



**SPECIAL PROVISIONS
FOR
WATER DISTRIBUTION SYSTEMS**

**Johnson County
IMN-380-6(337)2--0E-52**

**Effective Date
July 18, 2017**

THE STANDARD SPECIFICATIONS, SERIES 2015, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

Furnish, construct, test and disinfect water mains, valves, fire hydrants and appurtenances.

1.02 SUBMITTALS

Comply with Article 1105.03 of the Standard Specifications, as well as the additional requirements listed below. Submit to the Engineer the following drawings or details for approval prior to installation. One copy of each with the approval stamp shall be kept at the work site at all times.

A. Shop and Working Drawings:

1. Pipe layout with valves, fitting and hydrants shown
2. Valves
3. Hydrants
4. Fittings
5. Bolts
6. Joints
7. Tapping sleeves, couplings, and special piping materials
8. Polyethylene

9. Thrust block designs and details

- B. Certificates: Sworn certificates of shop tests showing compliance with appropriate standard for all piping materials.
- C. Manufacturer's Literature:
 - 1. Catalog cuts of joints, couplings, gaskets, fasteners and other accessories.
 - 2. Brochures and technical data, coating and linings, and proposed method of application.
- D. Plans for initial operations and final operations: Special prepared drawings and typed list of sequences of steps are needed prior to any operation of water distribution system. Submit 2 weeks prior to date of planned operation.

1.03 DELIVERY, STORAGE, AND HANDLING

Comply with Section 1106 of the Standard Specifications, as well as the following:

- A. Remove pipe and fittings contaminated with mud and surface water from the site; do not use in construction unless thoroughly cleaned, inspected and approved by the Engineer.
- B. Remove valves, fire hydrants, and appurtenances contaminated with mud and surface water from the site; do not use in construction unless thoroughly cleaned, inspected and approved by the Engineer.

1.04 SCHEDULING AND CONFLICTS

Comply with Article 1108.02.I of the Standard Specifications, as well as the following:

- A. Notify the Engineer two working days in advance of testing or disinfection operations to coordinate the operations.
- B. The Engineer or his/her representative is required to be in attendance during testing or disinfection.

1.05 SPECIAL REQUIREMENTS

None.

1.06 MEASUREMENT AND PAYMENT

A. Water Main:

1. Trenched:

- a. **Measurement:** Each type and size of pipe installed in an open trench will be measured in linear feet along the centerline of the pipe, including the length through the fittings.
- b. **Payment:** Payment will be made at the unit price per linear foot for each type and size of pipe.
- c. **Includes:** Unit price includes, but is not limited to, trench excavation, dewatering, furnishing bedding material, placing bedding and backfill material, tracer system, testing, disinfection, and polyethylene wrap for ductile iron pipe and for fittings.

2. Trenchless:

- a. **Measurement:** Each type and size of pipe installed by trenchless methods will be measured in linear feet along the centerline of the pipe.

- b. **Payment:** Payment will be made at the unit price per linear foot for each type and size of pipe.
- c. **Includes:** Unit price includes, but is not limited to, furnishing and installing pipe; trenchless installation materials and equipment; pit excavation, dewatering, and placing backfill material; tracer system; testing; and disinfection.

B. Fittings by Count:

- 1. **Measurement:** Each type and size of fitting installed as specified in the contract documents or as required for proper installation of the water main will be counted.
- 2. **Payment:** Payment will be made at the unit price for each type and size of fitting.
- 3. **Includes:** Unit price includes, but is not limited to, restrained joints and thrust blocks

C. Water Service Stubs by Length:

- 1. **Water Service Pipe:**
 - a. **Measurement:** Each type and size of water service pipe will be measured in linear feet along the centerline of the pipe.
 - b. **Payment:** Payment will be made at the unit price per linear foot of each type and size of water service pipe.
 - c. **Includes:** Unit price includes, but is not limited to, trench excavation, dewatering, furnishing bedding material, installation of tracer wire system for non-metallic service pipe, and placing bedding and backfill material.
- 2. **Water Service Corporation:**
 - a. **Measurement:** Each type and size of water service corporation will be counted.
 - b. **Payment:** Payment will be made at the unit price for each type and size of water service corporation.
- 3. **Water Service Curb Stop and Box:**
 - a. **Measurement:** Each type and size of water service curb stop and box will be counted.
 - b. **Payment:** Payment will be made at the unit price for each type and size of water service curb stop and box.

D. Valve (Butterfly or Gate):

- 1. **Measurement:** Each type and size of valve will be counted.
- 2. **Payment:** Payment will be at the unit price for each type and size of valve.
- 3. **Includes:** Unit price includes, but is not limited to, all components attached to the valve or required for its complete installation, including underground or above ground operator, square valve operating nut, valve box and cover, valve box extension, and valve stem extension.

E. Tapping Valve Assembly:

- 1. **Measurement:** Each size of tapping valve assembly will be counted.
- 2. **Payment:** Payment will be at the unit price for each tapping valve assembly.

3. **Includes:** Unit price includes, but is not limited to, tapping sleeve, tapping valve, the tap, valve box and cover, valve box extension, and valve stem extension.

F. Fire Hydrant Assembly:

1. **Measurement:** Each fire hydrant assembly will be counted.
2. **Payment:** Payment will be at the unit price for each fire hydrant assembly.
3. **Includes:** Unit price includes, but is not limited to, the fire hydrant, barrel extensions sufficient to achieve proper bury depth of anchoring pipe and height of fire hydrant above finished grade, and components to connect the fire hydrant to the water main, including anchoring pipe, fittings, thrust blocks, pea gravel or porous backfill material, and fire hydrant gate valve and appurtenances, except tapping valve assembly if used.

- G. Valve Box Adjustment, Minor:** Measurement and payment for minor adjustment of an existing valve box by raising or lowering the adjustable valve box is incidental.

H. Valve Box Extension:

1. **Measurement:** Each existing valve box adjusted to finished grade by adding a valve box extension will be counted.
2. **Payment:** Payment will be at the unit price for each valve box extension.

I. Fire Hydrant Adjustment:

1. **Measurement:** Each existing fire hydrant adjusted to finished grade by addition of an extension barrel section and stem will be counted.
2. **Payment:** Payment will be at the unit price for each adjustment of an existing fire hydrant.
3. **Includes:** The unit price for each adjustment of an existing fire hydrant includes, but is not limited to, removal and reinstallation of the existing fire hydrant; furnishing and installing the extension barrel section and stem; and all other necessary appurtenances.

- J. Testing and Disinfection:** Testing and disinfection of water systems is incidental to the construction of pipe and fittings.

PART 2 - PRODUCTS

- 2.01** All products used for this work shall be from the list of "Accepted Products for Water Distribution Materials" contained in the North Liberty design standards and found in Part 4 of this Special Provision.

2.02 WATER MAIN

- A. Polyvinyl Chloride (PVC) Pipe:** Comply with AWWA C900 or AWWA C905 with gray iron pipe equivalent outside diameters.

1. **Minimum Wall Thickness:**
 - a. **4 inch through 24 inch sizes:** DR 18.

2. **Joint Type:** Use push-on joint type, except as otherwise specified in the contract documents or as authorized by the Engineer. Trenchless installation requires restrained joint pipe.
 - a. **Push-on:** According to AWWA C900 or AWWA C905.
 - b. **Integral Restrained Joint:** AWWA C900 or AWWA C905 pipe with restraining system manufactured integrally into pipe end.
 - c. **Mechanical Restrained Joint:** Ductile iron mechanical device designed for joint restraint of AWWA C900 or AWWA C905 pipe complying with the requirements of ASTM F 1674.

3. **Markings on Pipe:**
 - a. Name of manufacturer.
 - b. Size and class.
 - c. Spigot insertion depth gauge.
 - d. National Sanitation Foundation (NSF) seal.

2.03 BOLTS FOR WATER MAIN AND FITTINGS

- A. Use corrosion resistant NSS Cor-Blue nuts and bolts. Include factory-applied lubricant that produces low coefficient of friction for ease of installation.

2.04 FITTINGS

- A. **For DIP and PVC Pipe:** Comply with AWWA C110 (ductile iron or gray iron) or AWWA C153 (ductile iron) rated for 350 psi.

1. **Joint Type:**
 - a. For pipe sizes 16 inches and less, use mechanical joint complying with AWWA C111.
 - b. Use of alternate restraint systems must be approved by the Engineer.
2. **Lined:** Cement mortar lined according to AWWA C104 with asphalt coating.
3. **Wall Thickness:** Comply with AWWA C153.
4. **Gaskets:** Comply with AWWA C111.

B. Flange Adapter:

1. **Body:** Ductile iron complying with ASTM A 536.
2. **End Rings (Follower Rings):** Ductile iron complying with ASTM A 536.
3. **Gaskets:** New rubber compounded for water service and resistant to permanent set.
4. **Bolts and Nuts:** High strength, low alloy corrosion resistant steel or carbon steel bolts complying with ASTM A 307.

C. Pipe Coupling:

1. **Center Sleeve (Center Ring):** Steel pipe or tubing complying with ASTM A 53 or ASTM A 512, or formed carbon steel with a minimum yield of 30,000 psi.
2. **End Ring (Follower Ring):** Ductile iron complying with ASTM A 536, or steel meeting or exceeding the requirements of ASTM A 576, grade 1010-1020.
3. **Gaskets:** New rubber compounded for water service and resistant to permanent set.

4. **Bolts and Nuts:** High strength, low alloy corrosion resistant steel.

2.05 CONCRETE THRUST BLOCKS

- A. Use Class C concrete.
- B. Comply with the contract documents for dimensions and installation of thrust blocks. Comply with Standard Road Plan WM-101.
- C. Use for all pipe sizes 16 inches in diameter or smaller or when specified.

2.06 PIPELINE ACCESSORIES

A. Polyethylene Wrap:

1. Comply with AWWA C105.
2. Provide tubes or sheets with 8 mil minimum thickness.

B. Tracer System: Comply with Standard Road Plan WM-102.

1. Tracer Wire:

a. Solid Single Copper Conductor:

- 1) **Size:** No. 12 AWG
 - 2) **Insulation Material:** Linear low-density polyethylene (LLDPE) installation suitable for direct burial applications.
 - 3) **Insulation Thickness:** 0.045 inches, minimum.
 - 4) **Color:** Yellow, Orange or Blue
2. **Ground Rod:** 3/8 inch diameter, 60 inch steel rod uniformly coated with metallically bonded electrolytic copper.
 3. **Ground-rod Clamp:** High-strength, corrosion-resistant copper alloy.
 4. **Splice Kit:** Inline resin splice kit with split bolt (1 kV and 5 kV) for use with single conductor and unshielded cable splices in direct bury and submersible applications.
 5. **Tracer Wire Station:** Comply with the contract documents.

2.07 SPECIAL GASKETS

- A. For soils contaminated with gasoline, use neoprene or nitrile gaskets.
- B. For soils contaminated with volatile organic compounds, use nitrile or fluorocarbon gaskets.
- C. For other soil contaminants, contact the Engineer for the required gasket.

2.08 NON-SHRINK GROUT

Comply with Materials I.M. 491.13.

2.09 VALVES

A. General:

1. **Valve Body:** Manufacturer’s name and pressure rating cast on valve body.
2. **Direction of Opening:** Opening direction is counterclockwise as viewed from the top, unless otherwise specified in the contract documents or as directed by the Jurisdiction.
3. **Joints:** For buried installations, use mechanical joints per AWWA C111.

B. Gate Valves:

1. **Standards:** Comply with AWWA C509 (gray iron or ductile iron) or AWWA C515 (ductile iron) and NSF 61.
2. **Stem Seals:** Double O-rings permanently lubricated between seals. Lubricant certified for use in potable water.
3. **External Bolts and Hex Nuts:** Stainless steel according to ASTM A 240, Type 304.

C. Tapping Valve Assemblies:

1. **Tapping Valve:** Gate valve complying with AWWA C509 or AWWA C515.
2. **Sleeve:**
 - a. Minimum 14 gauge, stainless steel according to ASTM A 240, Type 304.
 - c. Working pressure 150 psi.
 - d. Must fully surround pipe.
 - e. Flanged with dimensions and drillings per AWWA C110 or ANSI B16.1 class 125.
3. **Minimum Sleeve Length:** Comply with the following table.

Table 1: Minimum Sleeve Length

Outlet Flange Size	Minimum Sleeve Length
4"	15"
6"	15"
8"	20"
10"	25"
12"	25"
Over 12"	As approved by the Engineer

4. **Gasket:**
 - a. To completely surround pipe.
 - b. Minimum thickness 0.125 inch.
 - c. Use nitrile rubber.
5. **Outlet Flange:**
 - a. Stainless steel complying with ASTM A 240, Type 304.
 - b. ANSI B16.1, 125 pound pattern.
6. **Hex Nuts and Bolts:** Stainless steel complying with ASTM A 240, Type 304.
7. **Tapping Valve Assemblies:** Use only where specified in the contract documents.

2.10 FIRE HYDRANT ASSEMBLY

- A. Material:** Comply with AWWA C502.

B. Manufacturers: As allowed by the City or as specified in the contract documents.

C. Features:

1. **Breakaway Items:** Stem coupling and flange.
2. **Inlet Nominal Size:** 6 inch diameter.
3. **Inlet Connection Type:** Mechanical joint.
4. **Nozzles:** Provide two 2.5 inch nozzles and one 4.5 inch nozzle (Storz connection) with Standard Threads (NST).
5. **Direction of Opening:** Counterclockwise, unless otherwise specified.
6. **Items to be Specified:**
 - a. Red color.
 - b. Pentagon operating nut.
 - c. 6 inch MJ shoe.
 - d. 5.25 inch main valve nominal opening size.
 - e. Minimum thrust block size for hydrants: 24 inch by 24 inch by 18 inch thick.
 - f. Provide 12 inch by 12 inch by 4 inch thick solid concrete block under the shoe.

D. Painting:

1. Shop coating according to AWWA C502.
2. Above grade exterior coating type and color will be selected by the Engineer.

E. External Bolts and Hex Nuts: Stainless steel according to ASTM A 193, Grade B 8.

F. Gate Valve: Comply with Part 2 of this Special Provision.

G. Pipe and Fittings: Comply with Part 2 of this Special Provision.

2.11 APPURTENANCES

A. Flushing Device (Blowoff): As specified in the contract documents.

B. Valve Box:

1. **Applicability:** For all buried valves.
2. **Manufacturer:** As allowed by the Jurisdiction or specified in the contract documents.
3. **Type:**
 - a. In paved areas, use a slide type.
 - b. In all other areas, use a screw extension type.
4. **Material:** Gray iron.
5. **Cover:** Gray iron, labeled "WATER"
6. **Wall Thickness:** 3/16 inch, minimum.
7. **Inside Diameter:** 5 inches, minimum.

- 8. **Length:** Adequate to bring top to finished grade, including valve box extensions, if necessary.
- 9. **Factory Finish:** Asphalt coating.
- 10. **Valve Box Centering Ring:** Include in installation.
- C. **Valve Stem Extension:** For all buried valves, provide as necessary to raise 2 inch operating nut to within 3 feet of the finished grade. Stem diameter according to valve manufacturer's recommendations, but not less than 1 inch.

2.12 DISINFECTION AGENT - CHLORINE

- A. Liquid Chlorine complying with AWWA B300 and AWWA B301.
- B. Sodium Hypochlorite complying with AWWA B300.
- C. Calcium Hypochlorite complying with AWWA B300.
- D. All disinfecting agents to be NSF 60 certified. Supply and store in the original container.

PART 3 – EXECUTION

3.01 PIPE INSTALLATION

A. General:

- 1. Do not use deformed, defective, gouged, or otherwise damaged pipes or fittings.
- 2. Keep trench free of water. Clean pipe interior prior to placement in the trench.
- 3. Install pipe with fittings and valves to lines/grades specified in the contract documents.
- 4. Clean joint surfaces thoroughly and apply lubricant approved for use with potable water and recommended by the manufacturer.
- 5. Push pipe joint to indication line on spigot end of pipe before making any joint deflections.
- 6. Limit joint deflections to one degree less than pipe manufacturer's recommended maximum limit.
- 7. Tighten bolts in a joint evenly around the pipe.
- 8. Install concrete thrust blocks on all fittings 16 inches in diameter or smaller (comply with Standard Road Plan WM-101). For fittings larger than 16 inches, install restrained joints, and when specified in the contract documents, also install concrete thrust blocks.
- 9. Keep exposed pipe ends closed with rodent-proof end gates at all times when pipe installation is not occurring.
- 10. Close ends of installed pipe with watertight plugs during nights and non-working days.
- 11. Do not allow any water from the new pipeline to enter the existing distribution system piping until testing and disinfection are successfully completed.

B. Trenched:

1. Excavate trench and place pipe bedding and backfill material as specified in Section 2552 of the Standard Specifications, as well as the additional requirements listed below:
 - a. Water main shall be backfilled with either of the following and compacted to 95% standard proctor density:
 - 1) Suitable excavated material in accordance with Section 2552 of the Standard Specifications. If excavated material is not suitable, then;
 - 2) Class A roadstone (Gradation No. 11)
2. All water main shall be provided with Class P-2 trench bedding (Standard Road Plan SW-104).
2. Provide uniform bearing along the full length of the pipe barrel. Provide bell holes.

C. Trenchless: Comply with Section 2553 of the Standard Specifications.

3.02 ADDITIONAL REQUIREMENTS FOR PVC PIPE INSTALLATION

- A. Cut the pipe perpendicular to the pipe barrel. Deburr and bevel cut spigot end of the pipe barrel to match factory bevel. Re-mark the insertion line.
- B. When connecting to shallow-depth bells, such as on some cast iron fittings or valves, cut the spigot end square to remove factory bevel. Deburr the end and form partial bevel on the end.

3.03 POLYETHYLENE ENCASEMENT INSTALLATION

- A. Apply polyethylene encasement to buried ductile iron pipe and to buried fittings, fire hydrants, and appurtenances. The polyethylene encasement is used to prevent contact between the pipe and the bedding material, but need not be airtight or watertight.
- B. Install polyethylene encasement according to AWWA C105, using tubes or flat sheets, and pipe manufacturer's recommendations.
- C. Do not expose the polyethylene encasement to sunlight for long periods before installation.
- D. Remove all lumps of clay, mud, cinders, etc. on the pipe surface before encasing the pipe. Take care to prevent soil or bedding material from becoming trapped between the pipe and polyethylene.
- E. Lift polyethylene-encased pipe with a fabric-type sling or padded cable.
- F. Secure and repair encasement material using polyethylene tape, or replace as necessary.

3.04 TRACER SYSTEM INSTALLATION

- A. Install with all buried water main piping (comply with Standard Road Plan WM-102 for tracer wire installation).
- B. Begin and terminate the system at all connections to existing mains.
- C. Install wire continuously along the lower quadrant of the pipe. Do not install wire along the bottom of the pipe. Attach wire to the pipe at the midpoint of each pipe length; use 2 inch wide, 10 mil thickness polyethylene pressure sensitive tape.

- D. Install splices only as authorized by the Engineer. Allow the Engineer to inspect all below-grade splices of tracer wire prior to placing the backfill material.
- E. Install ground rods adjacent to connections to existing piping and at locations specified in the contract documents or as directed by the Engineer.
- F. Bring two wires to the surface at each fire hydrant location and terminate with a tracer wire station (Standard Road Plans WM-102 and WM-201) set flush with the grade adjacent to the hydrant.
- G. Final inspection of the tracer system will be conducted at the completion of the project and prior to acceptance by the owner. Verify the electrical continuity of the system. Repair discontinuities.

3.05 FIRE HYDRANT, VALVE AND APPURTENANCE INSTALLATION

- A. Install according to the contract documents.
- B. Apply polyethylene wrap to all iron pipe, valves, fire hydrants, and fittings.
- C. Set tops of valve boxes to finished grade, unless otherwise directed by the Engineer.
- D. Check the working order of all valves by opening and closing through entire range. Before opening the valves, check with the Jurisdiction on operating requirements.
- E. Test and disinfect all valves, fire hydrants, and appurtenances as components of the completed water main according to Part 3 of this Special Provision.

3.06 FLUSHING DEVICE (BLOWOFF)

Install and construct as specified in the contract documents.

3.07 FIRE HYDRANT

- A. Install according to Standard Road Plan WM-201.
- B. If the fire hydrant valve is positioned adjacent to the water main, attach it to an anchor tee.
- C. If the fire hydrant valve is positioned away from the water main, restrain all joints between the valve and water main.
- D. Fire Hydrant Depth Setting:
 - 1. Use adjacent finished grade to determine setting depth.
 - 2. Set bottom of breakaway flange between 2 and 5 inches above finished grade.
 - 3. If finished grade is not to be completed during the current project, consult with the Engineer for proper setting depth.
- E. Coordinate installation with tracer wire installation.
- F. Orient fire hydrant nozzles as directed by the Engineer.

3.08 ADJUSTMENT OF EXISTING VALVE BOX OR FIRE HYDRANT

A. Minor Valve Box Adjustment: For existing adjustable boxes that have sufficient adjustment range to bring to finished grade, raise or lower valve box to finished grade.

B. Valve Box Extension: For existing valve boxes that cannot be adjusted to finished grade, install valve box extensions as required.

C. Fire Hydrant Adjustment:

1. Add extension barrel sections and stems as necessary (12 inch maximum extension height) to set existing fire hydrant at finished grade.
2. Paint exterior of new barrel section to match existing fire hydrant unless otherwise specified.

3.09 CONFLICTS

A. Horizontal Separation of Gravity Sewers from Water Mains:

1. Separate gravity sewer mains from water mains by a horizontal distance of at least 10 feet unless:
 - a. The top of sewer main is at least 18 inches below the bottom of the water main, and
 - b. The sewer is placed in a separate trench or in the same trench on a bench of undisturbed earth at a minimum horizontal separation of 3 feet from the water main.
2. When it is impossible to obtain the required horizontal clearance of 3 feet and a vertical clearance of 18 inches between sewers and water mains, the sewers must be constructed of water main materials meeting the requirements of Article 4150.02, A of the Standard Specifications. However, provide a linear separation of at least 2 feet.

B. Separation of Sewer Force Mains from Water Mains: Separate sewer force mains and water mains by a horizontal distance of at least 10 feet unless:

1. The force main is constructed of water main materials meeting a minimum pressure rating of 150 psi and the requirements of Article 4150.02, A of the Standard Specifications, and
2. The sewer force main is laid at least 4 linear feet from the water main.

C. Separation of Sewer and Water Main Crossovers:

1. Vertical separation of sanitary and storm sewers crossing under any water main should be at least 18 inches when measured from the top of the sewer to the bottom of the water main. If physical conditions prohibit the separation, the sewer may be placed not closer than 6 inches below a water main or 18 inches above a water main. Maintain the maximum feasible separation distance in all cases. The sewer and water pipes must be adequately supported and have watertight joints. Use a low permeability soil for backfill material within 10 feet of the point of crossing.
2. Where the sanitary sewer crosses over or less than 18 inches below a water main, locate one full length of sewer pipe of water main material so both joints are as far as possible from the water main.
3. Where the storm sewer crosses over or less than 18 inches below a water main, locate one full length of sewer pipe of water main material or reinforced concrete pipe (RCP) with flexible O-ring gasket joints so both joints are as far as possible from the water main.

3.10 SEQUENCE OF TESTING AND DISINFECTION

Perform operations according to AWWA C651 in the sequence below. Successfully complete each operation before continuing to the next operation. The Jurisdiction will provide reasonable quantities of water for flushing and testing.

A. Continuous-Feed or Slug Method (After Water Main Installation): The sequence of testing and disinfection may be modified with approval of the Engineer.

1. Perform initial flush.
2. Perform disinfection.
3. Flush after disinfection.
4. Perform pressure and leak testing.

B. Tablet Method (Concurrent with Water Main Installation): Use this method only if approved by the Engineer. Modify the procedure for flushing, disinfection, and pressure and leak testing as needed if tablet method is used.

1. Perform disinfection.
2. Flush after disinfection.
3. Perform pressure and leak testing.

3.11 INITIAL FLUSHING

A. Flushing:

1. Coordinate flushing with the Jurisdiction.
2. Flush pipe prior to disinfection using potable water.
3. Measure flushing velocity.
4. Obtain a minimum flushing velocity of 2.5 feet per second in the pipe to be disinfected.

B. Minimum Flushing Rate: According to AWWA C651, Table 3, based on 40 psi residual pressure (see table below).

Table 2: Minimum Flushing Rate

Pipe Diameter (inches)	Flow Rate for Flushing (gpm)	Number of Taps ²			Number of 2 1/2" Fire Hydrant Outlets ¹
		1"	1 1/2"	2"	
4	100	1	-	-	1
6	200	-	1	-	1
8	400	-	2	1	1
10	600	-	3	2	1
12	900	-	-	2	2
16	1,600	-	-	4	2

¹With a 40 psi pressure in the main with the fire hydrant flowing to atmosphere, a 2 1/2 inch fire hydrant outlet will discharge approximately 1,000 gpm; and a 4 1/2 inch fire hydrant outlet will discharge approximately 2,500 gpm.

²Number of taps on pipe based on discharge through 5 feet of galvanized iron pipe with one 90 degree elbow.

C. Property Protection: Protect public and private property from damage during flushing operations.

3.12 DISINFECTION

A. General:

1. Disinfect according to AWWA C651. The tablet method contained in AWWA C651 is not to be used unless approved by the Engineer.
2. Keep piping to be chlorinated isolated from lines in service and from points of use.
3. Coordinate disinfection and testing with the Engineer.
4. Obtain and test water samples, unless otherwise provided by the Engineer.

B. Procedure:

1. Induce a flow of potable water through the pipe.
2. Introduce highly chlorinated water to the pipe at a point within 5 pipe diameters of the pipe's connection to an existing potable system, or within 5 pipe diameters of a closed end, if there is no connection to an existing system.
3. Introduce water containing a minimum of 25 mg/L free chlorine until the entire new pipe contains a minimum of 25 mg/L free chlorine.
4. Retain chlorinated water in the pipe for at least 24 hours and no more than 48 hours.

3.13 FINAL FLUSHING

- A. Flush pipe using potable water until chlorine residual equals that of the existing potable water system.
- B. Dispose of chlorinated water to prevent damage to the environment. Dechlorinate highly chlorinated water from testing before releasing into the ground or sewers. Obtain City approval prior to flushing activities.
 1. Check with the local sewer department for the conditions of disposal to the sanitary sewer.
 2. Chlorine residual of water being disposed will be neutralized by treating with one of the chemicals listed in the following table.

Table 3: Amounts of Chemicals Required to Neutralize Various Residual Chlorine Concentrations in 100,000 Gallons of Water

Residual Chlorine Concentration mg/L	Sulfur Dioxide (SO ₂) lb	Sodium Bisulfite (NaHSO ₃) lb	Sodium Sulfite (Na ₂ SO ₃) lb	Sodium Thiosulfate (Na ₂ S ₂ O ₃ + 5H ₂ O) lb	Ascorbic Acid (C ₆ O ₈ H ₆) lb
1	0.8	1.2	1.4	1.2	2.1
2	1.7	2.5	2.9	2.4	4.2
10	8.3	12.5	14.6	12.0	20.9
50	41.7	62.6	73.0	60.0	104

3.14 PRESSURE AND LEAK TESTING

- A. Remove debris from within the pipe. Clean and swab out pipe, if required.

- B. Secure unrestrained pipe ends against uncontrolled movement.
- C. Isolate new piping from the existing water system.
- D. Fill and flush all new piping with potable water. Ensure all trapped air is removed.
- E. Pressurize the new pipe to the test pressure at the highest point in the isolated system. Do not pressurize to more than 5 psi over the test pressure at the highest point in the isolated system.
- F. Test and monitor the completed piping system at 1.5 times the system working pressure or 150 psi, whichever is greater, for 2 continuous hours.
- G. If at any time during the test the pressure drops to 5 psi below the test pressure, repressurize the pipe by pumping in potable water in sufficient quantity to bring the pressure back to the original test pressure.
- H. Accurately measure the amount of water required to repressurize the system to the test pressure.
- I. Maximum allowable leakage rate according to AWWA C600:

$$L = \frac{(S)(D)(P)^{0.5}}{148,000}$$

Where:

- L = allowable leakage, in gallons per hour
- S = length of pipe tested, in feet
- D = nominal pipe diameter, in inches
- P = average test pressure, in pounds per square inch

The following table assumes an average test pressure (P) of 150 psi and 1,000 feet of test section.

Table 4: Maximum Allowable Leakage Rate

Pipe Diameter (inches)	Allowable Leakage Rate (gallons/hour/1,000 feet of pipe)
4	0.33
6	0.50
8	0.66
10	0.83
12	0.99
14	1.16
16	1.32
18	1.49
20	1.66
24	1.99
30	2.48
36	2.98

- J. If the average measured leakage per hour exceeds the maximum allowable leakage rate, repair and retest the water main.
- K. If the measured pressure loss does not exceed 5 psi, the test will be considered acceptable.

L. Repair all visible leaks regardless of the amount of leakage.

3.15 BACTERIA SAMPLING

Test water mains according to AWWA C651; including collection of two consecutive sets of acceptable bacteria samples 24 hours apart. If the initial disinfection procedure fails to produce satisfactory bacteriological results or if other water quality is affected, repeat the disinfection procedure.

3.16 PUTTING WATER MAIN IN SERVICE

A. The following verifications are required to be coordinated with the City and completed by the Contractor:

1. All new valves are to be located and tested to verify operation.
2. Fire hydrants shall be tested to verify operation.
3. Flow tests shall be conducted to verify that all components of the water system are fully open and operational and to determine fire flow capacity.

B. Put completed water system in service only after obtaining permission from the Jurisdiction.

PART 4 – ACCEPTED PRODUCTS FOR WATER DISTRIBUTION MATERIALS

WATER PIPE: (Ductile) ANSI/AWWA – A21.51/C151

American, Clow, McWane, and US Pipe
Class 52 for direct buried piping unless otherwise indicated or specified.
Class 53 for suspended from structures and bolted or restrained joint pipe.

WATER PIPE: (PVC) (Class 150) – C900

C900 thickness class DR 18 (6-inch thru 12-inch)

FITTINGS:

(Ductile Iron Standard) ANSI/AWWA – A21.10/C110 (3-inch to 24-inch – 350 psi)

(Ductile Iron Compact) AWWA C153 (350 psi)

Clow, Tyler / Union, U.S. Pipe, or Sigma

TAPPING SLEEVES:

**Full Body Ductile Iron w/ Stainless Steel and/or NSS Cor-Blue Nuts & Bolts
(for 12-inch and larger or under pavement)**

Mueller – H615, Kennedy, Tyler/Union, American Flow Control – Series 2800, or U.S. Pipe – T-9

TAPPING SLEEVES: (Stainless Steel)

Smith Blair – 662 or 663, Ford FAST, Mueller – H304, Romac SST, JCM – 432
Smith Blair – 664 or Romac SST with nitrile gaskets to be used in L.U.S.T areas

MECHANICAL JOINT RESTRAINT DEVICE: (Megalug – with NSS Cor – Blue Nuts and Bolts)

EBAA Iron Sales Inc. – 1100 series for ductile iron, 2000 PV for PVC, or Star Grip 3000 / 4000

STAINLESS STEEL REPAIR CLAMPS: (With Stainless Steel Nuts & Bolts)

Smith-Blair – 261, Ford FS1, Romac SS1

VALVES: (Resilient Seated Gate Valves) ANSI/AWWA – C509

Clow F-2640, Kennedy 8571 SS, Mueller Resilient Seat – A-2360-20, or U.S. Pipe USPO-23-without accessories or USPO-20-with accessories

VALVES: (Butterfly) ANSI/AWWA C504, Class 150B

Clow, Pratt, Mueller, Kennedy, M & H, DeZurik or Val-Matic

VALVES: (Tapping)

Clow – F-2640, Mueller – T-2360-16, Kennedy 8950 SS, U.S. Pipe – A-USPO-16

VALVE BOXES:

Tyler – (Series 6850, 6855 & Item 666A; Range 63-inch to 83-inch)

HYDRANTS: AWWA C502 (5 1/4 Main Valve Size)

Standard Threads (NST) on the two and one-half (2 ½) inch connections and four and one-half (4 ½) inch Storz connection; color red; opening counter clockwise; Pentagon operating nut; six (6) inch MJ shoe
Clow F-2545 Medallion, Mueller Super Centurion 250, Waterous Pacer WB-67-250

SLEEVE TYPE COUPLING: (With Stainless Steel Nuts & Bolts)

Standard solid black sleeve – Tyler/Union 5-1442, Griffin Bolted Straight Coupling with stainless steel bolts and nuts – Smith –Blair 441 or Romac Style 501 – Shop Coat/Epoxy

TRACER WIRE TERMINAL BOX (DAYLIGHT BOX):

U.S. Filter, WaterPro or Utility Equipment

Valvco – 95E (2.5-inch ID with Lockable Cast-Iron Lid; Minimum 18" Long; Telescoping)

TRACER WIRE CONNECTORS:

Twister DB Plus Wire Connector

POLYWRAP:

8 mil polyethylene encasement

WIRE:

#12 solid copper, LLDPE insulation in yellow, orange or blue

SERVICE SADDLES: ANSI/AWWA – C800/C900

AY McDonald or Smith Blair double stainless steel straps, studs, washers, nuts with brass body

CORPORATION VALVES: ANSI/AWWA C800

AY McDonald or Mueller ball style rated for minimum 300 PSIG water pressure

BALL CURB VALVES: ANSI/AWWA C800

AY McDonald or Mueller ball style rated for minimum 300 PSIG water pressure

CURB BOX ARCH PATTERN: ANSI/AWWA C800 – with stainless steel rod and cotter pin

AY McDonald 5607LTW with 5660SS-5' shut off rod