewer mains, sanitary sewer force mains, sanitary sewer manholes, and other sanitary sewer facilities, including non-potable waters such as wastewater effluent used in “reuse” applications, the requirements of the 30 TAC 290.44 (e) & (f) must be met.

Contractor must start his work at a tie-in point, unless otherwise indicated on the plans, or directed. Pipe must be laid with bell ends facing the direction of lying, unless otherwise authorized or directed. Under no circumstances should pipe be laid in water and no pipe should be laid under unsuitable weather or trench conditions. All valves and fire hydrants must be installed as soon as pipe laying reaches their established location. Pipe must be installed to the required lines and grades with fittings, valves, and hydrants placed at the required locations.

Spigots must be centered in bells or collars, all valves and hydrant stems must be set plumb, and fire hydrant nozzles must face as shown on the plans, or as directed. No valve or other control on the existing system must be operated for any purpose by the Contractor unless approved.

Contractor must maintain a neat and orderly work area. Complete cleanup must be maintained at all times as closely behind the pipe laying operations as possible, but in no case, is such cleanup permitted to lag more than 1,000 ft. behind the pipe laying, unless otherwise directed.

3.5.2. **Crossing other Underground Lines.**

New water mains crossing other utilities (not including sanitary sewer or "reuse" facilities) must have a minimum of 30 in. of cover over the top of the pipe unless otherwise shown on the plans or as directed. Excavation around other utilities must be by hand for at least 12 in. all around. Any damage to the protective wrap on gas lines or electrodes must be reported immediately to the owner of the gas utility, contact information as shown on the plans. Any damage to other utilities must be immediately reported to the utility owner.

3.5.3. **Pipe Grade.**

Water mains 16 in. or smaller must have a minimum of 48 in. of cover from the proposed final finish ground or street elevation and 60 in. of cover when the main is installed in a parkway or under the pavement where there are no existing or proposed curb or existing drainage facilities. Water mains 20 in. and above must have a minimum of 60 in. of cover over the top of the pipe from the proposed final finish ground or street elevation unless otherwise waived or modified by the Engineer.

Pipe grades must be as required on the plans, or as directed. Grades must be met in accordance with Section 3.1., "Excavation." Care must be taken to ensure the pipe barrel has uniform contact with the bedding material for its full length, except at couplings. The coupling must not be in contact with the original trench bottom before backfilling. Bedding material must be placed under the coupling and compacted by hand before backfilling to provide an even bearing surface under the coupling and pipe. Change in grade must be made only at joints.

3.5.4. **Bedding and Bedding Materials.**

Before placing pipe in a trench, the trench must have been excavated to the proper depth in accordance with Section 3.1, "Excavation." Approved materials must be smoothly worked by hand across the entire width of the trench bottom to provide supporting bedding for the pipe.

3.5.4.1. **Structures to Support Pipe.**

When either the Inspector or Engineer note the material at the bottom of a trench at subgrade consists of material notably unstable and conditions are such that the existing material cannot be reworked to make it stable the trench subgrade must be over excavated, filled with approved material and properly compacted in place to provide a suitable base to support the pipe. If it is determined by the Engineer that this method cannot be used to stabilize the trench subgrade, the Contractor must construct a foundation for the pipe consisting of piling, concrete beams, or other supports in conformance with plans prepared by the Engineer. Extra compensation will be allowed for the Contractor, for the additional work. Coordinate with Engineer for approval of extra compensation before beginning work.

3.5.5. **Lowering Materials into Trench.**

Proper implements, tools, and facilities satisfactory to the Engineer must be approved and used by the Contractor for the safe and convenient execution of work. All pipe, fittings, valves, and hydrants must be carefully lowered into the trench piece by piece by means of a derrick, ropes, or other suitable tools, or equipment in such a manner to prevent damage to water main materials and protective coatings and lining. Under no circumstances should water main materials be dropped or dumped into the trench. Take care to avoid damaging polywrap films. Use of chains or slings is not allowed unless entire sling is wrapped with a protective nylon web sock.

3.5.6. **Installing Pipe.**

Every precaution must be taken to prevent foreign material from entering the pipe while it is being placed in the line. Under adverse trench conditions, extended period of time or otherwise required by the Engineer, a manufactured cap or plug must be used to prevent any foreign type material entering. Leave the cap or plug in place until a connection is made to the adjacent pipe. Inspect the interior of each pipe for defects and reject if defects are found.

After placing a length of pipe in the trench, the jointed end must be centered on the pipe already in place, forced into place, brought to correct line and grade, completed in conformance with the requirements specified. The pipe must be secured in place with approved backfill material tamped around it. Pipe and fittings which do not allow enough uniform space for joints will be rejected and must be replaced with pipe and fittings of proper dimensions. Precautions must be taken to prevent dirt or other foreign matter from entering the joint space.

At times when pipe laying is not in progress the open end of pipe in the trench must be closed by a watertight plug or other means approved. Pipe in the trench which cannot temporarily be jointed must be capped or plugged at each end to make it watertight. This provision must apply during all periods when pipe laying is not in progress.

Should water enter the trench, the seal must remain in place until the trench is completely dry. Contractor must provide plug and caps of various sizes required.

3.5.6.1. **PVC (C-900 and C-905).** Lay PVC mains to the depths and grades shown on plans, or as directed. Lay pipe by inserting spigot end into bell flush with insertion line or as recommended by manufacturer. At no time is bell end allowed to go past “insertion line.” A gap between end of spigot and adjoining pipe is necessary to allow for expansion and contraction.

3.5.6.2. **Tracer Wire.** Tracer wire must be used for location purposes and tapped to the pipe. Tracer wire must be of solid core (14 gauge insulated) and must be taped to the main in minimum 10 in. increments. The tracer wire must also come up to the top of valve extensions and fire hydrant stems, as directed by the Inspector.

3.5.6.3. **Ductile Iron Pipe.**

3.5.6.3.1. **Excavations at Bells and Collars.** Ductile Iron pipe must be installed in conformance with these specifications. Bell holes of enough size must be provided at each joint to permit the joints to be made properly. For mechanical type joints, the minimum clearance between the bell and natural ground must be 6 in. in all directions. Subject to the above provisions, the length of excavation for bell holes below grade of the trench bottom must be kept to a minimum.

Except as otherwise shown on the plans or as directed, anti- corrosion embedment must be provided for all ductile iron pipe, fittings, and valves and at all valves, fittings, or outlets for nonferrous or reinforced concrete steel cylinder pipe. The embedding material must be in accordance with Section 2.10., “Backfill.”

The preparation of the trench must be as set forth elsewhere in these specifications. After the subgrade has been prepared, the pipe must be laid to grade in conformance with these specifications. The pipe, fitting, or valve must be firmly embedded in and surrounded by an insulating blanket of the embedding material. The minimum thickness of this blanket must be 6 in. in every direction.

Where ductile-iron pipe must be installed in a bore, the pipe must be thoroughly cleaned down to the coal-tar enamel pipe coating by approved methods. Where damaged, a prime coat compatible to the polyvinyl tape used must then be applied to the pipe. Following the application of the prime coat, the pipe must be wrapped with Scotchrap, Trantex V-10 polyvinyl tape, or an approved equal. The tape must not be applied until the prime coat is completely dry.

The tape must be spirally and tightly wrapped on each section of the pipe with a 50% lap. The wrap must be made to the bell on the bell end and to a point 6 in. from the spigot end. The joint must be protected with tape 6 in. in width on pipe 12 in. or less in size and with tape 8 in. in width on pipe greater than 12 in. in size.

Ductile-iron pipe installed in a trench must be protected in the following manner. Each pipe joint must be covered with a 4 mm thick polyethylene sleeve that is 2 ft. longer than the pipe joint. The sleeve must cover the full length of the pipe joint, lap over 1 ft. on each end of the adjoining pipe joints, and be secured with a minimum of two circumferential turns of pressure sensitive polyvinyl tape. Excess material must be neatly drawn up around the pipe barrel, folded into an overlap on top of the pipe, and held in place by means of pieces of pressure sensitive tape at approximately 5 ft. intervals. After assembling the joint, the polywrap tube from the previously installed pipe must be pulled over the joint and secured by the Contractor. The polywrap tube from the new joint must be pulled over the first tube and secured by the Contractor to provide a double seal.

Cast-iron and Ductile-iron fittings and valves must be completely wrapped in 8 mm thick polyethylene film with a minimum of one 1 ft. overlap on each end and appropriately taped. Laps must cover joints with adjoining pipe joints or fittings when installed. Fire Hydrant barrel from the surface to the valve must be wrapped as specified.

Any damaged areas in the polyethylene film must be repaired by covering the area with a sheet of polyethylene film large enough to lap over the damaged area 1 ft. minimum in any direction and appropriately taped. Extreme care must be taken at service tap locations to ensure that the tape extends beyond the corporation and onto the service line pipe 1 ft.

Before placing pipe in the trench, a cushion of approved materials must be placed in the trench as required by in the trenching specifications. Backfill material must be carefully placed on the pipe to avoid any damage to the polyethylene sleeve.

Contractor must use care to protect and preserve the polyethylene wrap around ductile iron water mains when installing service corporations. The required method must wrap pipe tape around the pipe over the polywrap in the area to be tapped. The tap must be made through the tape and polywrap. It is not necessary to remove and replace polywrap. All exposed pipe, the corporation, and the first 3 ft. of the service must be wrapped and taped to achieve a complete seal. In addition, a sand envelope must extend over and around the connection to a depth of 8 in. above the main.

All bolts and nuts destined for underground service on valves, fire hydrants, cast-iron mechanical joint fittings, pipe joints, and other ferrous metal appurtenances must be packed in an approved protective coating material after installation. After the joint has been made and bolts drawn to the proper tension, the joint including glands, flanges, bolt heads, and nuts must be covered with an Engineer approved protective coating. Such protective coating is supplemental to anti-corrosive sand embedment as set forth elsewhere in these specifications. Coating and wrapping of joints will be considered incidental to the installation, and no separate payment will be made for this item. Asphaltic material such as Talcote, and other asphaltic type coatings, must not be used.

All cuts made on ductile-iron pipe must be with a power saw or approved mechanical cutter. The cuts must be made at right angles to the pipe axis and must be smooth. The edges of the cut must be finished smoothly with a hand or machine tool to remove all rough edges. The outside edge of pipe must be finished with a small taper at an angle of about 30°.

3.5.7. **Defective or Damaged Material.**

Pipe and accessories must be inspected for defects before being lowered into the trench. Any pipe section, fitting, or special which shows dents, kinks, abrupt changes of curvature other than specified, or any other damage will be rejected. Any pipe section, fittings, or special section that has been dropped (from a truck or crane, etc.) will be rejected. Contractor must, at his expense, replace or recondition each rejected section. Reconditioning procedures must be acceptable to the Engineer. Any defective, damaged, or unsound material must be repaired or replaced as directed.

Should a damaged piece of pipe furnished by the Contractor be placed in the water main, the Contractor must furnish, at his expense, all labor and materials required for removing and replacing the defective pipe and restoring the street to its condition before the failure of the pipe. Should the Contractor damage the pipe

after installation, the Engineer may permit the damaged section to be cut from the length unless it is the opinion of the Engineer that the entire length was damaged. The cost and replacement of broken pipe will be at the expense of the Contractor.

3.5.8. **Holes at Bells and Collars.**

Bell holes of enough size must be provided at each joint to permit the joints to be made properly. For mechanical type joints the minimum clearance between the bell and natural ground must be 6 in. in all directions. Bell holes for concrete steel cylinder pipe must be of enough size of excavation for bell holes below grade of the trench bottom must be kept to a minimum.

3.5.9. **Deviations in Line or Grade.**

Wherever obstructions, not shown on the plans, are encountered during the progress of the work and such obstructions interfere to such an extent that an alteration on the plan is required, the Engineer will have the authority to change the plans and direct a deviation from the line and grade or to arrange with the Owners of the structures for the removal, relocation, or reconstruction of the obstruction. Any deviation from the line must be accomplished by using appropriate bends unless such requirements are specifically waived by the Inspector.

3.5.10. **Cutting Pipe.**

The cutting of pipe for inserting valves, fittings or closure pieces must be accomplished to produce a smooth end at right angles to the axis of the pipe. Strictly follow the recommendations of the pipe manufacturer. Under no circumstances is a workman not equipped with proper safety goggles and helmet and other required safety attire permitted to engage in this work.

3.5.10.1. **Asbestos-Cement (AC).** No field cutting will be allowed on asbestos-cement pipe. Repairs to AC pipe must be accomplished by removing one full joint of AC pipe and replacing with appropriate PVC or Ductile Iron pipe and fittings.

All cuts made on ductile-iron pipe must be with a torch or power saw. The cuts must be made at right angles to the pipe axis and must be smooth. The edges of the cut must be finished smoothly with a hand or machine tool to remove all rough edges. The outside edge of pipe must be finished with a small taper at an angle of about 30°.

Field Cut PVC (C-900 and C-905) using a power saw with a steel blade or abrasive disc depending on the size of pipe. If a bevel is needed after field cutting, it must be in accordance with Uni-Bell recommendations.

To facilitate future repair work on water mains, no sections less than 3 ft. in length between fittings is allowed.

3.5.11. **Coating and Wrapping Underground Pipe.**

3.5.11.1. **Steel Pipe.**

Steel pipe, bends and specials must be prepared, primed, painted or wrapped in the field as follows.

3.5.11.1.1. **Exterior Surface Above Ground.** Exterior surfaces of new pipe and appurtenances installed must be thoroughly cleaned to bare metal by high speed wire brushing, scraping, or other suitable methods approved by Engineer, given one coat of industrial grade rust inhibitive primer and two finish coats of aluminum paint.

3.5.11.1.2. **Exterior Surfaces Underground.** Exterior surface of steel pipe, bends and specials installed in open trench must be thoroughly cleaned to bare metal by high speed wire brushing, scraping, or other suitable methods approved by Engineer, given one coat rust inhibitive primer and wrapped with polyvinyl tape in accordance with AWWA C-203-91 “Protective Coatings for Steel Water Pipelines,” (Appendix C).

The procedure for coating flanged joints and mechanical coupling joints when used with steel pipe must be as specified.

3.5.11.1.3. **Interior Surfaces.** The interior surfaces of steel pipe, fittings and specials must be cleaned by sandblasting and then primed and coated in the shop with coal tar enamel.

3.5.11.2. **Ductile-Iron Pipe.**

3.5.11.2.1. **Open Trench.** Ductile-iron pipe to be installed in a trench must be protected in the following manner. Each pipe joint must be covered with a 4 mm thick polyethylene sleeve that is 2 ft. longer than the pipe joint. The sleeve must cover the full length of the pipe joint, lap over 1 ft. on each end of the adjoining pipe joints and be secured with a minimum of two circumferential turns of pressure sensitive polyvinyl tape. Excess material must be neatly drawn up around the pipe barrel, folded into an overlap on top of the pipe, and held in place by means of pieces of pressure sensitive tape at approximately 5 ft. intervals. After assembling the joint, the polywrap tube from the previously installed pipe must be pulled over the joint and secured by the Contractor. The polywrap tube from the new joint must be pulled over the first tube and secured to provide a double seal.

Cast iron and ductile-iron fittings must be completely wrapped in 8 mm thick polyethylene films with a minimum of 1 ft. overlap on each end and appropriately taped. Laps must cover joints with adjoining pipe joints or fittings when installed. Fire hydrant barrel from the surface to the valve must be wrapped as specified.

Any damaged areas in the polyethylene film must be repaired by covering the area with a sheet of polyethylene film large enough to lap over the damaged area 1 ft. minimum in any direction and appropriately taped. Take care at service to locations to ensure that tape extends beyond corporation and onto service line pipe 1 ft.

Before placing pipe in the trench, a cushion of approved materials must be placed in the trench as required by Section 3.7., “Backfill,” material must be carefully placed on the pipe to avoid any damage to the polyethylene sleeve.

Use care to protect and preserve polyethylene wrap around ductile iron water mains when installing service corporations. The required method must wrap pipe tape around pipe over polywrap in the area tapped. The tap must be made through the tape and polywrap. It is not necessary to remove and replace polywrap. All exposed pipe, the corporation, and the first 3 ft. of the service must be wrapped and taped to achieve a complete seal. In addition, a sand envelop must extend over and around the connection to a depth of 8 in. above the main.

3.5.11.2.2. **In Casing.** Where ductile-iron pipe is installed in a bore, the pipe must be to thoroughly clean down to the coal- tar enamel pipe coating by approved methods. Where damaged, a prime coat compatible to the polyvinyl tape used must be applied to the pipe. Following application of prime coat, wrap pipe with Scotchrap, Trantex V-10 polyvinyl tape, or approved equal. Tape must not be applied until prime coat is completely dry.

Tape must be spirally and tightly wrapped on each section of pipe with 50% lap. Wrap must be made to bell on bell end and to a point 6 in. from spigot end. Protect joint with tape 6 in. in width on pipe 12 in. or less in size and 8 in. on width on pipe greater than 12 in. in size.

3.5.12. **Protective Coating and Wrapping on Joints.**

All bolts and nuts installed for underground service on valves, fire hydrants, cast- iron mechanical joint fittings, pipe joints, and other ferrous metal appurtenances must be packed in an approved protective coating material after installation. After the joint has been made and bolts drawn to proper tension, the joint including glands, flanges, bolt heads, and nuts must be covered with an approved coating. Such protective coating is supplemental to anti-corrosive sand embedment. Asphaltic coatings such as Talcote, or other asphaltic type coatings, are not allowed. Coating and wrapping of joints must be considered subsidiary to the installation and will not be paid for directly.

3.5.12.1. **Steel Pipe Field Welded Joints.** After installation of pipe, bends and specials, all end of pipe adjacent to welded field joints, including the weld proper, must be cleaned, primed, painted, or wrapped as specified for the pipe adjacent to the weld.

3.5.13. **Joint Assembly.**

3.5.13.1. **Rubber Ring Joints.** The installation of pipe and the assembly of rubber ring joints for ductile-iron pipe, concrete-steel cylinder pipe, and asbestos cement pipe, must conform to the pipe manufacturer's assembly instructions. The method of inserting spigot ends of pipe in bells or collars known as “stabbing” is not permitted with pipe larger than 6 in. in size. Spigot ends of pipe larger than 6 in. in size must be properly inserted in the joint by means of suitable pushing or pulling devices.

3.5.13.2. **Mechanical Couplings.** The installation of mechanical couplings must be assembled and installed according to the standards recommended by the manufacturer. Before the installation of the mechanical coupling, the pipe ends must be cleaned by wire brush or other acceptable method to provide a smooth bearing surface for the rubber compression gasket. The pipe must be marked to align the end of the coupling which must center it over the joint. After positioning, the nuts must be drawn up finger tight. Uniform pressure on the gaskets must be applied by tightening alternate bolts on the opposite side of the circle in incremental amounts. Final tensioning must be accomplished with a torque wrench and in a manner similar to the tightening procedure. The coupling must then be left undisturbed for 24 hr. to allow the gaskets to “pack- in.” Final torque check must be made before coating and wrapping the joint. Table 17, “Torque for Mechanical Couplings,” sets forth the proper torque for various sized mechanical couplings and is included for the convenience of the Contractor.

3.5.13.3. **Restrained Joints.** Install restraint joints as shown on plans or as directed by the Engineer. Install in accordance with manufacturer’s recommendations.

Table 17
Torque for Mechanical Couplings

Coupling Size	Bolt Diameter	Torque
2 in. to 24 in.	5/8 in.	75 ft. per pound
2 in. to 24 in.	3/4 in.	90 ft. per pound
30 in. and 36 in. (1/4 in. x7 in. Middle Rings)	5/8 in.	65 ft. per pound
30 in. thru 36 in. (3/8 in. and heavier Middle Rings)	5/8 in.	70 ft. per pound
30 in. to 48 in.	3/4 in.	80 ft. per pound
48 in. to 72 in.	3/4 in.	70 ft. per pound

3.5.14. **Gray Iron and Ductile Iron Fittings.**

3.5.14.1. **Fittings.** Fittings 6 in. through 12 in. in size must be either mechanical joint, push-on joint short body, or push-on joint compact body unless otherwise stated on the plans or as directed. Fittings must be installed with the thrust blocking or joint restraint shown in standard drawing DD-839 series. Fittings 16 in. through 24 in. in size must be mechanical joint type unless otherwise specified on the plans. Adaptors must be used where necessary to provide a transition between asbestos-cement pipe and the fittings. Restraint or thrust blocking must be provided as specified on the plans or as directed. Anti-corrosion embedment incidental to all installed cast-iron fittings must be provided and no separate payment will be made for this embedment.

3.5.14.2. **Cleaning Ductile Iron.** All lumps, blisters, and excess coal-tar coating must be removed from the ends of ductile-iron pipe fittings. The outside of the spigot and the inside of the bell must be wire-brushed and wiped clean, dry, and free from oil and grease before the pipe is laid. The interior of the pipe must be blown clean with compressed air or swabbed out clean and dry as directed. Immediately before placing any pipe in the trench the interior must be cleaned by an approved brush or swab or with compressed air to remove all dirt

and foreign materials. All pipe and fittings must be inspected by the Contractor for defects while suspended above ground.

3.5.15. **Corrosion Protection for Ferrous Pipe, Fittings, and Valves.**

Except as otherwise shown on plans or as direct, anticorrosion embedment must be provided for all ductile-iron pipe, fittings and valves, and at all valve fittings or outlets for nonferrous or reinforced concrete steel cylinder pipe. The embedding material must be Modified Grade 5 gravel in accordance with Section 2.10 of this Specification.

Prepare the trench in accordance with Section 3.1 of this Specification. After subgrade has been prepared, lay pipe to grade in conformance with the plans and specifications. Pipe, fitting, or valve must be firmly embedded in and surrounded by an insulating blanket of embedding material. The minimum thickness of this blanket must be 6 in. in every direction.

3.5.16. **Tie-in to Existing Mains.**

Contractor must make all ties to existing mains shown on plans or as directed. Contractor is responsible for; shutdowns and isolation of existing main, coordinating with the City of Grandview on site before cutting pipe for connection, dewatering the excavation, customer notification of shutdown, proper material and all other requirements as directed to provide completion in a safe and secure manner. Tie-ins must be during normal work hours, (8 A.M. – 5 P.M.). During construction, planned shutdown and tie-in must be coordinated through and approved by the Engineer. Planned shutdown and tie-in must be accomplished at a time which must be at the least inconvenience to customers. No additional compensation will be provided for tie-ins accomplished after normal working hours. Tie-in to existing mains of asbestos cement (AC) pipe, Contractor must observe and comply with all federal, state and local laws, ordinances and regulations regarding the management of asbestos containing materials. At the minimum, work involving AC pipe must be overseen by a person who has received asbestos training and is familiar with the National Emissions Standards for Hazardous Air Pollutants (NESHAP). If greater than 260 ft. of pipe must be removed, written notification to the Texas Department of Health (TDH) 10 days before commencing with the removal of AC pipe is required. At each location shown on the plans and identified by the Contractor to involve AC pipe, the Contractor is required to coordinate with the Department's AC Abatement Contractor for the removal of the necessary amount of AC pipe required to make the connection without creating any friable material. The Department's AC Abatement Contractor must remove whole sections of AC pipe so the Contractor can make the tie-in at the nearest joint. The Department's AC Abatement Contractor must remove the AC pipe, store it in a secure Engineer approved location, and dispose of it. Before requiring the service of the Department's AC Abatement Contractor, the Contractor must notify the Engineer and the City of Grandview of the work schedule, a minimum of two weeks in advance of requiring such services, not to delay the overall project. Delays or claims made by the Contractor, resulting from the failure to provide advanced notification and schedule coordination with the Department's AC Abatement Contractor, will not result in additional payment.

3.5.17. **Abandonment of Old Mains and Valves.**

Contractor must accomplish all cutting, capping, plugging, and blocking necessary to isolate those existing mains retained in service from those abandoned. The open ends of abandoned mains and all other openings or holes in such mains occasioned by cutting or removal of outlets must be blocked off by manually forcing cement grout or concrete into and around the openings in enough quantity to provide a permanent substantially watertight seal.

Valves abandoned in the execution of the work must have the valve box and extension packed with sand to within 8 in. of the finished surface. The remaining 8 in. must be filled with 2,500 psi concrete or an equivalent sand-cement mix and finished flush with the adjacent pavement or ground surface. The valve covers must be salvaged and returned to the City of Grandview. Abandoning old mains and valves must be considered subsidiary to the installation and will not be paid for directly.

3.5.18. **Pipe Joint Restraint System.**

Pipe joint restraints must be used to prevent movement for PVC push-on bell and spigot pipe connections. The restrainer may be adapted to connect a plain end PVC pipe to a ductile iron mechanical joint (MJ) bell fitting. Joint restraint must be non-directional and installed to fully restrain system.

3.5.19. **Concrete Encasement, Cradles, Saddles and Collars.**

3.5.19.1. **Concrete Encasement.** When concrete encasement is shown on the plans or when directed, the trench must be excavated and fine graded to a depth conforming to the details and sections shown on the plans. The pipe must be supported by pre-cast concrete blocks of the same strength as the concrete for encasement and securely tied down to prevent floatation. Encasement concrete must be placed to a depth and width conforming to details and sections shown on the plans.

3.5.19.2. **Concrete Cradles.** When concrete cradles are shown on the plans or when directed, the trench must be prepared and the pipe supported in the same manner as described in Concrete Cradles, of this Section. The cradle must be constructed in conformance with details and sections shown on the plans. Straps or tie downs must be No. 4 rebar diameter minimum or better as determined by the Engineer.

3.5.19.3. **Concrete Saddles.** When shown on the plans or when directed, pipe to receive concrete saddle must be backfilled in accordance with Section 3.7., “Backfill,” of this Specification to the spring line and concrete placed for a depth and width conforming to details and sections shown on the plans.

3.5.19.4. **Concrete Collars.** When shown on the plans or when directed, concrete collars must be constructed in conformance with details and sections shown on the plans.

3.6. **Fire Hydrants and Miscellaneous Appurtenances.**

3.6.1. **Fire Hydrants.**

Hydrants must be connected to the main as shown on the plans or as directed. They must be installed in a manner which must provide complete accessibility and in a sage location where there is a minimum possibility of damage from vehicles or injury to pedestrians.

When the hydrant is placed directly behind the curb, the hydrant barrel must be set so no portion of the hydrant will be less than 12 in. nor more than 7 ft. from the back of the curb.

When the hydrant is set in the lawn space between the curb and the sidewalk or between the sidewalk and the property line, no portion of the hydrant or nozzle cap must be within 6 in. of the sidewalk. Setting final grade of fire hydrants to match proposed or existing field conditions is the responsibility of the Contractor.

Hydrants must be set in conformance with plans and details must be set plumb and must have their nozzles parallel with or at right angles to the curb with the pumper nozzle facing the curb. Drainage and concrete pad must be provided at the base of the hydrant as shown on the plans, or as directed. No fire hydrant drainage system or pit must be connected to a storm sewer or to a sanitary sewer.

3.6.1.1. **Restrained Joints.** Restrained mechanical joints that require field welding or groove cuts into the pipe barrel for restrain will not be accepted. Restrained joints must be furnished for pipe at all changes in direction as indicated on plans, details, or as directed. Restrained mechanical joints must be locked mechanical joints. Joints must be capable of test pressure twice the maximum sustained working pressure of 350 psi for ductile iron pipe and PVC.

3.6.1.2. **Replacing and Relocating Existing Fire Hydrants.** When existing fire hydrants are replaced or relocated, the work must be accomplished by either of the following:

- cutting or installing a tee of the size and type indicated on the plans or as directed,
- using a tapping sleeve and valve of the size and type indicated on the plans to install and a new fire hydrant to an existing or new water main; size on size taps is not permitted,
- retained on No. 4 sieve: 20 - 80%, and

- retained on No. 10 sieve: 75 - 100%.

Using a tapping sleeve and valve of the size and type indicated on plans to install a new fire hydrant to an existing or new water main. Size on size taps is not permitted.

Relocating the existing fire hydrant by closing the existing fire hydrant, extending the fire hydrant branch and installing the existing fire hydrant as specified.

Salvage the existing fire hydrant and other materials as designated in the field by the Inspector and Owner and deliver to City of Grandview at a location determined by the Engineer. Fire hydrant branches must be abandoned by cutting and capping fire hydrant cast iron tee at the service main and surface restored to its original condition.

After the fire hydrant has been set, paint hydrant with suitable primer and finish with oil-based aluminum paint from top of hydrant to a point 18-20 in. below center line of the pumper nozzle and apply to all exposed metal surfaces above the hydrant base flange. The payment for fire hydrant painting must be included in the unit cost for installing the fire hydrant.

Pipe, fittings, and valves used in the placement of fire hydrants and connections to the main must be considered subsidiary to the fire hydrant installation and not a part of the main construction and will not be paid for directly.

3.6.2. **Valve Boxes, Adjustments.**

Valves must be provided with valve boxes, manholes, or valve pits as shown on the plans, or as directed.

The valve box must be placed in such a manner to prevent shock or stress from being transmitted to the valve. It must be centered and set plumb over the operating nut of the valve with the box cover flush with the surface of the finished pavement or at such other level as directed. Valve boxes located in streets or other areas subjected to vehicular traffic must be provided with concrete collars as shown on the plans, or as directed. Collars around such valve boxes must be formed and finished off neatly.

Valve box must be located so the valve operating nut is readily accessible for operation through the opening in the valve box. The valve box must be set flush with the surface of the finished pavement or at such other elevations as may be specified. Pits must be constructed to permit minor valve repairs and to afford protection to the valve and pipe from impact where they pass through the pit walls.

Existing valve boxes located within the limits of new street construction which are in conflict must be adjusted to match proposed finish grades.

Valve boxes installed as part of a new valve and mainline construction project are considered “new valves.” Adjustments to “new valves” are incidental to the installation of the valve. No separate pay will be given to adjust “new valves” to finished grade.

3.6.3. **Blow-offs.**

Permanent and temporary blow-off assemblies must be installed at the locations shown on the plans, or as directed. The permanent blow-off must consist of all galvanized pipe, valve, and fittings of the various sizes detailed on the plans, 6 in. valve box assembly including the 6 in. valve box and concrete collar around the valve box where subjected to vehicular traffic. The temporary blow-off must consist of all galvanized pipe, valve, and fittings of the various sizes detailed on the plans, or as directed. Valve box must be raised and installed to finished grade in accordance with details.

3.6.4. **Buried Gate and Butterfly Valves.**

Valve installation must include valve, reaction blocking when required conforming to plans, cast iron boot, valve box extension (Ductile Iron Riser Pipe), valve box, concrete collar where subjected to vehicular traffic, and valve box lid. Valves constructed in terrace must be constructed with No. 3 bars all around.

The valve box must be placed to prevent shock or stress being transmitted to the valve. All valves located 6 ft. and deeper must include valve key extensions inside the valve box. The Contractor has the option to install fully adjustable valve box and valve key extension systems, on all valves located between 6 ft. and 13 ft. Adjustable valve box and valve key extension systems must be centered over the valve's operating nut with the box cover flush with the finished pavement surface or located at another level as directed. Valve boxes located in streets or other area subject to vehicular traffic must be provided with concrete collars as shown on the plans, or as directed. Collars around such valve boxes must be formed and finished off neatly and in a workmanlike manner.

Valve pits must be located so the valve operating nut is readily accessible for operation through the opening in the valve box. The valve box must be set flush with the finished pavement surface or at other finish elevations as may be specified. Pits must be constructed to permit minor valve repairs and provide protection to the valve and pipe from impact where penetrating through pit walls. In a High-Pressure Distribution System as specified in this Specification, all valves 6 in. and larger, must be supported on a concrete pad in accordance with the plans, or as directed.

3.6.5. **Anchorage and Blocking.**

Suitable reaction blocking or anchorage must be provided at all dead ends, plugs, caps, tees, crosses, valves, and bends as shown on the plans, or as directed. All mechanical restraints must be bidirectional. Anchor blocks must be constructed solidly behind the fitting and symmetrical with the axis of resultant thrust except where this is not possible, as in the case of gravity anchorage for vertical bends. Special ties and anchor fittings may be used in conjunction with blocking when shown on the plans, or as directed.

Thrust blocking must be a minimum of Class "A" (3,000 psi), concrete placed between solid ground and the fitting except as shown on the plans, or as directed. The area of bearing in contact with solid ground must be as shown on the plans or as directed.

All thrust blocking placed in conjunction with mains and appurtenances constructed in conformance with standard details provided in the construction drawings. In all cases, the design of thrust blocking must be of enough size to withstand a soil pressure of 3,000 psf, unless specified otherwise in the job plans or specifications. The maximum soil pressure value that will be allowed for the design of thrust blocking must be 5,000 psf. When soil pressure bearing values of 4,000 psf or 5,000 psf are recorded for design of thrust blocks, copies of soil tests made for determining the bearing value of the soil in question must be submitted to the Engineer for verification.

The blocking must be placed so pipe and fitting joints must be accessible. Pipe polywrap must be placed between the pipe or fitting and the concrete.

The reaction block on the unused branch of a tee must be poured separately from the block across the back of the tee. If they are poured simultaneously, a rigid partition must be placed between the blocks.

Valves 12 in. and larger in size must be supported on a concrete pad extending vertically from 12 in. below the bottom of the valve to the lower quarter point of the hub and laterally from face to face of hubs and transversely from wall to wall of the trench.

3.7. **Backfill.**

3.7.1. **Initial Backfill.**

Initial backfill is defined as backfill with a thickness in its compacted state from the surface of the bedding to a point 1 ft. above the top of pipe. The first lift of initial backfill must be inspected and approved before placement of the second lift.

The second lift of initial backfill material must extend from the spring line of the pipe with a minimum of 1 ft. above the top of the pipe. The second lift must be evenly spread in a similar manner as the first lift.

For diameters 24 in. and larger, simultaneously spread initial backfill material alongside, under the lower quadrant of pipe and over the pipe in 12 in. lifts to a minimum of 1 ft. above the top of pipe.

Consolidate initial backfill material to assure it is incorporated. A handheld vibrator, commonly used for concrete work, can be used for this purpose. The vibrator must be inserted every 3 ft. on each side of pipe.

3.7.2. **Secondary Backfill.**

Secondary backfill is defined as backfill from 1 ft. above the top of pipe to the top if the trench. Secondary back fill is to be constructed in conformance with details shown on plans and these specifications, or as directed.

Secondary backfill material must be placed in maximum 12 in. loose lifts or as directed.

3.7.3. **Sand Backfilling of Cross Trenches and Open Holes.**

Blow-offs, tie-ins, air release valves, and service lines, meter boxes, or other specials must be backfilled with sand and thoroughly consolidated by saturating with water, unless otherwise directed. The use of mechanical tamping equipment for compaction of backfill will not be permitted at such locations. Disposal of surplus excavated material and placement of sand must be considered subsidiary to trenching and backfilling and will not be paid for directly.

3.7.4. **Trench Backfill Across Traffic Arteries.**

Any trench in or across traffic arteries must be backfilled immediately after the pipe is installed unless the Engineer determines unusual conditions exist that render immediate backfilling unfeasible.

3.7.5. **Flowable Backfill.**

Instead of normal backfill materials, the Contractor must backfill the trench with flowable backfill with fly ash material at the locations shown on the plans and at locations directed. The flowable backfill material and operation must be in accordance with Item 401, “Flowable Backfill.”

3.8. **Flushing and Testing Mains.**

3.8.1. **Flushing.**

Immediately upon completion of pipe lying, the Contractor must flush all mains. This flushing must be at the direction of the Engineer and must consist of completely filling sections of main between valves and displacing such initial volumes of water by introducing clear water from existing facilities into and through the main to the point of discharge from the main being flushed.

The flow-through must continue until the Engineer determines all dust, debris, or foreign matter that may have entered during pipe laying operations has been flushed out. The new line must be left under system pressure for testing.

To avoid damage to pavement and inconvenience to the public, fire hoses must be used to direct flushing water from the main into suitable drainage channels or sewers.

3.8.2. **Operation of Valves.**

No valve in the distribution system must be operated by the Contractor without prior permission. The Contractor must notify the utility Owner when a valve must be operated and must only operate the valve in the presence of the Engineer's representative.

3.8.3. **Hydrostatic Tests.**

Except in high pressure sections of the water distribution system where test pressures must exceed 150 psi, all new mains must be hydrostatically field tested at a maximum test pressure of 150 psi before approval by the Engineer. Where designated as "high pressure area," all new mains must be hydrostatically field tested at a maximum test pressure of 200 psi before acceptance by the Engineer. All joints which are found to leak either by observation or during any test must be made watertight by the Contractor. In case repairs are required, the hydrostatic field test must be repeated until the pipe installation conforms to the specified requirements and is acceptable. The expense for tests which meet specified requirements must be made in accordance with the unit price for the hydrostatic pressure test. No payment will be made for tests which fail to meet specified test leakage requirements.

After the new main has been laid and backfilled as specified, but before chlorination and replacement of pavement, it must be filled with water for a minimum of 24 hr. and then subjected to a hydrostatic pressure test. The specified test pressure must be supplied by means of a pump connected to the main in a satisfactory manner. The pump, pipe connection, and all necessary apparatus including gauges and meters must be furnished by the Contractor. Unless otherwise specified, the Water System Company will furnish water for filling lines and making tests through existing mains.

Before applying the specified test pressure, all air must be expelled from the main. To accomplish this, taps must be made, if necessary, at the points of highest elevation and afterwards tightly plugged at no cost to the Department or City of Grandview. At intervals during the test, the entire route of the new main must be inspected to locate any leaks or breaks. If any are found, they must be stopped or repaired. The test must be repeated until satisfactory results are obtained.

The hydrostatic test must be made so the maximum pressure at the lowest point does not exceed the specified test pressure. The duration of each pressure test must be a minimum of 4 hr. for new mains in excess of 1,000 ft. and a minimum of 1 hr. for new mains less than 1,000 ft. after the main has been brought up to test pressure. The test pressure must be measured by means of a tested and properly calibrated pressure gauge acceptable to Engineer. All pressure tests must be continued until the Engineer is satisfied that the new main meets the requirements of these specifications. Should any test of pipe in place disclose leakage greater than listed in Table 18 or 19, Hydrostatic Test Leakage Allowances, the Contractor must, at their expense, locate and repair the defective joints until the leakage is within the specified allowance. Leakage is defined as the quantity of water supplied into the newly laid main, or any valve section of it, necessary to maintain the specified leakage test pressure after the main has been filled with water and the air expelled. The Contractor must notify the Engineer before beginning the test, and the water system company's Inspector must be present during the pressure test.

PVC pipe leakage allowances must conform to DI leakage allowances in accordance with Tables 18 and 19, Hydrostatic Test Leakage Allowances.

Table 18
Hydrostatic Test Leakage Allowance (Maximum) @ 150 psi
Allowable Leakage in Gallons Per Hour (GPH)

	Pipe Length in Feet													
Pipe	**100**	**200**	**300**	**400**	**500**	**600**	**700**	**800**	**900**	**1,000**	**2,000**	**3,000**	**4,000**	**5,000**
6" DI[1]	0.11	0.22	0.33	0.44	0.55	0.66	0.77	0.88	0.99	1.10	2.20	3.30	4.40	5.50
8" DI[1]	0.15	0.29	0.44	0.59	0.74	0.88	1.03	1.18	1.32	1.47	2.94	4.41	5.88	7.35
12" DI[1]	0.22	0.44	0.66	0.88	1.10	1.32	1.54	1.76	1.98	2.20	4.40	6.60	8.80	11.00

1. DI Pipe includes mechanical and push-on joints

Note: Leakage allowances may be determined for footages not specifically listed by interpolation or by the combination of various tabular data.

Table 19
Hydrostatic Test Leakage Allowances (Maximum) @ 200 psi
Allowable Leakage in Gallons Per Hour (GPH)

	Pipe Length in Feet									
Pipe	**100**	**200**	**300**	**400**	**500**	**600**	**700**	**800**	**900**	**1,000**
6" DI[1]	0.13	0.25	0.38	0.51	0.64	0.76	0.89	1.02	1.14	1.27
8" DI[1]	0.17	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70
12" DI[1]	0.26	0.51	0.77	1.02	1.28	1.53	1.79	2.04	2.3	2.55

1. DI Pipe includes mechanical and push-on joints

Note: Leakage allowances may be determined for footages not specifically listed by interpolation or by the combination of various tabular data.

3.9. **Disinfection.**

3.9.1. **Disinfection of New Mains Utilizing Machine Chlorination.**

After the new mains have successfully passed the pressure test in accordance with Section 3.8.3., "Hydrostatic Tests," Contractor must disinfect mains as shown on the plans or as directed as "Machine Chlorination." This disinfection must include chlorination, flushing, and placing the mains in service. All other disinfection requirements must also be accomplished by the Contractor.

3.9.1.1. **Operation of Valves.**

During and after the disinfection of mains, the Contractor will be notified by the Engineer in advance to enable the Contractor to have a competent representative present whenever valves must be operated that will affect the pressure in any part of the work for which the Contractor is responsible.

Contractor must supply labor and equipment necessary to make all excavations required for chlorination, equipment connections, subsequent flushing, and placing the mains in service.

3.9.1.2. **Safeguarding and Backfilling Open Holes.**

Contractor must be responsible for safeguarding any open holes excavated or left open for flushing and disinfection purposes. Following completion of disinfection, the Contractor must backfill such holes in accordance with appropriate provisions of Section 3.7., "Backfill."

3.9.2. **Disinfection of Mains Utilizing Dry Calcium Hypochlorite.**

Mains must be disinfected with dry calcium hypochlorite (HTH) where shown on the plans, or as directed, and must not exceed a total length of 800 ft. This method must also be followed for main repairs. Contractor must use appropriate safety measures to protect personnel during disinfection operation.

3.9.2.1. **Dosage.**

Contractor must disinfect the new or replaced mains with calcium hypochlorite (HTH) of 70% available chlorine. Enough calcium hypochlorite (HTH) must be used to obtain a minimum chlorine concentration of 50 ppm. The following Table 20, Chlorine Dosage, is included for the convenience of the Contractor:

Table 20
Chlorine Dosage

Diameter of Pipe (in.).	Ounces Per Foot To Obtain 50 ppm Chlorine Dosage
6	0.0138
8	0.0233
10	0.0364
12	0.0523

A heaping tablespoon holds approximately 1/2 oz., and a standard measuring cup holds approximately 8 oz.

3.9.2.2. **Filling the Main.**

Those sections of main to which dry calcium hypochlorite (HTH) has been applied must be filled slowly to allow for the even distribution of the disinfecting material. The manipulation of valves must be under the direction of the Engineer in accordance with Section 3.9.1.1., “Operation of Valves.”

3.9.2.3. **Holding Time.**

The length of time that sections of main disinfected with calcium hypochlorite (HTH) must be allowed to stand undisturbed will depend upon the particular job and Texas Commission on Environmental Quality (TCEQ) criteria.

When circumstances permit a shutdown with no customers out of service, the required minimum detention time must be 24 hr. with a 50 ppm chlorine dosage.

When customers are out of service during a shutdown with no leakage past valves, the required minimum detention time must be 3 hr. and the chlorine dosage must be 300 ppm.

When customers are out of service during a shutdown with some leakage past valves, the required minimum detention time must be 30 min. with a 500 ppm chlorine dosage.

3.9.3. **Flushing.**

Following the expiration of the specified holding time, the treated section of main must be flushed thoroughly by the Contractor in accordance with the applicable provisions of Section 3.8., “Flushing and Testing Mains.” Flushing must continue until no chlorine remains detectable by taste or odor or until the chlorine residual is less than 0.3 ppm. Contractor must make provisions for the disposal and runoff of the flushing operations to minimize erosion or impact to residents.

3.9.4. **Preventing Reverse Flow.**

Valves must be manipulated so the strong chlorine solution in the line being treated must be flushed out of the main and must not flow back into the line supplying the water.

3.9.5. **Supervision.**

All disinfection must be as directed.

3.9.6. **Additional Treatment.**

Should the new main fail to meet minimum public health standards for bacteriological quality after flushing, further treatment must be as directed. If further disinfection is required, chlorination must be in accordance with Section 3.9., "Disinfection." In no case, however, must the new line be acceptable as complete and satisfactory until the bacteriological quality of the water taken from the main meets the standards of the TCEQ.

If an open hole is unsafe and does not have proper trench protection, Owner's chlorination crew must not chlorinate project until acceptable trench protection is provided.

3.10. **Service Supply Lines.**

Service supply lines and fittings, meter boxes, and appurtenances must conform to material specifications and must be installed by the Contractor as specified, or as directed, and in conformance with the plans.

3.10.1. **Designation of Service Supply Lines.** A service supply line located between the water main and the inlet side of the water meter is designated as a "water service line." A service supply line located between the outlet side of the water meter to the point of connection within the limits of the Customers lot or property is designated as "Customer's yard piping." Services 2 in. and smaller are designated "small services;" services 4 in. and larger are designated "large services."

3.10.2. **Service Relays.** New transfer mains to which services must be relayed and are on the same side of the streets as the Customer's meter are defined as "short relays." New transfer mains to which services must be relayed and are on the opposite side of the street from the Customer's meter are defined as "long relays."

Existing services on the opposite side of the street to the new main must be defined as a "long relay."

3.10.3. **Service Relocates.** Service relocates are defined as services that are relocated from an alley to a side or front street. New transfer mains to which services must be relocated and are on the same side of the street as the Customer's new meter box location, are designated as "short relocates." New transfer mains to which services must be relocated and are on the opposite side of the street from the Customer's new meter box location, are designated as "long relocates."

3.10.4. **Tap Holes.** Tap holes are defined as excavations at existing mains, which are required in association with replacements of water service lines by pulling, boring or jacking operations.

All backfill material must be as specified for main and service line trench excavation.

For service lines and tap holes, payment for bedding, initial backfill, and secondary backfill must be included in the various sizes of each service placed.

3.10.5. **Service Line Installation.** Unless otherwise notified, service relays, service reconnects, service relocates, and new services must be installed as described, on plans, or as directed. Unless otherwise indicated, existing meter and meter box relocation must be included in the service line installation.

All service line installation must include a dielectric union to be installed within the meter box on the outlet side of the meter, as shown on plans, or as directed.

Cutting, excavation, backfill, and replacement of pavement must be completed as specified and in conformance with applicable sections of this Specification and the contract documents. The minimum trench width for small service lines must be 8 in., while the minimum trench width for large service lines must be the nominal pipe diameter plus 16 in., except when specified otherwise by the Engineer. For 3/4 in. to 2 in. service lines, minimum bury depth must be 3 ft. For services greater than 2 in., minimum depth of bury must be 4 ft.

All service lines must be installed in conformance with plans, and specifications, or as directed

Contractor must use precaution to protect and preserve the polyethylene wrap around Ductile-Iron (DI) water mains when installing service corporations. The required method is, wrap pipe tape around the pipe, over the polywrap, in the area to be tapped. The tap must be made through the tape and polywrap. It is not necessary to remove and replace polywrap. All exposed pipe, corporation and the first 3 ft. of the service, must be wrapped and taped to achieve a complete seal. In addition, a sand envelope must extend over and around the connection to a depth of 8 in. above the main.

Small service lines must be embedded in sand in conformance with this Specification.

Where approved by the Inspector, Contractor may lay the new service line from the corporation stop to the curb stop or angle valve. Upon completion, Contractor must isolate the new service line by closing the curb stop or angle valve until the meter box is set.

3.10.6. **Splicing.** A long service line single splice may be permitted by means of a 3-part compression or flared coupling only when approved in advance by the Engineer, provided the location of the splice is not under pavement or concrete. The segment added is required to be the same material as the existing service line, unless otherwise directed. Splicing short service lines will not be permitted.

3.10.7. **Boring or Jacking Service Lines.** Service lines which cross paved streets may be installed at the Contractor's option by boring or jacking operations. Where it becomes necessary to widen the main trench section to accommodate a bore pit, such widening must not extend more than one additional foot into the traffic side of the street.

3.10.8. **Tapping Asbestos Cement (AC) Water Mains.** All necessary service line tapping of AC pipe must be completed during the period immediately before or after hydrostatic pressure testing operations so subsequent flushing will maximize the elimination of contaminants associated with the tapping process.

Tapping of AC pipe must be completed in conformance with manufacturers' recommendation and performed only with a tap machine with a built in flush valve and the flush valve must be open during the entire procedure.

3.10.9. **Abandonment of Service Lines.** Contractor must accomplish all cutting, capping, and plugging necessary to isolate new service lines transferred to new and existing mains from those abandoned, including service lines designated on the plans as "tap plug" and "tap kill." The corporation stop for an abandoned service line tapped on a ferrous main must be removed, and the tap at the main must be plugged with an appropriately sized brass plug. For a non-ferrous main, the corporation stop must not be removed from the main. Instead, the corporation stop must be closed and the flared nut must be removed from the corporation stop. After the appropriately sized copper disc is inserted inside the flared nut, replace the flared nut on the corporation stop. Contractor must salvage copper service line tubing, brass fittings, and other materials as directed by the Inspector and return them to the Owner.

3.10.10. **Tapping PVC (C-900).** Tapping of PVC must be in accordance with Uni-Bell procedures. Direct tapping will not be allowed. All drill cutting tools must be the "shell type" with internal teeth or double slots which must retain the coupon.

The shell cutters must be designed for C-900 pipe, thus with enough root depth to handle the heavier walled pipe.

3.10.11. **Small Service Lines.** Copper tubing must be used for 3/4 in. through 2 in. service lines. Brass fittings for 3/4 in. and 1 in. service lines must be of the flared or compression type for the use with Type ‘K’ soft annealed copper tubing. Brass fittings for 1-1/2 in. and 2 in. lines must be of the flared or compression type for use with Type 'K' soft annealed copper tubing, except as modified by this Specification.

Copper tubing must be cut squarely by using an approved cutting tool and by avoiding excessive pressure on the cutting wheels which might bend or flatten the pipe walls. Following the copper tubing cut, but before flaring, a reamer must be used to remove the inside rolled lip from the tubing. Flared ends must be expanded by using a flaring tool using care to avoid splitting, crimping, or overstressing the metal. Pipe adjacent to the fittings must be straight for at least 10 in. Bending of tubing must be accomplished by using an appropriate sized bending tool. No kinks, dents, flats, or crimps will be permitted, and should such occur, the damaged section must be cut out and replaced. When compression fittings are used, the copper tubing must be cut squarely before insertion into the fitting, final assembly must be in conformance with the manufacturers recommendations.

3.10.12. **Small Service Lines on New Mains.** Installation of new copper service lines must consist of all excavation through miscellaneous material encountered, trench excavation protection, drilling and tapping the new main with an approved tapping machine, setting the curb stop or angle valve at the meter; laying the new copper service line at the specified depth between the main and the meter and its tie-in at the corporation and the curb stop or the angle valve, relocating the existing meter and installing a new meter box where required, backfilling the trench with approved select material and disposal of surplus excavated material, capping the tap hole with asphalt treated base, including the outer limits of the main trench line with service line trench, cutting and replacing pavements, and cutting and replacing curbing and sidewalks of all types over the limits of the main line trench and the completed service line trench.

3.10.13. **Reconnecting Service Lines.** Both old and new water mains at existing service line connections, as shown on the plans, must be exposed. The old main must be exposed for the purpose of gaining access to the existing service corporation stop and the new main for the purpose of installing the new corporation stop. The new main must be exposed for the purpose of being drilled and tapped with an approved tapping machine, a new corporation stop installed under pressure, and the trench extended laterally to expose enough length of the existing service line to provide slack to bend it to position for tying to the new corporation stop. After suitable notification to the Customer, Contractor must “kill” the existing service by closing the corporation stop, removing the existing flare nut, inserting the existing flared nut on the corporation stop if the main is non-ferrous, or plugging the existing service line at the main if the main is ferrous. Contractor must then immediately open the stop and restore water service to the Customer. Where it is not possible to obtain enough length in the existing service to tie directly to the new main, at the direction of the Engineer, Contractor must splice the necessary length of new tubing and tie it to the existing service by means of a compression coupling at a point as close as practicable to the new main.

Cutting and bending of the tubing, introduction of slack to compensate for soil movement, and completion of the installation must be as specified in this Specification.

Where old and new mains are on opposite sides of the street, service lines may be installed under the street pavement by boring rather than trenching.

3.10.14. **Relaying Service Lines.** The existing or new mains shown on plans must be exposed opposite location stakes placed on site as directed. The existing or new main must be drilled and tapped with an approved tapping machine, a new corporation stop installed, and the trench extended laterally to the location specified for the meter box. The existing meter must be reset and the meter box and base must be installed at its staked location and perpendicular to the corporation stop in the water main. The meter box location must not vary more than 24 in. in any direction from its staked location. The service line must be installed with enough slack to compensate for soil movement. Where the location of the existing meter is not changed, the new service line must be extended from the main to the existing meter, a new curb stop installed at the end of the service line, and connected to the inlet side of the meter. If disturbed, the existing meter box must be reset to correct grade. Long service relays may be placed under the street pavement by boring or jacking rather than trenching.

3.10.15. **Small Service Lines on Existing Mains.** The work involved in the installation of new copper service lines on existing mains must consist of jacking, boring, tunneling, and, where authorized, open trench excavation through whatever material encountered, trench excavation protection, using the existing corporation when approved by the Engineer, tapping the existing main and installing the new corporation and setting the curb stop or angle valve at the meter, relocating the existing meter and installing a new meter box where required, abandoning the existing corporation stop, removing the existing flared nut, inserting inside the existing flared nut an appropriately sized copper disc and replacing the existing flared nut on the corporation stop if the main is non-ferrous, or plugging the existing service line at the main if the main is ferrous, installing the new service line at the same grade as the existing service line or at the specified grade between the main and the existing meter and its tie-in at the corporation and the curb stop, disposal of surplus excavated material, capping the tap hole with asphalt treated base including the outer limits of the main line trench and the service line trench, cutting and replacing all surfaces of whatever type encountered over the completed service line trench, and restoration of the site.

3.10.16. **Meter Boxes.** Physical movement of existing meters and meter boxes to new locations may be required where service lines are transferred to new mains in conjunction with main replacement work. Unless specified otherwise, Contractor must move existing meters and meter boxes and reconnect and adjust Customer's yard piping as part of transferring service lines. A dielectric coupling PVC schedule 80 must be installed within the meter box between the meter and the Customer's yard piping.

Round and oval meter boxes with round covers must be salvaged and returned to the Owner by the Contractor. Contractor must also replace the salvaged meter boxes with the new, appropriately styled oval plastic meter box with oval cover, or rectangular meter box. Unless otherwise specified, the old service line must be abandoned after the existing meter has been reset in the existing or new meter box.

Where meter boxes are installed in sidewalks or driveways, Contractor must install a number one meter box (two pieces) as shown on the Specification and on plans.

New meters must be set by the Owner where mains are extended and new services lines are installed for new or initial customer service. Instead of the new meter, Contractor must furnish and install a meter template in conformance with the plans.

Meter and meter box configuration, must have the meter set horizontal, approximately 6 in. below the top of meter box, so the meter is above the bottom of the meter box and in line with the meter box lid opening. The top of the meter box must be flush with the existing ground surface. All excess soil above the meter coupling, meter flange and meter nuts inside the meter box must be removed so the meter register is clearly visible. Contractor must exercise special precautions during excavation at the existing meter location to minimize the disturbance of the Customer's yard piping. However, if the existing meter elevation is low, Contractor must raise the existing meter to conform to the correct configuration specified. Adjustment of meter to proper grade is incidental to the construction and will not be paid for separately.

Where required, pressure reducing valves must be installed by the Customer in accordance with the Uniform Plumbing Code and must be placed beyond the outlet side of the meter, but not within the Owner's meter box. The pressure reducing valve must be the property of the water user who must be responsible for its installation, maintenance, and replacement as required.

The meter box adjustment must not exceed 10 ft. from the existing box.

3.11. **Asbestos-Cement (AC).**

No field cutting will be allowed on asbestos cement pipe. Installation of fire line services to AC pipe mains must be accomplished in accordance to Section 3.5.10.1. of this Specification.

3.12. **Joint Assembly.**

3.12.1. **Rubber Ring Joints.** The installation of pipe and the assembly of rubber ring joints for Ductile-Iron pipe must conform to the pipe manufacturer's assembly instructions. The method of inserting spigot ends of pipe in

bells or collars known as “stabbing” will not be permitted. Spigot ends of pipe must be properly inserted in the joint by means of suitable pushing and pulling devices or a manufacture approved method.

3.12.2. **Mechanical Couplings.** Mechanical couplings must be assembled and installed in conformance to the standards recommended by the manufacturer.

Mechanical coupling consists of a cylindrical steel middle ring, two steel follower rings, two rubber compound gaskets, and a set of steel bolts. The middle ring is flared at each end to receive the wedge-shaped gasket which is compressed between the middle ring flare and the outer surface of the pipe by pressure exerted on the follower rings through the bolt circle.

Before the installation of the mechanical coupling, the pipe ends must be cleaned by wire brush or other acceptable method to provide a smooth bearing surface for the rubber compression gasket. The pipe must be marked to align the end of the coupling which must center it over the joint. After positioning, the nuts must be drawn up finger tight. Uniform pressure on the gaskets must be applied by tightening alternate bolts on the opposite side of the circle in incremental amounts. Soap and final tensioning must be accomplished with a torque wrench and in a matter similar to the tightening procedure after 15 min.

3.12.3. **Restrained Joints.** Restrained joints must be installed as shown on the plans, or as directed by the Inspector. Installation must conform to the manufacture’s recommendations.

3.13. **Installation of the Nonmetallic Pipe Detection System.**

The nonmetallic pipe detection system must be installed concurrently with the proposed pipe placement. Tracer wire must be used for location purposes and taped directly to the pipe. The tracer wire must be solid core (14 gauge insulated) and must be taper to the main in 10 in. increments. Wire must also come up to the top of valve extensions and fire hydrant stems, as directed.

4. MEASUREMENT

This Item will be measured as follows and as explicitly detailed in accordance to Table 21.

Table 21
Pay Items

Description Code Bid Codes	Description	Unit of Measure
7261-6001	RELAY 3/4" EXISTING WTR SERV (COMPLETE)	EA
7261-6002	8" PIPE WTR MAIN (PVC)(C900)(RESTRAIN)	LF
7261-6003	CUSTOMER SHUTOFF VALVE	EA
7261-6004	8" GATE VALVE AND BOX (COMPLETE)	EA
7261-6005	2" TEMPORARY BLOWOFF (COMPLETE)	EA
7261-6006	FIRE HYDRANT ASSM W/6" VALVE AND BOX	EA
7261-6007	REMOVE EXISTING FIRE HYDRANT	EA
7261-6008	DUCTILE IRON AND GRAY IRON FITTINGS	TN
7261-6009	8" WATER TIE INS (COMPLETE)	EA
7261-6010	HYDROSTATIC TESTING	EA
7261-6011	ABANDON EXISTING VALVE	EA
7261-6013	20" STEEL CASING PIPE (OPEN CUT)	LF
7261-6014	CUT AND PLUG EXT WATER MAIN W/PAV	EA
7261-6015	GROUT ABANDONMENT WATER MAIN (6"TO 12")	LF
7261-6016	2" WTR SRV (LONG)(OPEN CUT) W/PV	LF
7261-6017	6" PIPE WTR MAIN (PVC)(C900)(RESTRAIN)	LF
7261-6018	6" WATER TIE INS (COMPLETE)	EA

5. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit prices bid for the items of work described. These prices must be full compensation for furnishing and hauling all materials; for placing or installing the materials; for inspection and testing; and for all other items of material, labor, equipment, tools and incidentals necessary to complete the work in accordance with the plans and specifications.

Payment for "Pipe Water Main (DI)," "Pipe Water Main (PVC, AWWA C900)," "Pipe Water Main (PVC Casing)(Open Cut)," and "Pipe Water Main (Steel Casing)(Open Cut)" will be made at the unit price bid per foot of pipe of the various sizes installed by the open cut method. This payment includes selected bedding, excavation, backfill materials, polyethylene sleeve, all required fittings associated with the installation of the water main pipe of the various sizes, and hauling and disposition of surplus excavated materials.

Carrier pipe used in bores or tunnels will be paid for at the Contract unit price bid for "Carrier Pipe for Jacking, Boring or Tunneling" per foot of pipe installed and measured as prescribed above.

Casings or liners used in bores or tunnels will be paid for at the Contract unit price bid for "Casing or Liner for Jacking, Boring or Tunneling" per foot of casing or liner installed and measured as prescribed above.

Payment for "Gate Valve and Box (Complete)" and "Tapping Sleeve, Valve and Box (Complete)" will be made at the unit price bid for each such assembly of the various sizes installed. This payment includes selected embedment material, anti-corrosion embedment when specified, concrete collar at the valve box where subjected to vehicular traffic, ductile iron riser pipe, cast-iron boot, packing, tarpaper, concrete grout, concrete reaction blocking, asphaltic material for bolts, nuts and ferrous surfaces, polyethylene sleeve, hauling and disposition of excavated surplus material and backfill where required. For butterfly valves only, such payment includes mechanical or transition couplings, and coated and wrapped steel pipe nipples required to complete the connection.

Payment will be made at the unit price bid for "Concrete Encasement, Cradles, Saddles and Collars" by the cubic yard of concrete placed. Reinforcing, if required, will not be measured for payment.

Payment for "Fire Hydrant with 6 in. Valve and Box" and "Relocate Fire Hydrant" will be made at the unit prices bid for each such assemblies installed.

These payments include backfill, selected material, anti-corrosion embedment when specified, branch line pipe, fittings exclusive of the tee from the main line pipe, polyethylene sleeve, hauling and disposition of excavated surplus material where required, asphaltic material for ferrous surfaces, concrete reaction blocking, concrete pad restoration of existing fire hydrant sites and installing a new fire hydrant as directed.

Payment for "Permanent Blow-off (Complete)" and "Temporary Blow-off (Complete)" will be made at the unit price bid for each such assembly installed in conformance with the details shown on the plans. Payment for the eccentric reducer will be made at the unit price bid for each ton of fittings of all types and sizes installed. Payment for the pipe nipple with reaction stop ring will be made at the unit price bid for each foot of pipe of the various sizes installed by the open cut method. These payments include excavation, anti- corrosion when specified, the housing and disposition surplus excavated materials and approved selected backfill.

Payment for "Trench Excavation Protection" and "Joint Trench Excavation Protection" will be made on the basis of the unit price bid for each foot of "Trench Excavation Protection" and "Joint Trench Excavation Protection" in place. Payment includes all components of the trench protection system which can include, but not limited to sloping, sheeting, trench boxes or trench shields, sheet piling, cribbing, bracing, shoring, dewatering or diversion of water to provide adequate drainage. Payment includes the additional excavation and backfill required, any jacking, jack removal and removal of the trench support after completion and be full compensation for all other labor, materials, tools, equipment and incidentals necessary to complete the work.

Payment for “Water Tie-In (Complete)” will be made at the unit price bid for each tie-in of the various sizes and types completed. This payment includes shutdown and isolation of the existing main to which the tie must be made, cutting pipe for connection, dewatering the excavation, and customer notification of service interruption where required. Connections between new and existing mains which are made with tapping sleeves and valves by cutting in tees will be as a no-separate pay item.

Payment for “Waterline Service (Long)” will be made at the unit price bid for each new service line of the various sizes and types installed. This payment includes reconnection of new service to the existing meter and the adjustment of the meter, meter box, and Customer valve. Such payment must also include excavation, trench excavation protection, hauling and disposition of surplus excavated materials, sand backfill, cutting pavement and surface structures of whatever type fittings of the various sizes used in the service line relay and copper tubing or ductile iron pipe (2 in. and larger).

Payment for “Relay Short Service” and “Relay Long Service” will be made at the unit price bid for each service line of the various sizes and types relaid. This payment includes reconnection of new service to existing meter, sand backfill, meter box relocation where required, copper tubing or ductile iron pipe (4 in. and larger), valve and valve box assembly, and fittings of the various sizes used in the service line relay.

Payment for “Relocate Short Service” and “Relocate Long Service” will be made at the unit price bid for each service line of the various sizes relocated. This payment includes sand backfill, meter box relocation where required, copper tubing or ductile iron pipe (4 in. and larger) when required, valve and valve box assembly when required, and fittings of the various sizes used in the service line relocation.

Payment for “Relocate Existing Meter and Existing Meter Box” will be made at the unit price bid for each assembly relocated. This payment includes excavation protection, hauling and disposition of surplus excavated materials, sand backfill, removal and replacement of yard piping with piping of the various sizes and types and in the quantities necessary to complete the connection between the relocated existing meter and existing meter box, and the existing yard piping.

Payment for “Relocate Existing Meter and New Meter Box” will be made at the unit price bid for each assembly relocated. This payment includes sand backfill, removal and replacement of yard piping with piping of the various sizes and types and in the quantities necessary to complete the connection between the relocated existing meter and new meter box, and the existing yard piping.

Payment for the number one meter box installation in sidewalks and driveways will be paid in the amount difference between the standard meter box and the number one meter box.

Payment for “Cut and Replace Concrete Sidewalk, Driveway, Etc.” will be made at the unit price bid.

Payment for “Cut and Replace Asphalt Pavement” will be made at the unit price bid Payment for “Cut and Replace Asphalt Pavement with 6 in. of Asphalt Treated Base” will be made at the unit price bid.

Payment for “Cut and Replace Concrete Sidewalk (Asphalt)” will be made at the unit price bid. Payment for “Concrete Curb” will be made at the unit price bid.

Payment for “Hydrostatic Test” will be made at the unit price bid for each successful test for a fully function water system. Such payment includes all materials and equipment required to conduct test.

Payment for “Flowable Backfill” will be made at the unit price bid for each cubic yard of flowable backfill placed, but not to exceed the minimum trench width specified in Section 3.1.1.1., “Width of Trench.”

Payment for “Ductile Iron and Gray Iron Fittings” will be considered incidental to the pipe installation and a “No-Pay” item, with the exception of bends and tees as noted on plans. Bends and tees are paid by weight in tonnage and will include full furnishing, installation and testing of components as needed for water main system function.

Payment for “Abandon Existing Valve” will consist of the removal of the valve stem, riser, system components as directed by Owner and Department, and filled by grout material to depth indicated by Owner and Department. This will include excavation, removal, disposal, grout, and backfill material, compaction and any associated soils testing.

Payment for “Grout Abandonment Water Main” will be made for all types of pipe abandonment with grout, including asbestos-concrete pipe, and will be paid for at the Contract bid price per foot for each size diameter of pipe, irrespective of the depth of the main, which will include the cost of removing content within the pipe, cleaning, grouting, plugging, capping and abandoning all pipe, pipe bend section and all other appurtenances, and for dewatering, trenching, excavation and backfill, removal, transportation and disposal, and all material or work necessary to properly abandon the pipe. Payment for abandoning water lines will be made on the Contract unit price per foot per each size diameter of pipe complete in place at locations shown on the plans. Said price will be full compensation for furnishing all materials, labor, equipment, tools and incidentals necessary to complete the work.

No direct payment will be made for concrete (thrust) blocking of water mains; coating and wrapping pipe joints; trench excavation below specified limits; excavation and removal of unsuitable material at bottom of trench grade and restoration with approved material; supporting pipe or conduits of public utilities; abandonment of water mains and valves; resetting existing meters and meter boxes in proper configuration; salvaging fire hydrants, valve boxes and meter boxes; flushing water mains; and disinfection of water mains. This work will be considered subsidiary to the various bid items.

No direct payment will be made for furnishing and installing the non-metallic pipe detection system. This work and materials will be considered subsidiary to the various pay items. In addition, Contractor must ensure that the detection system is complete and operational to the satisfaction of the Engineer.

No direct payment will be made for furnishing and installing the pipe joint restraint system. This work and materials will be considered subsidiary to the various bid items.

No direct payment will be made for furnishing and installing the Joint Restraint System for PVC C-905. This work and materials will be considered subsidiary to the various pay items.

The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the various unit prices. These prices are full compensation for furnishing materials and for equipment, labor, tools, and incidentals.