

DIVISION 600 - WATER SYSTEM

SECTION 601 WATER LINE IMPROVEMENTS (12 INCHES AND SMALLER)

601.01 SCOPE OF WORK

The work included in this section of the specifications shall consist of furnishing and installing water mains, 12-inches and smaller, and appurtenances for water distribution.

601.02 QUALIFICATIONS AND SUBMITTALS

All pipe shall be manufactured by an established manufacturer having at least three (3) years of experience in successfully manufacturing the type of pipe specified.

Any company supplying Ductile Iron (DI) pipe shall submit a full and complete set of detailed shop drawings to the Engineer for review.

The Contractor shall furnish to the Engineer three (3) copies of certificates of shop tests on all pipe furnished under this items. The Engineer shall furnish one (1) copy to the Owner. These tests shall be witnessed by a reputable and established independent testing laboratory. The cost of this testing shall be included in the price bid for this item. No payment shall be made for the materials until the necessary certificates have been furnished.

The manufacturer shall furnish to the Engineer a certified statement that all pipe materials have been manufactured and tested in accordance with the referenced standards.

601.03 CONSTRUCTION SCHEDULING AND COORDINATION

Service to water customers shall not be disrupted during installation of the water line improvements except for the time required to change individual services as specified herein.

No commercial services shall be disrupted during business hours without the approval of the Engineer.

The Contractor shall notify the City of Fort Smith Utility Department at least 4 business days prior to scheduled connections of mains. Shut-downs shall not exceed a maximum of 4 hours, subject to change per the City of Fort Smith policy and the Arkansas Department of Health. Scheduling shall be subject to the approval of the Utility Department and the Engineer. The work of this Section shall be coordinated with the work of other Sections. The Contractor shall make field measurements at the site to verify or supplement indicated dimensions and to ensure proper coordination of all construction items.

The sequence of construction and change over shall be as follows:

- A. Install new mains as shown on the plans, including fire hydrants in accordance with AWWA C600 and C605, latest revisions.
- B. Test, disinfect and sample mains as specified by the Arkansas Department of Health and AWWA C651, latest revision. After samples are approved by the Arkansas Department of Health and Utility Department, the Utility Department shall operate the water valves to place mains in service.
- C. Install new services and transfer customer services to the new main as detailed in Sections 603 and 604.
- D. Water lines that are to be abandoned shall have all existing valves closed, the water line shall be cut and capped or plugged within one foot of closed valve. Remove any existing valve boxes and fire hydrants attached to the abandoned line. All removed appurtenances shall remain the property of the Utility Department and returned to 3900 Kelly Highway.

601.04 MATERIALS

All substituted materials must be submitted and approved in accordance to the process laid out in Section 105.15 SUBSTITUTIONS OF MATERIALS AND EQUIPMENT.

- A. **DUCTILE IRON PIPE & FITTINGS.** Pipe shall be 350 pressure class, designed in accordance with AWWA C150, latest revision. Piping shall be manufactured in accordance with AWWA C151, latest revision.

Pipe shall be standard cement lined and seal coated with an approved bituminous seal coat in accordance with AWWA C104, latest revision.

Pipe joints shall be push-on, conforming to AWWA C111, latest revision. Push-on joints shall be equal to the Super Bell-Tie joint as manufactured by the Clow Corporation, or Tyton Joints as manufactured by U.S. Pipe, or equal.

When specified by the Engineer, the exterior of ductile iron pipe shall be coated with a layer of arc-sprayed zinc per ISO 8179. The mass of the zinc applied shall be 200g/m² of pipe surface area. A finishing layer topcoat shall be applied to the zinc. The mean dry film thickness of the finishing layer shall not be less than 3 mils with a local minimum not less than 2 mils. The zinc coating system shall conform to ISO 8179-1 "Ductile iron pipe- external zinc-based coating – Part 1: Metallic zinc with finishing layer. Second edition 2004-06-01.

Polyethylene encasement must be installed anytime zinc coating is specified. When specified or detailed on the plans, any installation requiring polyethylene encasement for corrosion protection of ductile-iron pipe, the encasement shall be in accordance with AWWA C105, latest revision.

Restrained, push-on joint pipe shall be similar and equal to one of the following:

American Ductile Iron Pipe's FLEX-RING JOINT pipe or U.S. Pipe's TR FLEX pipe.

Shop drawings shall show all special appurtenances, bends, fittings, joint pulls, beveled joints, depth of bury, pipe classification and strength for the existing laying conditions and all other information necessary for the Engineers approval prior to start of construction.

- B. PVC PIPE. Polyvinyl chloride (PVC) pressure pipe shall conform to AWWA C900 and C909, latest revision. PVC pipe shall have the same outside diameter as cast iron pipe, shall have elastomeric-gasket type joints or fusible PVC0 when called for on plans, and shall have a minimum pressure class rating of 165 psi unless otherwise specified on the plans.
- C. FITTINGS. Fittings shall be ductile-iron compact fittings conforming to AWWA C153, latest revision. Fittings shall be mechanical joint, or flanged as designated on the plans and shall be cement lined, exterior bituminous coated and shall have a minimum working pressure rating of 350 psi.

Mechanical joints shall be furnished with anchor fittings or restrained glands designed for use with the pipe material when specified on the plans. Restrained glands shall be Megalug retainer glands as manufactured by EBAA Iron Sales, Inc or Utility Department approved equal.

- D. MISCELLANEOUS FITTINGS. Couplings for joining sections of pipe shall be manufactured of ductile-iron or gray cast-iron in accordance with AWWA C110, latest revision. Gaskets shall be of a permanent and set resistance material in accordance with AWWA C111, latest revision. Bolts shall conform to AWWA C230, latest revision.

The Hymax 2000 Coupling shall be acceptable for working pressure up to 260 psi when installed in accordance with AWWA C219, latest revision.

Adapters for connecting pipes of dissimilar materials shall be manufactured of ductile-iron or gray cast-iron in accordance with AWWA 219, latest revision. Gaskets shall conform to AWWA C111, latest revision.

The Hymax 2100 flanged Adapter shall be acceptable for working pressure up to 260 psi when installed in accordance with AWWA C219, latest revision.

Repair clamps, straps, bolts, and nuts shall conform to AWWA C230, latest revision. Gaskets shall conform to AWWA C111, latest revision.

- E. GATE VALVES AND BOXES. Gate valves shall conform to AWWA C509, latest revision or AWWA C515, latest revision. Resilient-Wedge Gate Valves shall be iron body, bronze mounted, resilient seated, non-rising stem valves designed for 250 psi minimum working pressure rating. Valves shall have O-ring packing, open counterclockwise and shall be furnished with 2 inch AWWA nut operator. Valves

furnished shall have mechanical joints for cast iron size pipe. Gate valves shall be Mueller A-2361 or Utility Department approved equal.

Valve boxes shall be of the cast iron extension type. Boxes may be of the screw type and shall be complete with lids marked with the inscription "WATER" cast into the top and a base of the proper size for the valve it is to be used with. The boxes shall be Tyler Two Piece Valve Box Series 461S or 562S, with 5-1/4 inch shaft or Utility Department approved equal. The boxes shall be of such size and length that they can be adjusted to the depth of cover required over the pipe at the valve location without using the full extension. Valve boxes shall have one priming coat and two coats of coal tar.

Valve box risers shall be cast or ductile iron and shall be Tyler Model 68-S 5 1/4-Inch 6850 Screw Type Series or Utility Department approved equal. Fixed type risers shall accommodate the original valve box lids. Adjustable type risers shall be slip type or screw type furnished with new lids. The Contractor is responsible for correct sizing of risers to fit existing valve boxes and lids.

- F. TAPPING SLEEVES AND VALVES. Tapping sleeves shall be Mueller H615, or Utility Department approved equal, for C900 PVC and ductile iron and Mueller H619, or Utility Department approved equal, for AC pipe.

Tapping valves shall conform to the requirements for gate valves specified above and shall be Mueller T-2361, or Utility Department approved equal.

- G. TRACER WIRE. Tracer wire shall be Trace-Safe type RT1802W or Utility Department approved equal.

- H. TRACER WIRE BOX. Tracer wire shall be terminated in magnetized tracer box, Model CD14*TP as manufactured by Copperhead Industries, LLC. or Utility Department approved equal. The tracer box cover will be color coded in accordance with APWA uniform color code. The tracer wire shall not be terminated in any other location.

- I. FIRE HYDRANTS. Fire hydrants shall conform to AWWA C502, latest revision. The hydrants shall have "O" Ring seals, two 2-1/2 inch hose nozzles, one 4-1/2 inch pumper nozzle, American Standard hose connection threads, 4-1/2 inch compression type main valve, drain valves, left (counterclockwise) opening, National Standard pentagon operation nut and a self-oiling system for stem threads. Valve and seal shall be all brass construction.

Hydrants shall have incorporated in their design, a breakable connection feature including a safety flange and safety stem coupling immediately above the bury line. This breakable connection shall have a lower breaking strength than the remainder of the unit. The inlet connection shall be 6 inches in size and shall be of the mechanical joint type conforming to AWWA C111, latest revision. Where fire hydrant extensions are required they shall be of the proper design to accommodate the make of fire hydrant installed. Public fire hydrant barrels shall be factory painted Mueller Yellow (Sherwin-Williams Polane SP

Polyurethane F63YL14) while touchup paint shall be Mueller Yellow (Sherwin-Williams KEM 400 Acrylic Enamel F75YH1) or with color as approved by the Owner. Private fire hydrant barrels shall be factory painted Mueller Red (Sherwin-Williams Polane SP Polyurethane F63RL15) while touchup paint shall be Mueller Red (Sherwin-Williams KEM 400 Acrylic Enamel F75RH1) or with color as approved by the Utility Owner. .

Fire hydrants shall be mechanical joint with anchor type fittings. Fire hydrant lead restrained joint shall be swivel hydrant adapter manufactured by Tyler Pipe Swivel by Swivel 5-199SS.

Fire hydrants shall be Mueller Super Centurion 250 A-421 or Utility Department approved equal.

- J. BLOW-OFFS. Blow-offs installed on four (4) inch dead end lines shall be an Eclipse No. 85 Blow-off hydrant or Utility Department approved equal. A valve shall be installed within five (5) feet for blow off maintenance. Valves shall conform to specifications in Section 601.04. Water lines six (6) inches to twelve (12) inches shall have a fire hydrants installed at dead end. Fire Hydrants shall be in accordance to 601.04(I).
- K. GRAVEL BEDDING. Gravel bedding shall conform to Section 205 "Trench & Structure Excavation and Backfill."
- L. CONCRETE. Concrete shall conform to Section 401 "Concrete General." Concrete shall be Class B (2500 psi), unless noted otherwise.
- M. POLYETHYLENE WRAPPING. Polyethylene wrapping shall meet the requirements of AWWA C105, latest revision.

601.05 CONSTRUCTION METHODS

A. TRENCH EXCAVATION AND BACKFILL

- 1. GENERAL. Trench excavation, bedding, boring, encasement, casing, and backfilling are covered in Section 205.
- 2. BEDDING. Pipe bedding for PVC pipe and Ductile Iron pipe shall conform to Class "B" bedding requirement covered in Section 205.02 (D).

Bell holes shall be provided at each joint to permit the jointing to be properly made and prevent the joint of the pipe from being a point of support. Each bell hole should be no larger than necessary for joint assembly while still allowing the pipe barrel to lie flat on the trench bottom.

Whenever any portion of the trench is excavated below grade, the un-necessary over-excavation shall be corrected as detailed in Section 205.04.

B. PIPE INSTALLATION

1. GENERAL. Pipe fittings and accessories shall be unloaded near the place where they are to be laid in the trench. Pipe shall be stored in a manner that allows it to remain clean. They shall at all times be handled with care to avoid damage. Cutting of pipe shall be done by means of a manufacturer approved type of mechanical cutter.
2. PLACEMENT OF PIPE. Section of pipe, fittings and accessories shall be cleaned and inspected for damage immediately prior to placement in the trench. All defective materials shall be rejected. Pipe, fittings and accessories shall be placed in the trench and shall be positioned utilizing hoisting equipment. Pipe shall be laid true to line and grade, with uniform bearing under the full length of the pipe barrel.

When water and sewer lines are closer than ten (10) feet of each other, sewers must be placed so that the bottom of the water line will be at least 18 inches above the top of the sewer line at its highest point. If this distance must unavoidably be reduced, the water line or the sewer line must be encased in watertight pipe with sealed watertight ends extending at least ten feet either side of the crossing. Any joint in the encasement pipe is to be mechanically restrained. The encasement pipe may be vented to the surface if carrying water or sewer under pressure. Whenever a sewer line must unavoidably pass above a water line, at least 18 inches of separation must be maintained between the outside of the two pipes in addition to the preceding encasement requirement.

Field bending of PVC pipe will not be allowed with the following exceptions:

- Four (4") inch lines used in cul-de-sacs shall have no less than a 100 foot radius
- When reviewed and approved by Utility Department.

All other changes in water line alignments shall be accomplished by the use of fittings.

Jointing of pipe shall be accomplished in accordance with the pipe manufacturers' recommendations. Gaskets and lubricants shall be the type recommended by the pipe manufacturer. The spigot end of the pipe shall be inserted into the bell to the required depth and in such manner as to avoid displacement of the gasket. Jointing of mechanical-joint pipe shall be accomplished such that the gland is positioned evenly by tightening alternately the bolts spaced 180 degrees apart.

At times when pipe laying is not in progress, the open ends of the installed pipe shall be closed by a watertight plug. Plug shall be Petersen Mechanical Hand Tightening Series 141, COB Industries Cast Aluminum Expansion Plug, or approved equal. This provision shall apply during the lunch period, overnight, or any other time when work is not in progress.

No pipe shall be laid in wet trench conditions that preclude proper bedding, on a frozen trench bottom, or when in the opinion of the Engineer, the trench conditions or the weather conditions are unsuitable for proper installation.

Polyethylene wrapping when specified, must be installed as detailed in AWWA C105, latest revision.

3. **RESTRAINED JOINT SYSTEM.** The sealed design drawing shall provide a minimum number of restrained joints to control the pipe thrust. Calculations of pipe restraint and number of restrained joints shall be submitted to the Owner for approval prior to manufacturer of the pipe.

Restrained joints shall be used unless concrete blocking is authorized by the Engineer. Concrete thrust blocking shall be installed only at the locations shown on the plans. The concrete shall be placed between undisturbed soil and the fitting to be anchored. Care shall be taken to place the thrust block so that the pipe and fitting joints will be accessible for repair. Polyethylene wrapping, as described in Section 601.04M, shall be used to prevent contact between pipe and fittings and the concrete used for thrust blocking.

The shape and contact area of the concrete thrust blocks shall be as shown on the plans and as directed by the Engineer. The contact area of backing shall be as required to prevent movement of the joint, but in no case shall the contact area be less than one square foot.

4. **CONNECTION TO MAINS.** Connection of new water mains to existing mains shall be accomplished by installation of tapping sleeves and valves, unless otherwise indicated on the plans. After the main connection is completed, a corporation stop or air relief valve shall be installed near the point of connection, or other locations as needed, to permit expelling air from the line or chlorination of the line. Installation of the tap shall be as directed by the Engineer.
5. **TRACER WIRE INSTALLATION.** Tracer wire shall be installed in a continuous non-interrupted circuit on all water mains. The wire shall be attached to the top center of the pipe every four feet by a method approved by the Engineer. Tracer wire boxes shall be installed at locations shown on the plans or as determined by the Engineer. A concrete collar with grout shall be placed on each tracer wire box and located outside of pavement surfaces or sidewalks. Tracer wire box spacing shall not exceed 500 feet.

C. VALVES AND APPURTENANCES

1. **GATE VALVES.** Valves shall be cleaned of all foreign matter before installation and shall be installed at the locations shown on the plans or as directed by the Engineer. Valves shall be set with operating stems in true vertical position. Valve box shall be centered upon the valve.

Earth fill shall be carefully tamped around each valve box for the full depth of the excavation for a distance of not less than 4 feet on all sides or the undisturbed wall of the trench if less than 4 feet. A concrete collar shall be placed on each valve box located outside of pavement surfaces or sidewalks. Precast valve collars are acceptable. All valve collars must be grouted, centered on the valve, and set flush with finished grade. Precast collars shall not be cut in any manner.

2. VALVE BOX GRADE ADJUSTMENT. Valve boxes in pavement areas to receive an asphalt concrete overlay shall be adjusted to grade prior to the start of the overlay operations. Adjustment of valve boxes in areas designated for reconstruction shall be accomplished prior to placement of final pavement surfacing. Boxes shall be set flush with the new roadway grade and cross slope. Structures damaged due to negligence by the Contractor shall be repaired at contractor's expense.

Where designated on the plans, existing valve boxes shall be removed and replaced with new valve boxes and lids of the type specified. Extensions shall be used as required to obtain the specified grade. Valve boxes shall be backfilled and compacted as specified above. Concrete collars, utilizing Class 'A' fiber-reinforced concrete, shall be constructed around all valve boxes that have been modified. Existing valve boxes that are removed shall remain the property of the Utility Department and returned to 3900 Kelly Highway.

3. APPURTENANCES. Adapters and special fittings shall be installed at the locations shown on the plans. Repair clamps shall be used when authorized by the Engineer.

- D. FIRE HYDRANTS. Fire hydrants shall be located and installed as shown on the plans or as directed by the Engineer. All hydrants shall stand plumb and shall have their nozzles parallel with or at right angles to the curb, with the pumper nozzle facing the curb. Hydrants shall be set to the finished grade, with bottom of pumper nozzles at least 18 to 24 inches above finished grade. The break away shall be set above finished grade.

Each hydrant shall be connected to the main with a 6-inch ductile iron branch. A 6-inch gate valve shall be placed on this branch to provide independent control of the hydrant. A watch valve must be installed within two (2) feet of hydrant if hydrant lead is longer than ten (10) feet.

The shoe of each hydrant shall be tied to the pipe with approved restrained swivel joints.

A drainage pit shall be provided at each fire hydrant. Location and dimensions of the drainage pit shall be as shown on the plans. Gravel shall conform to paragraph 601.04 (J) of this specification or as approved by the Engineer.

- E. STREET CROSSINGS. Installation of water mains at street crossings shall be by boring

unless open cut is required on the plans or is authorized by the Engineer. Excavation, trenching, backfilling and pipe installation shall be as specified in Section 205 "Trench and Structure Excavation and Backfill."

Cuts and repairs of existing asphalt or Portland cement concrete pavement shall be as specified in Section 205.

Removal and replacement of existing curbs and sidewalk shall be as specified in Sections 410 and 440.

- F. **ABANDONED LINES.** Water lines which are to be abandoned shall remain in place except where removal is required for construction of improvements or removal is specifically called for on the plans. Any existing asbestos cement (AC) pipes are to be avoided if at all possible unless directed to be removed by the Engineer or connection to it is required according to the plans. Removal and disposal of AC pipe shall be in accordance with standard construction practices for asbestos removal and the applicable OSHA Standards and State of Arkansas regulations. Any crushed AC pipe is to be removed and disposed of properly and shall not be placed into the fill. AC pipe shall be cut using a chain cutter.

Remaining pipe ends of abandoned lines shall be filled with a concrete plug. The concrete plug length shall be 3 times the diameter of the pipe. Existing fire hydrants to be abandoned shall be removed. Gate valves which are to be abandoned in place shall have the valve boxes removed.

Any abandoned fire hydrants, gate valves, valve boxes and fittings shall remain the property of the Owner. Materials designated on the plans for Owner salvage shall be delivered to the Fort Smith Utility Department located at 3900 Kelley Highway.

All removal, salvage, plugging, and disposal of water lines and appurtenances shall be considered incidental to the project except for AC pipe which will be paid for under the bid item listed in the proposal for 'Removal and Disposal of AC pipe water line.'

601.06 DISINFECTION AND TESTING

After, segments of water line 20 feet or greater have been installed as specified, the entire system shall be given a hydrostatic pressure test, disinfected, and bacteriological test. No water line installation will be accepted until bacteriological test and hydrostatic pressure tests have been performed and results accepted by the Owner.

- Hydrostatic Pressure Test as outlined in Section 601.06(A)
- Bacteriological Tests as outlined in Section 601.06(C)

The Engineer shall provide one copy of all test results to the Utility Department for acceptance.

- A. **HYDROSTATIC PRESSURE TEST.** This may be done in sections between valves as selected by the Contractor for his convenience. All testing must match minimum

standards set outlined in AWWA C600, latest revision, for ductile iron pipe and AWWA C605, latest revision, for PVC pipe.

These tests shall be performed by the Contractor in the presence of the Engineer. The Contractor shall furnish all necessary pressure gauges, meters and pumps and make all taps and connections.

Each valved section of pipe shall be slowly filled, in accordance with AWWA M23, with water and the specified test pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer. Before applying the test pressure, all air shall be expelled from the pipe by permanent taps or corporation cocks where necessary.

It shall be the Contractor's responsibility to locate and repair any and all leaks and defects that may develop. Even though the pipe line may pass the leakage test, any leaks apparent at the ground's surface, any leaking joints, fittings or appurtenances, or any other visible defects shall be repaired to the satisfaction of the Engineer.

The hydrostatic and leakage tests may be performed simultaneously, but the duration of the test shall be not less than 2 hours. A pressure equal to, or exceeding, 1.5 times the working pressure of the pipe and never less than 150 psig at the point of testing shall be maintained throughout the test. Test pressure shall not be less than 1.25 times the working pressure at the highest point along the test section. Visible leaks shall be repaired regardless of the amount of leakage measured.

- No pipe installation will be accepted until the leakage is less than the number of gallons per hour, permitted by AWWA C600, latest revision, as determined by the formula:

$$L = \frac{S * D * P^{1/2}}{148,000}$$

Where:

L = the allowable leakage, in gallons per hour;

S = the length of pipe line tested in feet;

D = the nominal diameter of the pipe, in inches;

P = the average test pressure during the leakage test, in psi inch gage.

The Engineer shall provide one copy of test results to the Utility Department.

- B. **DISINFECTION.** All materials, work, workmanship and methods shall be in accordance with AWWA C651, latest revision, for Disinfecting Water Mains.

The lines shall be thoroughly flushed at a velocity of not less than three (3) feet per second before the disinfection procedures commence in accordance with AWWA 651, latest revision. The disinfecting agent may then be introduced in any manner approved by the Engineer that will insure a uniform distribution in accordance with AWWA C651, latest revision.

The form of chlorine used for the disinfection may be either a liquid chlorine gas-water mixture applied by means of a solution-feed chlorinating device, or a mixture of water and a chlorine-bearing compound of known chlorine content. The chlorine-bearing compounds that may be used can be found in AWWA C651, latest revision. The preparation of these compounds shall be in accordance with AWWA C651, latest revision.

The chlorine mixture selected shall be used in such an amount as to provide a dosage of chlorine in the system of not less than twenty five (25) mg/Liter and a residual at the end of 24 hours of not less than ten (10) mg/Liter. All valves in the lines being disinfected shall be opened and closed several times during the disinfection period. Following a contact period of not less than 24 hours, the chlorinated water shall be flushed from the lines until the chlorine content of the water leaving the main is less than 1 mg/Liter unless otherwise directed by the Engineer. Chlorinated water shall be thoroughly neutralized in accordance to methods outlined in AWWA 655. The neutralized water may then be disposed of in the City's storm sewer system.

- C. **BACTERIOLOGICAL TEST.** Samples of water collected at least 24 hours apart shall be taken by the Contractor in accordance with AWWA C651, latest revision. The samples shall be submitted for analysis to the Arkansas Department of Health (ADH). A copy of the test results from ADH shall be furnished to the Engineer. The Engineer must provide the Utility Department a copy for review. Once the test results are approved by Utility Department, the Utility Department shall operate all water valves to bring the water lines in service.

The disinfection procedures outline in Section 601.06(B) shall be repeated as necessary until two consecutive samples indicate that the water is safe as determined by the ADH. Two copies of the test results from ADH shall be provided to the Engineer. The Engineer shall provide one copy to the Owner.

601.07 MEASUREMENT AND PAYMENT

The measurement and payment of the work included in this section of the specifications shall be at the contract unit prices listed in the proposal for the items of work. Payment at the contract unit price for each item shall be considered full compensation for furnishing all materials, labor, equipment, tools, supplies and incidentals necessary to complete each item of work.

- A. **WATER PIPE (TYPE, SIZE, CLASS, & COATING).** Water pipe will be measured by the linear foot along the centerline of the pipe from center to center of intersecting lines or to the point of connection to existing mains. Payment for water pipe at the contract unit price for the size and type of pipe listed in the proposal shall be considered full compensation for coating, furnishing and installing pipe and materials, including excavation, bedding, backfilling, pipe restraints, testing and disinfection, air release taps, tracer wire, tracer wire boxes, concrete collars, removal and salvage of materials to the city, and related work except as listed below.

Rock excavation and select backfill will be paid for under Section 205 "Trench & Structure Excavation and Backfill." Flowable fill will be paid for under Section 206, "Flowable Fill Material".

- B. FITTINGS. Gray and ductile iron fittings will be measured by the listed weight in pounds, excluding glands, bolts and accessories, as given in AWWA C153, latest revision.

No separate payment will be made for miscellaneous fittings, adapters, repair clamps, couplings or other appurtenances.

- C. GATE VALVE WITH BOX (SIZE). Gate Valves will be measured and payment made according to the number of each size furnished and installed. Valve boxes, concrete valve box collars, and grout will not be measured separately, but will be included as a portion of the payment for gate valves.

- D. VALVE BOX GRADE ADJUSTMENT. Valve boxes adjusted to grade will be measured and payment made according to the number acceptably placed and approved. Payment at the contract unit price per each for "Valve Box Adjustment" will be considered full compensation for excavation; adjustment of the existing valve box and lid; furnishing and installing any risers, if needed; backfill; compaction; concrete collar, grout, and related items.

- E. VALVE BOX REPLACEMENT. Payment at the contract unit price per each for "Valve Box Replacement" will be considered full compensation for excavation; furnishing and installation of new valve box and lid; furnishing and installation of any risers, if needed; backfill; compaction; concrete collar, grout, and related items.

- F. TAPPING SLEEVE AND VALVE WITH BOX (SIZE). Tapping sleeves and valves will be measured and payment made according to the number of each size furnished and installed including the valve box, concrete thrust blocking, concrete collars and related items.

- G. FIRE HYDRANT ASSEMBLY (TYPE). Regular and Parallel Fire hydrant assemblies will be measured and payment made according to the number acceptably placed and approved. Payment for the fire hydrant assembly at the contract unit price listed in the proposal shall be considered full compensation for the hydrant, gate valve, valve box, concrete collar, restraint system, the extension length necessary to install the hydrant at finished grade, the ductile iron pipe length between the line and the fire hydrant, the vertical riser pipe length necessary to install the fire hydrant at finished grade, crushed rock for the drains; and removal, salvage, and delivery of any existing hydrant.

- I. FIRE HYDRANT. Fire hydrants will be measured and payment made separately when replacement of only the existing fire hydrant is required, and not the full assembly. Payment for the fire hydrant at the contract unit price listed in the proposal shall be considered full compensation for the removal, salvage, and delivery of the existing fire

hydrant, furnishing and installing the new hydrant, ductile iron pipe required for moving the hydrant, the vertical riser pipe length necessary to install the hydrant at finished grade, and miscellaneous fittings, restraint system, and crushed rock for drains.

- J. FIRE HYDRANT EXTENSION. Fire Hydrants adjusted to grade will be measured and payment made according to the linear feet of acceptably installed and approved fire hydrant extension. Payment at the contract unit price per linear foot for “Fire Hydrant Extension” will be considered full compensation for excavation, furnishing and installing any Fire Hydrant Extensions, backfill, compaction, and related items.
- K. CONNECTION TO EXISTING LINE (SIZE). Connection to existing lines will be measured and payment made according to the number of each size connection made. Payment for the connection at the contract unit price listed in the proposal shall be considered full compensation for all labor and materials required to complete the work, including miscellaneous fittings.
- L. BLOW-OFF ASSEMBLY (SIZE). Blow-off assemblies will be measured and payment made according to the number acceptably placed and approved. Payment for the blow-off assembly at the contract unit price listed in the proposal shall be considered full compensation for the blow-off, miscellaneous fittings, and crushed rock for drains.
- M. POLYETHYLENE WRAP (SIZE). Polyethylene wrap will be measured by the linear foot along the centerline of the size of pipe wrapped. Payment for polyethylene wrap at the contract unit price for the size of pipe wrapped listed in the proposal shall be considered full compensation for all labor and materials required to complete the work.
- N. REMOVAL AND DISPOSAL OF AC WATER PIPE. Removal and disposal of AC pipe water line will be measured and payment made according to the lineal foot of water line directed to be removed by the Engineer and acceptably removed. Payment for the removal and disposal of AC pipe water line at the contract unit price listed in the proposal shall be considered full compensation for the removal and disposal of the AC pipe water line in accordance with applicable OSHA and State of Arkansas regulations and standards, and backfilling of trench, including all labor, materials and miscellaneous items required to complete the work.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Water Pipe (Type, Size, Class, and Coating)	LF
Fittings	LB
Gate Valve With Box (Size)	EA
Valve Box Grade Adjustment	EA

Valve Box Replacement	EA
Tapping Sleeve and Valve with Box (Size)	EA
Fire Hydrant Assembly (Type)	EA
Fire Hydrant	EA
Fire Hydrant Extension	LF
Connection to Existing Line (Size)	EA
Blow-Off Assembly (Size)	EA
Polyethylene Wrap (Size)	LF
Removal and Disposal of AC Water Pipe	LF

SECTION 602
WATER LINE IMPROVEMENTS (GREATER THAN 12-INCHES)

602.01 SCOPE OF WORK

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602.02 QUALIFICATIONS AND SUBMITTALS

All pipe shall be manufactured by an established manufacturer having at least ten (10) years of experience in successfully manufacturing the type of pipe specified.

Any company supplying Ductile Iron pipe shall submit a full and complete set of detailed shop drawings to the Engineer for review.

The Contractor shall furnish to the Engineer three (3) copies of certificates of shop tests on all pipe furnished under this items. The Engineer shall furnish one (1) copy to the Owner. These tests shall be witnessed by a reputable and established independent testing laboratory. The cost of this testing shall be included in the price bid for this item. No payment shall be made for the materials until the necessary certificates have been furnished.

The manufacturer shall furnish to the Engineer a certified statement that all pipe materials have been manufactured and tested in accordance with the referenced standards.

602.03 CONSTRUCTION SCHEDULING AND COORDINATION

Service to water customers shall not be disrupted during installation of the water line improvements except for the time required to change individual services as specified herein.

No commercial services shall be disrupted during business hours without the approval of the Engineer.

The Contractor shall notify the City of Fort Smith Utility Department at least 4 business days prior to scheduled connections of mains. Shut-downs shall not exceed a maximum of 4 hours, subject to change per the City of Fort Smith policy and the Arkansas Department of Health. Scheduling shall be subject to the approval of the Utility Department and the Engineer.

The work of this Section shall be coordinated with the work of other Sections. The Contractor shall make field measurements at the site to verify or supplement indicated dimensions and to ensure proper coordination of all construction items.

The sequence of construction and change over shall be as follows:

- A. Install new mains as shown on the plans, including fire hydrants in accordance with AWWA C200, C301, and C600, latest revisions.

- B. Test, disinfect and sample mains as specified by the Arkansas Department of Health and AWWA C651, latest revision. After samples are approved by the Arkansas Department of Health and Utility Department, the Utility Department shall operate the water valves to place mains in service.
- C. Install new services and transfer customer services to the new main as detailed in Sections 603 and 604.
- D. Waterlines that are to be abandoned shall have all existing valves closed, the waterline shall be cut and plugged within one foot of closed valve. Remove any existing valve boxes and fire hydrants attached to the abandoned line. All removed appurtenances shall remain the property of the Utility Department and returned to 3900 Kelly Highway.

602.04 MATERIALS

All substituted materials must be submitted and approved in accordance to the process laid out in Section 105.15 SUBSTITUTIONS OF MATERIALS AND EQUIPMENT.

- A. **CONCRETE PIPE & FITTINGS.** Concrete pipe shall conform in all respects to the AWWA C301, latest revision. The pipe shall be designed and furnished to fit the profile and head conditions shown on the Plans in accordance with AWWA C304, latest revision, and shall include the standard allowance for water hammer, in combination with earth dead load resulting from a backfill depth as shown on the plans, but in no case less than six (6) feet; plus external live load, including impact, equal to American Association of State Highway & Transportation Officials (AASHTO) HL-93. The bedding to be considered in the design shall be Type 3 embankment bedding in accordance with AWWA Manual M9, latest revision, "Concrete Pressure Pipe", Chapter 4 "Loads and Supporting Strengths", or as specified on the Plans.

Manufacturer's pipe design calculations shall be submitted to the Engineer for approval prior to manufacture of any pipe. Provide lay schedule of pictorial nature indicating alignment and grade, laying dimensions, welding procedures, fabrication, fittings, flange, and special details, with plan view of each pipe segment sketched, detailing pipe invert elevations, horizontal bends, welded joints, and other critical features. Indicate station numbers for pipe and fittings corresponding to the project Plans. Submit lay schedule to the Engineer for review and approval prior to production of pipe and fittings. Provide final approved lay schedule in Adobe portable document format (*.PDF) or other approved format.

Provide pipe sections in standard lengths with minimum length of sixteen (16) feet as indicated on approved lay schedule. Internally and externally mark pipe sections with durable marking to show location and pipe pressure. Prior to arrival on project site, identify pipe sections within limits of thrust restraint with permanent, brightly colored, and highly visible markings on outer coating as approved by Engineer.

Joints shall be rubber gasket push joint. Joint rings shall be protected by extra zinc metal

thickness. Minimum zinc coating shall be two-thousandths (0.002") inch. "Mechanical type" joint restraints shall be provided at every change in alignment, both vertical and horizontal. Joint restraints shall be of the type which provide uniform bearing around the entire circumference of the joint. Joints which provide restraint by concentrated point loads which permanently deform portions of the joint metal shall not be accepted-

All specials and fittings shall conform to AWWA C301, latest revision, and must be built to the details furnished by the manufacturer and approved by the Engineer. All fittings shall be provided with restrained joints of the "mechanical type" or welded.

- B. DUCTILE IRON PIPE & FITTINGS. Pipe shall be designed in accordance with AWWA C150, latest revision. Piping shall be manufactured in accordance with AWWA C151, latest revision.

Pipe shall be standard cement lined and seal coated with an approved bituminous seal coat in accordance with AWWA C104, latest revision.

Pipe joints shall be push-on, conforming to AWWA C111, latest revision. Push-on joints shall be equal to the Super Bell-Tie Joint as manufactured by the Clow Valve Company, or Tyton Joints as manufactured by U.S. Pipe, or equal.

Fittings shall be furnished in accordance with AWWA C110, latest revision. Joints shall be mechanical joint conforming to AWWA C111, latest revision. A cement mortar lining and seal coat shall be furnished as detailed above for pipe. Compact fittings conforming to AWWA C153, latest revision, may be used.-

When specified by the Engineer, the exterior of ductile iron pipe shall be coated with a layer of arc-sprayed zinc per ISO 8179. The mass of the zinc applied shall be 200g/m² of pipe surface area. A finishing layer topcoat shall be applied to the zinc. The mean dry film thickness of the finishing layer shall not be less than 3 mils with a local minimum not less than 2 mils. The zinc coating system shall conform to ISO 8179-1 "Ductile iron pipe- external zinc-based coating – Part 1: Metallic zinc with finishing layer. Second edition 2004-06-01.

Polyethylene encasement must be specified and installed anytime zinc coating is specified. When specified or detailed on the plans, for any installation requiring polyethylene encasement for corrosion protection of ductile-iron pipe, the encasement shall be in accordance with Section 602.04(M) and AWWA C105, latest revision.

Restrained, push-on joint pipe shall be similar and equal to one of the following: American Ductile Iron Pipe's FLEX-RING JOINT pipe or U.S. Pipe's TR FLEX pipe.

Shop drawings shall show all special appurtenances, bends, fittings, joint pulls, beveled joints, depth of bury, pipe classification and strength for the existing laying conditions and all other information necessary for the Engineers approval prior to start of construction.

- C. STEEL PIPE & FITTINGS. All Steel pipe shall be manufactured and tested in accordance with the AWWA C200, latest revision. Flanges shall be steel fabricated in accordance with AWWA C207, latest revision, Table 2 and 3, Class D. Minimum wall thickness shall be 0.250 inches.

All pipe shall be made up in the shop in sections forty (40) feet to sixty-five (65) feet in length with not more than one (1) circumferential joint in any length. Shorter lengths shall be allowed for specials. Pipes may be made by welding two (2) longitudinal joints or by spiral welding process. No riveted pipe shall be considered. Coupons may be required to be cut from as many as one (1) in each twenty (20) lengths of pipe furnished to check the strength of welds. The strength of any weld must be at least one hundred (100) percent of the strength of the pipe. After each joint of the pipe is completed, it shall be tested under hydrostatic pressure as prescribed by AWWA C200, latest revision, except that fittings fabricated from pipe which has passed the hydrostatic test, but shall have the welds tested by the dye-check method. General sweating of the welds will not be accepted under this test.

Changes in line and grade may be made by steel specials or in the joints. Steel specials shall be used wherever the angle exceeds ten (10) degrees. Specials may be made up of straight pipe fabricated into the required shape or may be made of special rolled sections. Any specials or fittings shall be of the same character and thickness of material as the main pipeline, and shall conform to AWWA C200, latest revision, and AWWA C208, latest revision. Openings for air valves, main connections, and blow-off connections must be provided with suitable reinforcement around the openings, welded to the body of the pipe.

Openings of the sizes shown on the plans shall be furnished with blank flanges or plugs of proper strength to withstand the working pressure of the line where no other provision is made for closing the openings.

Steel pipe shall have ends for slip joints for field welding, beveled ends for field butt welding, or plain ends for mechanically coupled field joints.

The interior of all steel pipe shall be cement mortar lined in accordance with AWWA C205, latest revision. Lining of field joints shall be in accordance with AWWA C205, latest revision.

The exterior of the pipe shall be cleaned and coated with a three layer, 80 mil polyethylene backed butyl rubber tape coating system in accordance with AWWA C214, latest revision. Coating is required on all buried pipe, even in areas where the pipe is to be encased with concrete. 80 mils shall consist of one 20 mil inner layer and two 30 mil outer layers.

Manufacturer's pipe design calculations shall be submitted to the Engineer for approval prior to manufacture of any pipe. Provide lay schedule of pictorial nature indicating alignment and grade, laying dimensions, welding procedures, fabrication, fittings, flange,

and special details, with plan view of each pipe segment sketched, detailing pipe invert elevations, horizontal bends, welded joints, and other critical features. Indicate station numbers for pipe and fittings corresponding to the project Plans. Submit lay schedule to the Engineer for review and approval prior to production of pipe and fittings. Provide final approved lay schedule in Adobe portable document format (*.PDF) or other approved format.

Pipe is to be furnished with O-ring joints unless otherwise noted on plan. Pipe fabricator shall prepare a pipe laying diagram or laying schedule showing the location of each piece by Mark Number.

O-ring joints shall consist of a flared bell end and a grooved spigot end designed to retain the "O-ring" rubber gasket. The spigot end groove may be rolled in or bar type. Bell and spigot ends shall be sized by forcing over a sizing die or by expanding to stretch the steel beyond its elastic limit so that the difference in diameter between outside of spigot and inside of bell at normal engagement does not exceed .03" measured on circumference with a diameter tape. The O-ring gasket shall have sufficient volume to approximately fill the area of the groove and shall conform to AWWA C200, latest revision. The joint shall be suitable for safe working pressure equal to the class of pipe furnished and shall operate satisfactorily with a deflection (the tangent of which is not to exceed $.75"/D$ where D is the outside diameter of the pipe in inches) or with a pull-out of 3/4".

O-ring joints shall be electrically bonded using #4 copper bonding wire and thermite welding cartridges furnished by the pipe fabricator.

Shop applied outside coating shall be continuous to the end of pipe on the bell end and shall be cut back on spigot end so that coating extends at least 1/2" inside of the bell end at normal engagement. Shop applied inside lining shall be continuous to the end of pipe on the spigot and shall be cut back on the bell end at the point of maximum engagement or further as shown on plans. Inside of bell and outside of spigot shall be painted one shop coat of primer (Polyken #927 or equal).

Fittings are to be fabricated in accordance with AWWA C200, latest revision, including non-destructive testing by dye penetrant of welds not previously tested in the straight pipe. Fittings shall conform to the dimensions of AWWA C208, latest revision, or may be fabricated into standard pipe lengths. Elbows 0 to 22-1/2 Degrees shall be two piece, 23 to 45 Degrees shall be three piece, 46 to 67-1/2 Degrees shall be four pieces, and laterals, and outlets shall be reinforced in accordance with ASME Pressure Vessel Code, Section VII Paragraph G-37 or AWWA M-11, latest revision. Flanges shall be in accordance with AWWA C-207, latest revision.

Couplings shall be coated with the same coating as specified for the pipe. The interior joints shall be plastered with cement-mortar as specified under AWWA C205, latest revision.

D. MISCELLANEOUS FITTINGS. Couplings for joining sections of pipe shall be

manufactured of ductile-iron or gray cast-iron in accordance with AWWA C110, latest revision. Gaskets shall be of a permanent and set resistance material in accordance with AWWA C111, latest revision. Bolts shall conform to AWWA C230, latest revision.

Adapters and couplings shall be approved by the Utility Department and acceptable for working pressure up to 260 psi when installed in accordance with AWWA C219, latest revision. Gaskets shall conform to AWWA C111, latest revision.

Adapters for connecting pipes of dissimilar materials shall be manufactured of ductile-iron or gray cast-iron in accordance with AWWA 219, latest revision. Gaskets conform to AWWA C111, latest revision.

Repair clamps, straps, bolts, and nuts shall conform to AWWA C230, latest revision. Gaskets conform to AWWA C111, latest revision.

E. VALVES.

1. BALL VALVES. Ball valves shall conform to AWWA C507, latest revision.
2. BUTTERFLY VALVES. Butterfly valves shall conform to AWWA C504, latest revision.
3. GATE VALVES AND BOXES. Gate valves shall conform to AWWA C509, latest revision, or AWWA C515, latest revision, and shall be iron body, bronze mounted, resilient seated, non-rising stem valves designed for 250 psi minimum working pressure rating. Valves shall have O-ring packing, open counterclockwise and shall be furnished with 2 inch AWWA nut operator. Valves furnished shall have mechanical joints for cast iron size pipe. Gate valves shall be Mueller A-2361 or approved equal.

Valve boxes if approved shall conform to Section 601.

F. TAPPING SLEEVE AND VALVES. Tapping sleeves shall be Mueller H615, or Utility Department approved equal, for C900 PVC and ductile iron and Mueller H619, or Utility Department approved equal, for AC pipe.

For pipe diameters of 14 inches and larger, Mueller H-304 SS and Smith-Blair 665 are acceptable with prior approval by the City of Fort Smith Utility Department. The entire assembly, including bolts, nuts, and washers, must be stainless steel.

Tapping valves shall conform to the requirements for gate valves specified above and shall be Mueller T-2361, or Utility Department approved equal.

G. TRACER WIRE. Tracer wire shall be Trace-Safe type RT1802W or Utility Department approved equal.

H. TRACER WIRE BOX. Tracer wire shall be terminated in magnetized tracer box, Model CD14*TP as manufactured by Copperhead Industries, LLC., or Utility Department approved equal. The tracer box cover will be color coded in accordance with APWA uniform color code. The tracer wire shall not be terminated in any other location.

I. FIRE HYDRANTS. Fire hydrants shall conform to AWWA C502, latest revision. The hydrants shall have "O" Ring seals, two 2-½ inch hose nozzles, one 4-½ inch pumper nozzle, American Standard hose connection threads, 4-½ inch compression type main valve, drain valves, left (counterclockwise) opening, National Standard pentagon operation nut and a self-oiling system for stem threads. Valve and seal shall be all brass construction.

Hydrants shall have incorporated in their design, a breakable connection feature including a safety flange and safety stem coupling immediately above the bury line. This breakable connection shall have a lower breaking strength than the remainder of the unit. The inlet connection shall be 6 inches in size and shall be of the mechanical joint type conforming to AWWA C111, latest revision. Where fire hydrant extensions are required they shall be of the proper design to accommodate the make of fire hydrant installed. Public fire hydrant barrels shall be factory painted Mueller Yellow (Sherwin-Williams Polane SP Polyurethane F63YL14) while touchup paint shall be Mueller Yellow (Sherwin-Williams KEM 400 Acrylic Enamel F75YH1) or with color as approved by the Owner. Private fire hydrant barrels shall be factory painted Mueller Red (Sherwin-Williams Polane SP Polyurethane F63RL15) while touchup paint shall be Mueller Red (Sherwin-Williams KEM 400 Acrylic Enamel F75RH1) or with color as approved by the Utility Department.

Fire hydrants shall be mechanical joint with anchor type fittings. Fire hydrant lead restrained joint shall be swivel hydrant adapter manufactured by Tyler Pipe Swivel by Swivel 5-199SS.

Fire hydrants shall be Mueller Super Centurion 250 A-421.

J. BLOW-OFFS. Blow-offs for water lines greater than twelve (12) inches shall conform to the design shown in City of Fort Smith Standard Drawings.

K. GRAVEL BEDDING. Gravel bedding shall conform to Section 205 "Trench & Structure Excavation and Backfill."

L. CONCRETE. Concrete shall conform to Section 401 "Concrete General." Concrete shall be Class B (2500 psi), unless noted otherwise.

M. POLYETHYLENE WRAPPING. Polyethylene material shall meet the requirements of AWWA C105, latest revision.

602.05 CONSTRUCTION METHODS

A. TRENCH EXCAVATION AND BACKFILL

1. GENERAL. Trench excavation, bedding, boring, encasement, casing, and backfilling are covered in Section 205.
2. BEDDING. Pipe bedding shall conform to Class "B" bedding requirement covered in Section 205.02 (D).

Bell holes shall be provided at each joint to permit the jointing to be properly made and prevent the joint of the pipe from being a point of support. Each bell hole should be no larger than necessary for joint assembly while still allowing the pipe barrel to lie flat on the trench bottom.

Whenever any portion of the trench is excavated below grade, the un-necessary over-excavation shall be corrected as detailed in Section 205.04.

B. PIPE INSTALLATION

1. GENERAL. Pipe fittings and accessories shall be unloaded near the place where they are to be laid in the trench. Pipe shall be stored in a manner that allows it to remain clean. Pipe shall at all times be handled with care to avoid damage. Cutting of pipe shall be done by means of a manufacturer approved type of mechanical cutter.
2. PLACEMENT OF PIPE. Section of pipe, fittings and accessories shall be cleaned and inspected for damage immediately prior to placement in the trench. All defective materials shall be rejected. Pipe, fittings and accessories shall be placed in the trench and shall be positioned utilizing hoisting equipment. Pipe shall be laid true to line and grade, with uniform bearing under the full length of the pipe barrel.

Field bending of pipe will not be allowed.

All changes in water line alignments shall be accomplished by the use of fittings.

Jointing of pipe shall be accomplished in accordance with the pipe manufacturers' recommendations. Gaskets and lubricants shall be the type recommended by the pipe manufacturer. The spigot end of the pipe shall be inserted into the bell to the required depth and in such manner as to avoid displacement of the gasket. Jointing of mechanical-joint pipe shall be accomplished such that the gland is positioned evenly by tightening alternately the bolts spaced 180 degrees apart.

At times when pipe laying is not in progress, the open ends of installed pipe shall be closed by a watertight plug. Plug shall be Petersen Mechanical Hand Tightening Series 141, COB Industries Cast Aluminum Expansion Plug, or approved equal. This provision shall apply during the lunch period, overnight, or any other time when work is not in progress.

No pipe shall be laid in wet trench conditions that preclude proper bedding, on a frozen trench bottom, or when in the opinion of the Engineer, the trench conditions or the weather conditions are unsuitable for proper installation.

Polyethylene wrapping when specified, must be installed as detailed in AWWA C105, latest revision.

- C **RESTRAINED JOINT SYSTEM.** Restrained joints shall be used unless concrete blocking is authorized by the Engineer. Concrete thrust blocking shall be installed only at the locations shown on the plans. The concrete shall be placed between undisturbed soil and the fitting to be anchored. Care shall be taken to place the thrust block so that the pipe and fitting joints will be accessible for repair. Polyethylene wrapping, as described in Section 602.04M, shall be used to prevent contact between pipe and fittings and the concrete used for thrust blocking.

The shape and contact area of the concrete thrust blocks shall be as shown on the plans and as directed by the Engineer. The contact area of backing shall be as required to prevent movement of the joint, but in no case shall the contact area be less than one square foot.

The Design Engineer must provide a sufficient number of restrained joints to control the pipe thrust. Calculations of pipe restraint and number of restrained joints shall be submitted to the Owner for approval prior to manufacturer of the pipe for this project.

602.06 DISINFECTION AND TESTING

After, segments of water line 20 feet or greater have been installed as specified, the entire system shall be given a hydrostatic pressure test, disinfected, and bacteriological test. No water line installation will be accepted until bacteriological test and hydrostatic pressure tests have been performed and results accepted by the Owner.

- Hydrostatic Pressure Test as outlined in Section 602.06(A)
- Bacteriological Tests as outlined in Section 602.06(C)

The Engineer shall provide one copy of all test results to the Owner for acceptance.

- D. **HYDROSTATIC PRESSURE TEST.** This may be done in sections between valves as selected by the Contractor for his convenience. All testing must match minimum standards set outlined in AWWA C600, latest revision, for ductile iron pipe and AWWA C605, latest revision, for PVC pipe.

These tests shall be performed by the Contractor in the presence of the Engineer. The Contractor shall furnish all necessary pressure gauges, meters and pumps and make all taps and connections.

Each valved section of pipe shall be slowly filled with water and the specified test pressure shall be applied by means of a pump connected to the pipe in a manner

satisfactory to the Engineer. Before applying the test pressure, all air shall be expelled from the pipe by permanent taps or corporation cocks where necessary.

It shall be the Contractor's responsibility to locate and repair any and all leaks and defects that may develop. Even though the pipe line may pass the leakage test, any leaks apparent at the ground's surface, any leaking joints, fittings or appurtenances, or any other visible defects shall be repaired to the satisfaction of the Engineer.

The hydrostatic and leakage tests may be performed simultaneously, but the duration of the test shall be not less than 2 hours. A pressure equal to, or exceeding, 1.5 times the working pressure of the pipe and never less than 150 psig at the point of testing shall be maintained throughout the test. Test pressure shall not be less than 1.25 times the working pressure at the highest point along the test section. Visible leaks shall be repaired regardless of the amount of leakage measured.

- Leakage is less than the number of gallons per hour, permitted by the latest AWWA revisions of C600 for Ductile Iron Pipe, C604 for Steel Pipe, and M9 for Concrete Pressure Pipe.

The Engineer shall provide one copy of test results to the Owner.

- E. **DISINFECTION.** All materials, work, workmanship and methods shall be in accordance with the latest revision of the AWWA C651, latest revision, for Disinfecting Water Mains.

The lines shall be thoroughly flushed at a velocity of not less than three (3) feet per second before the disinfection procedures commence in accordance with AWWA 651, latest revision. The disinfecting agent may then be introduced in any manner approved by the Engineer that will insure a uniform distribution in accordance with AWWA C651, latest revision.

The form of chlorine used for the disinfection may be either a liquid chlorine gas-water mixture applied by means of a solution-feed chlorinating device, or a mixture of water and a chlorine-bearing compound of known chlorine content. The chlorine-bearing compounds that may be used can be found in AWWA C651, latest revision. The preparation of these compounds shall be as outlined in AWWA C651, latest revision.

The chlorine mixture selected shall be used in such an amount as to provide a dosage of chlorine in the system of not less than twenty five (25) mg/Liter and a residual at the end of 24 hours of not less than ten (10) mg/Liter. All valves in the lines being disinfected shall be opened and closed several times during the disinfection period. Following a contact period of not less than 24 hours, the chlorinated water shall be flushed from the lines until the chlorine content of the water leaving the main is less than 1 mg/Liter unless otherwise directed by the Engineer. Chlorinated water shall be thoroughly neutralized in accordance to methods outlined in AWWA 655. The neutralized water may then be disposed of in the City's storm sewer system.

- F. **BACTERIOLOGICAL TEST.** Samples of water collected at least 24 hours apart shall be taken by the Contractor in accordance with AWWA C651, latest revision. The samples shall be submitted for analysis to the Arkansas Department of Health (ADH). A copy of the test results from ADH shall be furnished to the Engineer. The Engineer must provide the Owner a copy for review. Once the test results are approved by Owner, the Owner shall operate all water valves to bring the water lines in service.

The disinfection procedures outline in Section 602.06(B) shall be repeated as necessary until two consecutive samples indicate that the water is safe as determined by the ADH. Two copies of the test results from ADH shall be provided to the Engineer. The Engineer shall provide one copy to the Owner.

602.06 MEASUREMENT AND PAYMENT

The measurement and payment of the work included in this section of the specifications shall be at the contract unit prices listed in the proposal for the items of work. Payment at the contract unit price for each item shall be considered full compensation for furnishing all materials, labor, equipment, tools, supplies and incidentals necessary to complete each item of work. Valve Boxes, Fire Hydrants, Polyethylene Wrap, Removal and Disposal of AC Water Pipe, and associated items will be paid for under Section 601.

- A. **WATER PIPE (WATER LINE GREATER THAN 12-INCHES) (TYPE, SIZE, CLASS, & COATING).** Water pipe will be measured by the linear foot along the centerline of the pipe from center to center of intersecting lines or to the point of connection to existing mains. Payment for water pipe at the contract unit price for the size and type of pipe listed in the proposal shall be considered full compensation for coating, furnishing and installing pipe and materials, including excavation, bedding, backfilling, pipe restraints, testing and disinfection, air release taps, tracer wire, tracer wire boxes, concrete collars, removal and salvage of materials to the city, and related work except as listed below.

Rock excavation and select backfill will be paid for under Section 205 "Trench & Structure Excavation and Backfill." Flowable fill will be paid for under Section 206, "Flowable Fill Material".

- B. **FITTINGS (WATER LINE GREATER THAN 12-INCHES).** Gray and ductile iron fittings will be measured by the listed weight in pounds, excluding glands, bolts and accessories, as given in AWWA C153.

No separate payment will be made for miscellaneous fittings, adapters, repair clamps, couplings or other appurtenances.

- C. **VAULT ADJUSTMENT.** Valve vaults adjusted to grade will be measured and payment made according to the vertical feet acceptably placed and approved. Payment at the contract unit price per each for "Vault Adjustment" will be considered full compensation for excavation; adjustment of the existing vault and lid; furnishing and installing any

risers, if needed; backfill; compaction; and related items.

- D. VAULT. Payment at the contract unit price per each for “Vault” will be considered full compensation for excavation; furnishing and installation of new vault and lid; furnishing and installation of any risers, if needed; backfill; compaction; and related items.
- E. TAPPING SLEEVES AND VALVES WITH BOX (WATER LINE GREATER THAN 12-INCHES). Tapping sleeves and valves will be measured and payment made according to the number of each size furnished and installed including the valve box, concrete thrust blocking, concrete collars and related items.
- F. BLOW-OFF ASSEMBLY (WATER LINE GREATER THAN 12-INCHES). Blow-off assemblies will be measured and payment made according to the number acceptably placed and approved. Payment for the blow-off assembly at the contract unit price listed in the proposal shall be considered full compensation for the blow-off, miscellaneous fittings, and crushed rock for drains.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Water Pipe (Water Line Greater Than 12-Inches) (Type, Size, Class, and Coating)	LF
Fittings (Water Line Greater than 12-Inches)	LBS
Vault Adjustment	VF
Vault	EA
Tapping Sleeve and Valve with Box (Water Line Greater than 12-Inches)	EA
Blow-off Assembly (Water Line Greater than 12-Inches)	EA

SECTION 603
WATER SERVICES (1 and 2 Inch Service Lines)

603.01 SCOPE OF WORK

The work included in this section of the specifications shall consist of furnishing and installing water services and appurtenances for one (1) inch and two (2) inch service lines.

603.02 QUALIFICATIONS AND SUBMITTALS

All pipe shall be manufactured by an established manufacturer having at least five (5) years of experience in successfully manufacturing the type of pipe specified.

The Contractor shall furnish to the Engineer three (3) copies of certificates of shop tests on all pipe furnished under these items. Engineer shall provide one (1) copy to the Owner. These tests shall be witnessed by a reputable and established independent testing laboratory. The cost of this testing shall be included in the price bid for this item. No payment shall be made for the materials until the necessary certificates have been furnished.

The manufacturer shall furnish to the Engineer a certified statement that all pipe materials have been manufactured and tested in accordance with the referenced standards.

603.03 CONSTRUCTION SCHEDULING AND COORDINATION

Service to water customers shall not be disrupted during installation of the water line improvements except for the time required to change individual services as specified herein. No commercial services shall be disrupted during business hours without the approval of the Engineer.

The Contractor shall notify the City of Fort Smith Utility Department at least four (4) business days prior to scheduled connections to mains and installation of water meters. Scheduling shall be subject to the approval of the Utility Department and the Engineer.

It shall be the Contractor's responsibility to notify the water customer 48 hours prior to interruption of service. Service shall not be interrupted for more than 4 hours during service tie-over. The Contractor shall connect the service line and the customer service line to the meter. A licensed plumber is required to modify a customer's service lines.

The work of this Section shall be coordinated with the work of other Sections. The Contractor shall make field measurements at the site to verify or supplement indicated dimensions and to ensure proper coordination of all construction items.

The sequence of construction and change over shall be as follows:

- A. Install new mains as shown on the plans and specified in Sections 601 & 602.
- B. Test, disinfect and sample mains as specified by the Arkansas Department of Health requirements and specified in Sections 601 & 602. After samples are approved by the Arkansas Department of Health and Utility Department, the Utility Department shall operate the water valves to place mains in service.

- C. Install new services, including saddles, flush service lines, and transfer customer services to the new water service line.
- D. Service lines that are to be abandoned shall have all existing valves closed, the waterline shall be cut and plugged within one foot of closed valve.

603.04 MATERIALS

All substituted materials must be submitted and approved in accordance to the process laid out in Section 105.15 SUBSTITUTIONS OF MATERIALS AND EQUIPMENT.

- A. **SERVICE LINE.** Water service line shall be either copper or flexible plastic tubing. Copper tubing shall be in accordance with ASTM Specification B88, "Seamless Copper Water Tubing." All copper pipe shall be Type K suitable for flared fittings.

Flexible plastic tubing shall be ADS or JM Eagle HDPE Water Service Tubing or Utility Department approved equal. Flexible plastic tubing shall be manufactured of polyethylene plastic and in accordance with AWWA C901, latest revision. The outside diameter of all plastic tubing shall be same as copper tubing. All plastic tubing shall be capable of maintaining a pressure of 200 psi at 73 degrees Fahrenheit (23 degrees Celsius) for 1000 hours, shall have a minimum working pressure rating of 200 psi and SIDR of 9, and shall be approved by the National Sanitation Foundation.

- B. **WATER METER.** Meters shall be supplied by the Fort Smith Utility Department.
- C. **METER BOXES AND YOKES.** Meter boxes shall be of cast iron with cast iron locking lid. The words "WATER METER" shall be cast in the lid. Inlet and outlet connections shall be waterworks brass. A meter clamping devise within the box shall be provided to enable wrench-free changing of the meter and shall be of waterworks brass. The outlet shall be straight. The inlet shall incorporate a quarter-turn valve with "O" ring seal. The inlet connections shall be in line with meter connections. Meter Boxes shall be from the list below or Utility Department approved equal to:

METER SIZE	METER BOX
5/8"	Commercial, Residential, & Irrigation Ford LYLBB 111-444-95539-008-NL with A14 fitting
1"	Commercial, Residential, & Irrigation Ford LYLBB 244-444-95539-008-NL
1-1/2"	28"X30" Meter Box Assembly as manufactured by East Jordan Iron Works, Product Number 32143001A14 Meter setter shall be Ford VV77-18H-1177-NL with A67 fitting
2"	28"X30" Meter Box Assembly as manufactured by East Jordan Iron Works, Product Number 32143001A14 Meter setter shall be Ford VV77-18HB-11-77-NL

- D. **CORPORATION STOPS AND SERVICE SADDLES.** Corporation stops shall be 1-inch nominal size and shall be bronze with AWWA thread on inlet end. Outlet end shall be flared or compression fittings. Corporation stops to be Ford F1000-4-G-NL for 1 inch and in accordance with AWWA C800, latest revision.

Service saddles body shall be ductile iron epoxy coated and shall be tapped for AWWA thread. A neoprene gasket shall be cemented in place to saddle body. Saddle straps shall be stainless steel flat straps with stainless steel bolts. Service saddles shall be Smith-Blair 317 or Utility Department approved equal and conform to AWWA C800, latest revision.

- E. **MISCELLANEOUS FITTINGS.** Miscellaneous fittings and adapters for service lines shall be wrought copper, cast bronze, or brass and conform to AWWA C800, latest revision.

- F. **SERVICE LINE CASING.** Installation and payment of casing shall be as specified in Section 205 TRENCH STRUCTURE AND BACKFILL. One (1) inch service lines shall have a two (2) inch casing. Two (2) inch service lines shall have a four (4) inch casing.

603.05 CONSTRUCTION METHODS

Service lines and appurtenances shall be installed in conformance with the plans and as specified in these specifications.

Trench excavation and backfill and related work shall conform to Section 205.

- A. **SERVICE CONNECTION AND SERVICE LINE.** Service connections shall be made by use of a service saddle for all mains. Service taps shall be made at an approximate 45 degree angle from the vertical.

Service lines shall be placed to the line and grade shown on the plans or established by the Engineer. Service lines shall be placed at right angles to the water main. Service lines shall be laid to a minimum depth of 18 inches below the finish ground surface except when stated in Section 205.06.

Trenching, Bedding, and Backfilling shall conform to the appropriate subsections in Section 205.

Tubing shall be connected using the specified fittings and in such a manner to avoid excessive stress on the line.

- B. **SERVICE LINE CASING.** Service line conduit shall be installed as shown on the plans and as directed by the Engineer in accordance with the requirements for pipe casing in Section 205.

Service lines extending beneath existing pavements which are to remain in place shall be installed in an encasement by boring or other subsurface method. The method used shall be approved by the Engineer and shall be a method which will avoid subjecting the service tubing to excessive stress. If obstructions are encountered and installation of a

service line cannot be accomplished by boring, the service line shall be installed by the open trench method. Cutting and replacement of existing pavements shall be in accordance with Section 205.09.

- C. **WATER METER.** Water meters shall be installed by city personnel unless otherwise directed by Utility Department.
- D. **WATER METER BOX.** Water meter boxes shall be installed with the top of the box flush with the finished grade or sidewalk surface. The meter and yoke shall be centered within the box.
- E. **CUSTOMER SERVICE.** The abandoned meter, meter box, yoke and curb stop shall remain the property of the Owner. These materials shall be removed and delivered to the Fort Smith Utility Department located at 3900 Kelley Highway.

603.06 TESTING

Service line connections shall be inspected with normal system pressure on the service lines. The Contractor shall correct all leaks.

603.07 MEASUREMENT AND PAYMENT

The measurement and payment of the work included in this section of the specifications, shall be at the contract unit prices listed in the proposal for water line service in the various sizes specified. Payment at the contract unit price shall be considered full compensation for furnishing all materials, labor, professional services, equipment, tools, supplies and incidentals necessary to install service lines, connect to the main, and to reconnect to the customer's meter.

- A. **WATER SERVICE CONNECTION (SIZE).** Service connections shall be measured and payment made according to the number of each size furnished and installed. Payment for service connections will be full compensation for furnishing and installing corporation stops, service saddles, tapping of main line, excavation, trenching, backfilling, compaction, and related work.
- B. **WATER SERVICE LINE (SIZE, TYPE, CLASS).** Service line tubing will be measured by the linear feet of the size and type installed. Payment for water service line will be full compensation for furnishing and installing tubing, excavation, trenching, backfilling, compaction, connections to corporation stop, and meter box and related work.

Service line casing will be measured and paid for as casing under Section 205.

- C. **WATER METER BOX (SIZE).** Water meter box will be measured and payment made according to the number of each size and type furnished and/or installed. Payment for water meter boxes will be full compensation for meter boxes, meter stops, yokes, adapters, fittings, removal and disposal of any existing meter box, connection to customer service line and for excavation, backfilling, compaction, installation of meters and related work.

D. ADJUST WATER METER BOX TO GRADE. Adjust water meter box to grade will be measured and payment made according to the number of boxes adjusted. Payment will be full compensation for the adjusting of the existing meter box to grade, for excavation and backfilling, and all related work.

If replacement of existing meter box is required, payment will be made under Water Meter Box pay item.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Service Connection (Size)	EA
Service Line (Size & Type)	LF
Water Meter Box (Size)	EA
Adjust Water Meter Box to Grade	EA

SECTION 604
WATER SERVICES (Service Lines Greater Than 2 Inch)

604.01 SCOPE OF WORK

The work included in this section of the specifications shall consist of furnishing and installing water services and appurtenances for service lines greater than two (2) inches.

604.02 QUALIFICATIONS AND SUBMITTALS

All pipe shall be manufactured by an established manufacturer having at least five (5) years of experience in successfully manufacturing the type of pipe specified.

Any company supplying pipe shall submit a full and complete set of detailed shop drawings to the Engineer for review. Shop drawings shall show all special appurtenances, joint pulls, beveled joints, depth of bury, pipe classification and strength for the existing laying conditions and all other information necessary for the Engineers approval prior to start of construction.

The Contractor shall furnish to the Engineer three (3) copies of certificates of shop tests on all pipe furnished under these items. Engineer shall provide one (1) copy to the Owner. These tests shall be witnessed by a reputable and established independent testing laboratory. The cost of this testing shall be included in the price bid for this item. No payment shall be made for the materials until the necessary certificates have been furnished.

The manufacturer shall furnish to the Engineer a certified statement that all pipe materials have been manufactured and tested in accordance with the referenced standards.

604.03 CONSTRUCTION SCHEDULING AND COORDINATION

Service to water customers shall not be disrupted during installation of the water line improvements except for the time required to change individual services as specified herein.

No commercial services shall be disrupted during business hours without the approval of the Utility Department or Engineer.

The Contractor shall notify the City of Fort Smith Utility Department at least four (4) business days prior to scheduled connections to mains and installation of water meters. Scheduling shall be subject to the approval of the Utility Department and the Engineer.

It shall be the Contractor's responsibility to notify the water customer 48 hours prior to interruption of service. Service shall not be interrupted for more than 4 hours during service tie-over. The Contractor shall connect the service line and the customer service line to the meter. A licensed plumber is required to modify a customer's service lines.

The work of this Section shall be coordinated with the work of other Sections. The Contractor shall make field measurements at the site to verify or supplement indicated dimensions and to ensure proper coordination of all construction items.

The sequence of construction and change over shall be as follows:

- A. Install new mains as shown on the plans and specified in Sections 601 & 602.
- B. Test, disinfect and sample mains as specified by the Arkansas Department of Health requirements and specified in Sections 601 & 602. After samples are approved by the Arkansas Department of Health and Utility Department, the Utility Department shall operate the water valves to place mains in service.
- C. Install new services, including tap and sleeves, valves, and vaults as shown on plans. Disinfect service lines longer than 20 feet, perform bacteriological tests per ADH requirements, and once the tests pass, and transfer customer services to the new main.
- D. Water lines that are to be abandoned shall have all existing valves closed, the water line shall be cut and plugged within one foot of closed valve. Remove any existing appurtenances attached to the abandoned line. All removed appurtenances shall remain the property of the Utility Department and returned to 3900 Kelly Highway.

604.04 MATERIALS

All substituted materials must be submitted and approved in accordance to the process laid out in Section 105.15 SUBSTITUTIONS OF MATERIALS AND EQUIPMENT.

- A. **SERVICE LINES.** Water service line shall be ductile iron.

- 1. **Ductile Iron Pipe & Fittings.**

Pipe shall be designed in accordance with AWWA C150, latest revision. Piping shall be manufactured in accordance with AWWA C151, latest revision.

Pipe shall be standard cement lined and seal coated with an approved bituminous seal coat in accordance with AWWA C104, latest revision.

Pipe joints shall be push-on, conforming to AWWA C111, latest revision. Push-on joints shall be equal to the Super Bell-Tie joint as manufactured by the Clow Corporation, or Tyton Joints as manufactured by U.S. Pipe, or equal.

Fittings shall be furnished in accordance with AWWA C110, latest revision. Joints shall be mechanical joint conforming to AWWA C111, latest revision. A cement mortar lining and seal coat shall be furnished as detailed above for pipe. Compact fittings conforming to AWWA C153, latest revision may be used.

When specified by the Engineer, the exterior of ductile iron pipe shall be coated with a layer of arc-sprayed zinc per ISO 8179. The mass of the zinc applied shall be 200g/m² of pipe surface area. A finishing layer topcoat shall be applied to the zinc. The mean dry film thickness of the finishing layer shall not be less than 3 mils with a local minimum not less than 2 mils. The zinc coating system shall conform to ISO 8179-1 "Ductile iron pipe- external zinc-based coating – Part 1: Metallic zinc with finishing layer. Second edition 2004-06-01.

Polyethylene encasement must be installed anytime zinc coating is specified. When specified or detailed on the plans, any installation requiring polyethylene encasement

for corrosion protection of ductile-iron pipe, the encasement shall be in accordance with AWWA C105, latest revision.

Restrained, push-on joint pipe shall be similar and equal to one of the following: American Ductile Iron Pipe's FLEX-RING JOINT pipe or U.S. Pipe's TR FLEX pipe

- B. WATER METERS. Meters shall be supplied by the Fort Smith Utility Department. Water meters greater than two (2) inches have significant lead times. Meters should be requested a minimum of eight (8) weeks in advance to insure there are no delays in procurement.
- C. METER VAULT. Meter vaults shall be designed and constructed in a manner that meets or exceeds the design shown in the Standard Details.
- D. TAPPING SLEEVES AND VALVES. Tapping sleeves shall be Mueller H615, or Utility Department approved equal, for C900 PVC and ductile iron.

For pipe diameters of 14 inches and larger, Mueller H-304 SS and Smith-Blair 665 are acceptable with prior approval by the City of Fort Smith Utility Department. The entire assembly, including bolts, nuts, and washers, must be stainless steel.

Tapping valves shall conform to the requirements for gate valves specified in Section 601 and shall be Mueller T-2361, or Utility Department approved equal.

- E. SERVICE LINE CASING. Installation and payment of casing shall be in accordance with "water main casings" as specified in Section 205.06. Service line casings for services greater than two (2) inches shall have a minimum clearance of two (2) inches at each bell of the encased service line.

604.05 CONSTRUCTION METHODS

Service lines and appurtenances shall be installed in conformance with the plans and as specified in Section 601.05 CONSTRUCTION METHODS.

- A. SERVICE LINE CASING. Installation and payment of casing shall be in accordance with water main casings specified in Section 205.06.
- B. WATER METER. Water meters shall be installed by city personnel unless otherwise directed by Utility Department.
- C. WATER METER VAULT. Vaults shall be installed by city personnel unless otherwise directed by Utility Department. Vaults shall be installed with the top of the box flush with the finished grade or sidewalk surface.
- D. CUSTOMER SERVICE. The abandoned meter and appurtenances shall remain the property of the Owner. These materials shall be removed and delivered to the Fort Smith Utility Department located at 3900 Kelley Highway.

604.06 TESTING

Service line connections shall be inspected with normal system pressure on the service lines. The Contractor shall correct all leaks. Lines greater than twenty (20) feet in length shall be disinfected and tested in accordance with Arkansas Department of Health regulations and AWWA C651, latest revision and further detailed in Section 601.06 DISINFECTION AND TESTING.

604.07 MEASUREMENT AND PAYMENT

The measurement and payment of the work included in this section of the specifications, shall be at the contract unit prices listed in the proposal for water line service in the various sizes specified. Payment at the contract unit price shall be considered full compensation for furnishing all materials, labor, professional services, equipment, tools, supplies and incidentals necessary to install service lines, connect to the main, and to reconnect to the customer’s meter.

Pipe and Valves for service lines greater than two (2) inches shall be paid for in accordance with Section 601 WATER LINE IMPROVEMENTS (12 Inches and Smaller).

- A. WATER METER VAULT (TYPE). Water meter vault will be measured and payment made according to the number of each type furnished and installed. Payment for water meter vaults will be full compensation for meter vault, adapters, fittings, removal and disposal of any existing meter box, vault, connection to customer service line, excavation, backfilling, compaction, and related work.

Payment will be made under:

Pay Item

Pay Unit

Water Meter Vault (Type)