



**SPECIAL PROVISIONS  
FOR  
WATER MAIN AND APPURTENANCES**

**Polk County  
IM-080-3(264)124--13-77**

**Effective Date  
July 16, 2024**

**THE STANDARD SPECIFICATIONS, SERIES 2023, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.**

**230184.01 GENERAL REQUIREMENTS.**

**A. Purpose.**

To set forth requirements of performance, standards of materials and construction for the installation of water mains and appurtenances within the City of Urbandale.

**B. Scope.**

1. To ensure that water mains, appurtenances, and the construction thereof are in accordance with the requirements of the City of Urbandale, Urbandale Water Utility and the Water Supply Section of the Environmental Protection Division of the Department of Natural Resources.
2. As-built Drawings: One 'as-built record drawing' of the main is to be submitted to the Water Utility within 30 days after the completion of the water main installation, unless otherwise approved by the Engineer. Prior to the acceptance of the public improvements, as-built record drawings, (horizontal and vertical) as-built data in state plane coordinates and NAD 1983 State Plane Iowa South horizontal datum and NAVD 88 vertical datum, adjusted to Urbandale datum for all water piping and associated appurtenances will be provided. Submittals are preferred electronically, but a pdf format is acceptable.

**230184.02 MATERIALS**

This section covers materials approved for use in the construction of water mains and related construction. When a required material is not specified herein, the Engineer must approve such addition or changes. The approval of a material for a particular use does not constitute the approval of its use for any other purpose.

**A. General.**

1. Pipe and Fittings: Conform to the requirements of ANSI, AWWA. and ASTM.

2. Minimum Water Main Diameter: 8 inch unless otherwise directed by the Engineer.
3. Minimum Size Service Line: 1 inch diameter unless otherwise directed by the Engineer.

#### **B. Pipe Materials.**

1. Ductile Iron Pipe (DI): AWWA C151, ANSI A21.51 manufactured in accordance with ANSI 21.51; minimum thickness, Class 52.
  - a. Enameline pipe using standard cement lining: AWWA C104, ANSI A21.4.
  - b. Coat the outside of the pipe with bituminous enamel, 1 mil thickness.
  - c. Joints shall be push-on or mechanical in accordance with ANSI A21.15.
  - d. Shipment and Storage: For shipment and storage, small pipe shall not be telescoped inside larger pipe. All pipe materials are to be handled by use of slings, hoist, skids or other approved means. Dropping or rolling of pipe materials is not permitted.
  - e. Defective or damaged pipe shall be cause for rejection and removal from the site.
  - f. Pipe with damage to cement mortar lining will be rejected. Field patching will not be permitted except at the cut ends.
  - g. Use restrained or locked pipe joints on ductile iron pipe at stream crossings.
  - h. All ductile iron pipe shall be encased in polyethylene encasement material.
2. Poly Vinyl Chloride Pipe (PVC): PVC pipe 12 inch and smaller shall conform to AWWA C-900 specifications, Pressure Class 235 (DR 18). PVC pipes 20 inch and smaller shall conform to AWWA C-905 specifications, (DR-18).
  - a. PVC water main shall not exceed 20 inches in diameter. (Pipe larger than 20 inches shall be DI).
  - b. PVC pipe shall have cast iron outside diameter.
  - c. Pipe joints shall be elastomeric gasket push-on type joints.
  - d. Solvent cement joints are strictly prohibited.
  - e. Fittings for PVC shall be as specified for ductile iron pipe.
3. Locking PVC Pipe: Locking PVC pipe shall meet AWWA C-900 standards for PVC pressure pipe and fittings with a dimension ration of DR18, Certa-Lok, or approved equal.
  - a. The pipe shall be joined using separate PVC coupling with beveled edges, built-in sealing gaskets and restraining grooves. The restraining splines shall be square or rectangular as specified by the manufacturer.
  - b. Exposed splines shall be cut flush to coupling to reduce soil drag.
  - c. Couplings shall be beveled on leading degrees to minimize soil friction.
4. **Water Service Pipes and Private Mains.**
  - a. The minimum size service lines shall be 1 inch unless otherwise directed by the Engineer.
  - b. One inch thru 2 inch Diameter: Type K (Heavy), soft annealed copper, seamless ASTM B88.
  - c. Pipes larger than 2 inch shall be DI, cement-mortar lined, ANSI A21.50, Class 52 mechanical or push joint, or poly vinyl chloride (PVC), push joint, AWWA C-900 specification, Pressure Class 235 (DR-18) with cast iron outside diameter.

#### **C. Fittings.**

1. **Fittings:** Fittings for 3 inch thru 20 inch size ductile iron pipe shall be compact iron per AWWA C153, ANSI A21.53, or gray cast iron, or full size ductile iron per AWWA C110, ANSI A21.10. The pressure rating for gray cast iron fittings shall be 350-psi for 3 inch thru 24 inch mains and 250 psi for fittings greater than 24 inch, Tyler, or approved equal.
2. **Mechanical Joint:** Fittings shall be mechanical joint.

3. **Lining:** All fittings shall be furnished with cement mortar lining of standard thickness and given a seal coat of bituminous enamel per AWWA C104, ANSI A21.4.
4. **Fitting Joints:** Provide restrained or locked joints on all fittings.
5. **Anchoring Tee:** Short short body (SSB) Class 350, Tyler, or approved equal.
6. **Anchoring Pipe:** Short short body (SSB) Class 350, Tyler, or approved equal.
7. **Anchoring Coupling:** Short body (SSB) Class 350, Tyler, or approved equal.
8. **Glands.**
  - a. Ductile Iron: Megalug Series 1100.
  - b. PVC: Megalug Series 200PV.
9. **Cap:** Short body (SSB) Class 350, Tyler, or approved equal.
10. **Plug:** Short body (SSB) Class 350, Tyler, or approved equal.
11. **Anchoring Rods and Eye Bolts:** 3/4 inch diameter stainless steel or high strength low alloy steel to be used only with the prior approval of the Engineer.
12. **Couplings:** Romac Macra Smith Blair 421 Top Bolt, or approved equal.
13. **Solid Sleeves:** Tyler mechanical joint or approved equal.

#### D. Valves.

1. **General.**
  - a. Valves shall be of a type permitting repacking under pressure when wide open.
  - b. Provide special tools required for disassembling and repacking valves.
  - c. Must be coated both inside and out with a protective epoxy coating that meets or exceeds AWWA C550 and certified to ANSI 61.
  - d. Each valve shall have the name of the manufacturer and the year when cast on the body with raised letters.
  - e. Bolts and hex nuts used on the bonnet of the valve shall be stainless steel.
  - f. Valves shall have mechanical joint ends, AWWA C111, ANSI A21.11.
  - g. Glands:
    - 1) Ductile Iron: Megalug Series 1100.
    - 2) PVC: Megalug Series 2000PV or approved equal.
2. **Gate Valves.**
  - a. All 20 inch and smaller valves shall be a resilient wedge gate and conform to AWWA C509, or AWWA C515 and be manufactured by Mueller, Clow, or American Flow Control.
  - b. Non-rising stem with 2 inch operating nut; open counter clockwise direction (left).
  - c. O-ring seals, 200 psi working pressure.
  - d. Ductile Iron Body, AWWA C509, American Flow Control Series 2500, or approved equal.
3. **Butterfly Valves.**
  - a. Installation of butterfly valves must be approved by the Engineer.
  - b. Butterfly valves shall conform to AWWA C504, Class 150B.
  - c. Valves shall be equipped with Ni-resist discs.
  - d. Valves shall have O-ring seals and stainless steel shaft.
  - e. Valves and operators shall be for buried service.
  - f. Equipped with a 2 inch by 2 inch operating nut and a lifetime grease pack and shall open in the counter clockwise direction (left).

g. Certified shop test reports shall accompany each valve.

**4. Tapping Valve and Sleeves.**

- a. American Flow Control Series 2500 MJ valve, or approved equal.
- b. Smith-Blair Model 665 Sleeve, or Ford FTSS, or approved equal. The tapping sleeve constructed entirely of stainless steel including stainless steel MJ adapter.

**5. Cutting In Valves and Sleeves.**

American Flow Control Series 2500 MJ valve cutting in valve and cutting in sleeve, or approved equal. Use when directed by the Engineer.

**6. Valve Boxes.**

- a. All valve boxes shall be domestic cast iron screw type adjustable with cast iron, stay-put covers marked "Water". Inside diameter of valve box is to be a minimum of 5 1/8 inch. This shall be Tyler Series 6850, Model 666S and cover.
- b. Valve Box Adaptor II by Adaptor, Inc., (alignment centering ring) shall be required to position the valve box and for proper alignment of the valve box. The valve box adaptor II shall also be the proper type (A, B, C, etc.) to fit the various valve manufacturers.

**7. Valve Stem Extensions.**

- a. Extensions shall be Tyler Model 60, or 69. Drop in extensions shall not be allowed.
- b. When the nut of the valve is deeper than 6 feet the valve stem extension is required. The valve stem extension shall be solid steel, with no couplings.

**E. Service Lines.**

- 1. **Material:** All material shall comply with AWWA C800 and ANSI/NSF 61. Use gate valve in lieu of curb stop for service lines larger than 2 inch.
- 2. **Minimum size:** 1 inch unless directed by the Engineer.
- 3. **Flared Fittings:** For 1 inch thru 2 inch services.
  - a. Corporation Stops: Shall be Mueller HI-15000, Ford F600 - # - NL, or approved equal; suitable for tapping iron pipe.
  - b. Curb Stops: Shall be Ford Ball Valve B22- # - NL, or Mueller Oriseal H-15204 curb valve, 90 degree turn for flared copper services, or approved equal.
  - c. Coupling: Shall be Ford C22, or approved equal.
- 4. **Compression Fittings:** For 1 inch thru 2 inch services.
  - a. **Corporation Cocks:** Shall be Ford FB1000 - # - NL, or approved equal.
  - b. **Curb Stops:** Shall be Ford B44 - # - NL, or approved equal.
  - c. **Coupling:** Shall be Ford C44 - # - NL series, or approved equal.
- 5. **Water Service Saddles:** Service saddles shall be single band, stainless steel. Ford 313 on 4 inch to 12 inch pipe, or approved equal, and Ford 323 for pipe 16 inch and larger, or approved equal. Saddles will be used for corporation cocks.
- 6. **Curb Stop Boxes.**
  - a. **Body:** 1 inch inside diameter steel pipe.
  - b. **Rod:** Metal curb box, sliding extension type, arch pattern base with stationary rod, A.Y. McDonald 5601 for 1 inch and A.Y. McDonald 5603 for 1 1/2 inch and 2 inch, or approved equal. Stationary rod shall be stainless steel. When an extension is required, red Loctite shall be applied to the connecting threads. Stainless steel rod shall be minimum 12 inch to maximum 24 inch below the ground level. Self-centering in the box. Top end of rod shall be blade shaped with thickness appropriate for operation using a stationary rod key.

- c. **Lid:** A.Y. McDonald 5607-L, or approved equal. This lid has a 1 inch pentagon plug.

## **F. Blowoffs.**

### **1. Temporary.**

- a. Temporary blowoffs shall only be used on water designed to be Extended.
- b. Blowoffs are to be sized accordingly to provide at least 2.5 feet per second water flow from the main for disinfection purposes.
- c. For blowoffs on temporary mains 6 inch in diameter and smaller, the blow-off shall be Kupferle Eclipse #2, or approved equal, or provide a minimum 2 inch diameter curb stop, stop box and riser.
- d. For mains 8 inch and larger, hydrants shall conform to AWWA C502, break-flange hydrant, Waterous Company Model WB 67-250 Pacer, or approved equal.

### **2. Permanent.**

- a. Blowoffs are to be sized accordingly to provide at least 2.5 feet per second water flow from the main for disinfection purposes.
- b. Blowoffs for mains smaller than 6 inch in diameter, the blowoff shall be Kupferle Eclipse No. 2, or approved equal.
- c. Blowoffs on mains 6 inch and larger, hydrants shall conform to AWWA C502, break flange hydrant, Waterous, Model WB67-250 pacer, or approved equal.
- d. Riser pipes will not be allowed.

## **G. Hydrants.**

### **1. General.**

- a. Hydrants shall conform to AWWA C502, break-flange hydrant, Waterous Company Model WB 67-250 Pacer, or approved equal.
- b. Coat interior and exterior of hydrants, except exterior above grade mark, with two coats of asphalt varnish per AWWA C502; paint the exterior of hydrant above grade mark with one coat primer and finish paint of Highway Yellow.
- c. Provide two 2 1/2 inch hose nozzles and one 5 inch STORZ pumper nozzle; O-ring packing, 6 feet 6 inch depth of bury.
- d. Nozzles shall be threaded, or pinned into the barrel. No leaded connection allowed.
- e. Nozzle Threads: National Standard.
- f. Provide 6-inch mechanical joint inlet and 5 1/4 inch main valve unless otherwise directed.
- g. Cap and operating nut shall be Type C. The valve shall open counter clockwise direction (left).
- h. The break flange of hydrant shall be 4 inches to 8 inches above grade.
- i. Auxiliary Valve: Use gate valve and valve box as specified for gate valve.

### **2. Hydrant Flags.**

Hydrant flags shall be 4 feet to 5 feet tall and attach to the bonnet of the hydrant. The shaft shall be made of fiberglass coated with a protective formula that prevents the ultraviolet rays from reaching the resin fibers. Displayed on the shaft will be a minimum of four strips of high-intensity reflective tape. Each strip shall be a minimum of 4 inches in width. The shaft shall be attached at the base with a spring to allow the operation of the hydrant without removal.

## **H. Bolting Material.**

All bolts and hex nuts used for mechanical and flanged joints shall be fabricated from a high strength "Cor-Blue".

## **I. Corrosion Control.**

1. **Polyethylene Encasement Material:** The polyethylene encasement shall be 8 mil minimum thickness polyethylene tube manufactured in accordance with AWWA C105, ANSI A21.5.
2. **Polyethylene Encasement Requirement:** All cast iron, or ductile iron mains, fittings, valves and hydrants shall be polyethylene encased.
  - a. Polyethylene tube encasement shall be used on water main. See Standard Drawings in the Plans for installation procedures.
  - b. Polyethylene pressure sensitive pipe wrapping tape shall be 2 inch wide by 10 mil thick.
3. **Polyethylene Tube Size Requirements: For Water Main:**

Normal Pipe Diameter inches	Minimum Polyethylene Flat Tube Width inches
4	16
6	20
8	24
10	27
12	30
14	34
16	37

**J. Tracer System.**

1. **Tracer Wire:** Shall be No. 12 AWG high-strength copper clad steel (HS-CCS), color blue, manufactured by Copperhead industries, or approved equal.
2. **Splicing Material:** Underground wire splices shall be protected against deterioration/corrosion using Dryconn Direct Bury Lug, Part #3WB-01.
3. **Tracing Wire Receptacles:** Provide TW-18 tracing wire receptacles, or approved equal at all hydrants.
4. **Anode Ground Rod:** 1 pound by 1.315 inch D by 18.5 inch L, magnesium drive in anode manufacturer by Copperhead Industries, or approved equal. Cap installed on one end of anode ground rod to be HDPE. Provide a beveled pointed end on anode ground rod opposite of the cap to aid in hammering into the ground.

**K. Thrust Blocks**

1. **Requirement:** Provide concrete thrust blocks where piping changes direction, dead-ends, and at the hydrants.
2. **Location:** Carry thrust block to undisturbed edge of trench for bearing.
3. **Thickness:** Minimum thickness of thrust blocks: 18 inch, or 1.5 times the outside diameter of the pipe, whichever is greater.
4. **Bearing Area:** Bearing area of thrust blocks, square feet.:

Pipe Size (inches)	90 Degree Bend	45 Degree Bend	11 ¼ & 22 ½ Degree Bend	Tee or Dead-end
4	3	1	2	1
6	6	3	2	4
8	11	6	3	8
10	17	9	5	12
12	24	13	7	17

14	33	18	9	23
16	43	23	12	31

5. Refer to Standard Drawings in the plans for the general arrangement of thrust blocks. Also refer to Concrete Gravity Block Standard Drawing in the plans for volume of gravity blocks as needed. Place plywood between fittings and thrust block. No bolts shall come into contact with the concrete thrust block. A sheet of plastic shall be wrapped around the pipe including the bolt circle before the concrete is placed.

**L. Concrete.**

1. Portland cement ASTM 150, Type 1.
2. Concrete shall have a compressive strength of 4000 psi at 28 days.

**230184.03 CONSTRUCTION.**

**A. Trench Excavation**

1. **Trench Width:** Keep trench width as narrow as possible and still provide adequate room for backfill and jointing.
2. **Maximum Width:** Maximum width trench on top of pipe: 2 times pipe diameter, or 2 feet; whichever is greater.
3. **Trench Walls:** Maintain vertical walls of excavation below top of the pipe.
4. **Shoring:** Provide sheeting, shoring and bracing where required to hold the walls of excavation, to protect existing structures and utilities, and provide safety for workers.
5. **Bottom of Trench.**
  - a. Hand shape to provide a uniform bearing and support for full length of the pipe barrel against undisturbed earth.
  - b. Provide suitable bell holes at each pipe joint after the bottom of the trench has been graded.
  - c. Remove large clods, stones and other foreign material from the bottom of the trench.
6. **Unstable Material:** When unstable material is encountered which may not provide a suitable foundation for pipe, remove the unstable material and replace with stabilizing material. Place pipe bedding on top of stabilizing material.
7. **Rock and Rubble Excavation.**  
If trench bottom is extremely hard, or is in rock, or rubble where there is possibility of pipe being subjected to point contact, over excavate trench bottom 6 inch minimum below grade and backfill with pipe bedding material.
8. **Bedding Material.**
  - a. Normal bedding for water main in dry trench conditions shall consist of natural soil found in the trench bottom. The contractor may elect to use sand or gravel.
  - b. For wet trench conditions, crushed stone or gravel cannot exceed 1 inch diameter and shall be used as normal bedding.
  - c. When, in the opinion of the inspector, the trench bottom is such that 1 inch diameter stone or gravel cannot provide a proper foundation for the pipe, the aggregate used shall be either crushed limestone or crushed gravel with a maximum size no greater than 2 inch.

- d. Use sand or gravel around corporation cocks to prevent stress on main or service line.

## **B. Trench Backfill**

1. **Backfill Timing:** Backfill trench immediately after the location of connections and appurtenance have been recorded.
2. **Unsuitable Material:** Do not use large stones, large clods, organic matter, concrete, rubbish, and frozen or unsuitable materials in backfill.
3. **Right-of-Way and Street Crossing Backfill:** Carefully hand tamp select material to 1 foot above top of pipe. Backfill remaining trench with excavated material to at least 95% maximum density – Standard Proctor Method. Maximum lift shall be 2 feet, except at street locations or other areas as directed.
4. **Soil Testing.**
  - a. Field tests for density and moisture content shall be performed by the City of Urbandale. Testing shall be done using ASTM D2922 nuclear methods or another method approved by the Engineer.
  - b. Density tests shall be taken at finished grade, at 3 feet below finished grade, and as directed by the Engineer under special conditions. Test locations will be selected by the Engineer immediately prior to performing the tests. The Contractor shall excavate, as directed by the Engineer, for tests at intermediate depths. As a minimum, density tests shall be taken at approximately 200 foot intervals along the trench. Additional tests shall be required at the following locations:
    - 1) Over jacking pits where the casing was installed.
    - 2) Immediately adjacent to all structures.

## **C. Erosion Control.**

1. Provide construction practices to minimize soil erosion and control water pollution. Prevent the eroded soil from leaving the construction site and from entering onto adjacent property or waterways.
2. Install and maintain slope protection, slope stabilization and erosion control devices.

## **D. Water Mains.**

1. **Taps:** The Urbandale Water Utility shall make all taps for water main extension. See Excavation Detail for Tapping Sleeve Standard Drawing in the Plans. All tapping sleeves shall be air pressure tested prior to tapping the main.
2. **Main Size:** Reference AWWA C605 (Underground Installation of PVC Pressure Pipe) for all PVC water main installations. All water mains shall be sized large enough to provide domestic, irrigation, and fire protection flows to the area requesting service. The minimum water main size shall be 8 inches in diameter, unless otherwise approved by the Engineer.
3. **Pipe Depth and Location:** Lay pipe in the dry; 5 feet 6 inch earth cover except where otherwise directed by the Engineer. Install water main and appurtenances in accordance with AWWA C-600. Locate water main 3 feet back of curb line of existing or proposed pavement.
4. **Cleaning:** Clean the pipe interior of foreign material before lowering into the trench. Keep clean at all times by securely closing open ends of pipe and fittings.
  - a. Use minimum amounts of gasket lubricant; apply to gasket only. Do not apply to inside of the bell.





- c. When it is impossible to obtain the required horizontal clearance of three feet and a vertical clearance of 18 inches between sewers and water mains, the sewers must be constructed of water main materials meeting both a minimum pressure rating of 150 psi. A linear separation of at least 2 feet shall be provided.

**19. Separation of Water Mains and Sewer Force Mains.**

Sewer force mains and water mains shall be separated by a horizontal distance of at least 10 feet unless:

- a. The force main is constructed of water main materials meeting a minimum pressure rating of 150 psi and the requirements of Section 8.2 and 8.4 of the "Iowa Standards for Water Supply Distribution Systems" and
- b. The sewer force main is laid at least 4 linear feet from the water main.

**20. Separation of Water Mains Crossing Sewers.**

- a. Vertical separation of sanitary 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. The separation distance shall be the maximum feasible in all cases.
- b. Where the sewer crosses over or less than 18 inches below a water main, one full length of sewer pipe of water main material shall be located so both joints are as far as possible from the water main. The sewer and water pipes must be adequately supported and have watertight joints. A low permeability soil shall be used for backfill material within 10 feet of the point of crossing.

**21. Separation of Water Mains and Sewer Manholes.**

No water main shall pass through or come in contact with any part of a sewer manhole.

**E. Valves.**

- 1. **Location:** When the water main is installed in proposed street right-of-way, install valves at street intersections as shown on Water Main and Valve Location Detail Standard Drawing in the Plans. Isolate pipe serving each block.
- 2. **Placement:** When the water main is installed in other locations, install valves to isolate no more than 800 linear feet of water main in residential areas and 400 linear feet in industrial or commercial areas.
- 3. **Valve Box Adaptor:** Install the valve with valve box adaptor to ensure the stem is centered in the valve box. Carefully compact backfill around valve box to required grade.
- 4. **Valving Main Termination Ends:** Where construction terminates, the main will be valved 20 feet before the terminating point. At the terminating point, a plug, blow-off valve, and thrust block shall be installed.
- 5. **Polyethylene Encasement:** All valves shall be wrapped in polyethylene encasement material.
- 6. **Valve Stem:** Use one solid appropriately sized valve stem extension when the nut is deeper than 6 feet. Valve stem extensions shall be securely fastened to the valve nut.

**F. Hydrants.**

- 1. **Placement:** A hydrant shall be placed at each street intersection and equally spaced between intersections. Maximum hydrant spacing shall be 500 linear feet. A hydrant shall be placed at the end of each cul-de-sac.

2. **Valved:** Each hydrant is to be independently valved.
3. **Anchoring:** Install hydrants using anchoring tee, anchoring coupling or pipe with megalugs and other appurtenances as required. Anchoring rods and eyebolts may be used in lieu of anchoring pipe or anchoring coupling, only with permission of the Engineer.
4. **Hydrant Drains:** Hydrant drains shall not be connected to or located within 10 feet of sanitary sewer and storm drains. The hydrant drain port shall be plugged prior to installation in areas where water rises and where the existing soil will not provide adequate drainage.
5. **Elevations:** Install plumb. Set at elevations so that the flange is at a minimum of 4 inches and no more than 8 inches above the finished grade line.
6. **Foundation:** Set on concrete foundations.
7. **Backfill:** Provide 1 cubic yard of 1/2 inch river rock at each hydrant.
8. **Operation:** Tighten all valves and nuts, and operate hydrant to assure all parts are in working condition.
9. **Blocking:** Hydrants shall be blocked as shown on Hydrant Standard Detail Drawing in the plans.
10. **Compaction:** Carefully compact backfill around hydrant to required grade.
11. **Hydrant Flags:** Hydrant Flags shall be provided at every dead-end hydrant, ie. cul-de-sacs, permanent dead-end mains.

#### G. Service Lines.

1. **Taps:** Urbandale Water Utility will make all taps to a public or private water main unless otherwise directed by the Engineer.
2. **Spacing:** No tap shall be made closer than 18 inches from an existing tap or pipe joint.
3. **Pipe Length:** All new copper service lines shall be one continuous pipe from the corporation cock to the curb stop for services shorter than 100 feet.
4. **Tap Angle:** 1 inch service line tap shall be made at a 45 degree angle in the water main. See Detail of 1 inch Copper Service Installation Standard Drawing in the plans. Taps 1 1/2 inches thru 2 inches shall be made at a 90 degree angle as shown on Detail of 1 1/2 inch or 2 inch Service Installation Standard Drawing in the plans. Curb stop shall have a minimum depth of 5 feet 0 inches and a maximum depth of 7 feet 0 inches.
5. **Backfill:** Use sand or gravel around corporation cocks to prevent stress on water main and service lines.
6. **Minimum Size:** Minimum service line shall be 1 inch unless otherwise directed by the Engineer.
7. **Curb Stop Placement:** Curb stop shall be placed 1 foot from the property line in public right-of-way. See Adjusting Stop Box to New Grade Standard (Arch Pattern Box) Drawing in the plans.
8. **Curb Box Marker:** Mark location of curb with a post painted blue; extend top of post a minimum of 3 feet above ground.

## H. Surface Water Crossings.

### 1. Above-Water Crossings.

The pipe shall be adequately supported and anchored, protected from vandalism, damage and freezing, and accessible for repair or replacement.

### 2. Underwater Crossings.

A minimum cover of 5 feet shall be provided unless otherwise approved by the Engineer. When crossing water courses which are greater than 15 feet in width, the following shall be provided:

- a. The pipe shall be of a special construction, having flexible, restrained or welded watertight joints, locking PVC pipe or ductile iron pipe with flexible locking watertight joints shall be used.
- b. Valves shall be provided at both ends of water crossings so that the section can be isolated for testing or repair; the valves shall be easily accessible, and not subject to flooding.
- c. Water main shall be securely anchored to prevent movement of the pipe.

## I. Tests.

1. **Test Expense:** Perform required tests at contractor's expense.
2. **Pressure Test & Leakage:** Water mains shall be tested for leakage in accordance with AWWA C-600 for a 2 hour period.
3. **Air Removal:** Flush out main before test to remove air. Insert taps to release trapped air.
4. **Flushing:** Additional flushing may be charged back to the contractor at the Engineer's discretion.
5. **Test Pressure:** Test pressure shall be 150 psi.
6. **Water Pumped for Testing:** Water pumped during test to maintain pressure shall be pumped from a tank or drum so quantities pumped can be accurately measured.
7. **Allowable Leakage:** Testing allowance (makeup water) (L) in gallons per hour shall be in accordance with the following:

$$L = \frac{SD \times P^{1/2} \text{ power}}{148,000}$$

S = length of pipe tested, in feet

D = Pipe diameter in inches

P = Average test pressure psi (pounds per square inch).

8. **Pipe Replacement:** Examine trench for leakage during the test. Replace all defective pipe and fittings that do not pass leakage test. Repeat test until requirements have been met and approved by the inspector.
9. **Corporation Cocks:** After testing is completed, remove corporation cocks if not used for water service connections and install brass plugs.
10. **Tapping Sleeve Hydraulic Test:** All tapping sleeves shall be air pressure tested by the contractor prior to tapping the main.

**J. Disinfection.**

Following satisfactory pressure tests, in accordance with the current revision of AWWA Standard C651, all service mains shall be disinfected, sampled and tested as follows:

1. The form of chlorine used and procedures for disinfection shall be as outlined in AWWA Standard C651. Disinfect by injecting a solution of calcium hypochlorite and water at a slow rate to provide minimum residual chlorine content of 50 ppm in the water main; allow system to stand full of solution for 24 hours. A minimum free residual chlorine concentration of 10 mg/l at end of test period.
2. Maintained for the 24 hour disinfection period. The Contractor will supply the chlorine for disinfection purposes and this is to be considered incidental to the project.
3. After the 24 hour disinfection period, the service main shall be flushed to remove the chlorine. The Water Utility shall be notified when the flushing of the water main is scheduled.
4. Water used for flushing and sampling shall be provided by the Water Utility for the first test of the main. If the first test samples do not pass laboratory tests, any labor and equipment costs incurred by the Water Utility for further disinfection, flushing and sampling shall be billed to the Contractor.
5. After final flushing, two consecutive sets of acceptable samples, taken at least 24 hours apart, shall be collected from the new main. At least one set of samples shall be collected from every 1000 feet of the new water main, plus one set from the end of the line and at least one set from each branch. All samples shall be tested for bacteriological (chemical and physical) quality in accordance with Standard Methods for the Examination of Water and Wastewater; and shall show the absence of coliform organisms; and, if required, the presence of a chlorine residual.
6. All samples shall be taken within 21 days of the water main installation.
7. Contractor shall follow the AWWA standard for water dechlorination so not to discharge super-chlorinated water from the disinfection test into local creeks, streams or rivers.

**K. Boring Applications**

1. **Steel Encasement:** When steel casing pipe is used, it shall meet the following criteria:
  - a. Ductile Iron pipe or locking PVC pipe may be used when Steel Encasement is required.
  - b. Casing pipe shall be a minimum of 6 inch in diameter, greater than the water main, which is being installed.
  - c. The casing pipe thickness shall be determined by the conditions in the area.
  - d. All joints in the casing pipe shall be welded in an acceptable manner.
  - e. Each 20 foot section of water main shall be fitted within a minimum of two supports per section throughout the casing. The pipe supports shall be Power Seal Casing Chock Model No. 4810 or approved equal.
  - f. Minimum 1/8 inch thick manufactured synthetic rubber casing end seal with stainless steel bands and fasteners.
2. **Directional Boring:** Locking PVC or ductile iron pipe shall be used. Follow manufacturer's recommendation for installation and maximum deflection.

**L. Corrosion Protection.**

1. The polyethylene encasement material shall be used on all ductile iron pipe, fittings, rods, and appurtenances in accordance with AWWA Standard C-105, ANSI A21.5. The

polyethylene encasement shall prevent contact between the pipe and bedding material, but is not intended to be a completely airtight and watertight enclosure.

2. Place the tube of polyethylene material on pipe prior to lowering it into the trench. Pull the tube over the length of pipe. Tape tube to pipe joint. Fold the material around the adjacent spigot end and wrap with tape to hold the plastic tube in place. Overlap first tube with adjacent tube and secure with plastic adhesive tape. The polyethylene tube covering the pipe shall be loose. Excessive material shall be neatly drawn up around the pipe barrel, folded on top of and taped in place. See Polyethylene Wrap Detail Standard Drawing in the plans.
3. Iron-pipe fittings, including valves and hydrants, shall be wrapped with two layers of polyethylene pressure sensitive tape material. The wrapping shall extend at least 1 foot beyond the fitting joints onto the adjoining pipe and fastened to the pipe with plastic tape. The tape shall be used as needed to hold the wrap material in place, close seams and hold overlaps.
4. Damage to the polyethylene encasement material in the trench prior to and during backfill shall be replaced or repaired in a workmanlike manner to the satisfaction of the Engineer.

#### M. Tracer System.

1. **Tracer Wire:** Tracer wire shall be installed with all pipes. Wire shall be laid along the bottom of the pipe, beginning with the first laid section and end at the connection to an existing main. The ends of the wire are to be protected using the material specified in Article SP-230184.02, J, 2. Wire shall run continuously along the pipe and be attached to the bottom of the pipe at the midpoint of each pipe length, using 2 inch wide, 10 mil thickness, polyethylene pressure sensitive tape. No below grade splicing of the wire shall be permitted, except as authorized by the Engineer. See Tracer Wire Detail Standard Drawing in the Plans.
2. **Tracer Wire Terminals:** Tracer wire terminals shall be installed at each public and private hydrant, and at each public and private blow-off.
  - a. **Hydrants and Permanent Blow-offs:** Extend the wire from the pipe connected to the hydrant tee along the hydrant branch and up to the ground surface where it shall be secured to a tracing wire receptacle.
  - b. **Temporary Blow-offs:** Wrap the tracing wire around the temporary blow-off and secure with tape.
  - c. The tracing wire system shall be tested to ensure continuity. The tracing wire test shall be scheduled with the Engineer.
  - d. DryConn Direct Bury Lug shall be used for all connections below ground.
  - e. Tracing wire shall not be brought up at valve boxes.
  - f. Tracing wire is required on all public and private mains.
  - g. **Tracing Wire for Domestic and Fire Service Lines:** Tracing wire is required on all private services larger than 2 inches. Tracing wire shall be terminated in the mechanical room and shall be provided with an independent ground.
  - h. All new and repaired tracer wire shall tie into existing tracing systems. This shall include temporary connections to the distribution system.
  - i. For all new and replacement mains, where there is no existing tracing wire to connect to, the newly installed tracing wire shall be terminated with an anode ground rod.