SP- 152016
(New)

SPECIAL PROVISIONS
FOR
WATER MAINS, VALVES, FIRE HYDRANTS, AND APPURTENANCES

Black Hawk County
BROS-1185(649)--8J-07

Effective Date
November 21, 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.

152016.01 DESCRIPTION.

A. Construct water mains and building service pipes.

B. Install valves, fire hydrants, and appurtenances for water mains.

C. Test and disinfect water mains, valves, fire hydrants, and appurtenances.

152016.02 MATERIALS.

A. Pipe Standards for Ductile Iron Pipe (DIP) Pressure Pipe, Centrifugally Cast, for Water Distibution.
Ductile iron pipe shall be push-on joint or mechanical joint, centrifugally cast conforming to ANSI/AWWA C151/A21.51, latest revision, plain end to be gage push-on. Pipe thickness shall be Pressure Class 350 for sizes 14 inches through 20 inches, and Pressure Class 250 for 24 inches size and larger.

B. Fitting Standards.

1. **Ductile Iron.**
   - **a.** Ductile iron fittings 3 inch through 24 inch shall be mechanical joint type, ductile iron, rated for 350 psi working pressure and shall conform to ANSI/AWWA C110/A21.10, latest revision, with the joints conforming to ANSI/AWWA C111/A21.11, latest revision, with the bolt holes bored straddle vertical centerline.
   - **b.** Cast markings shall be: pressure rating, nominal diameter, manufacturer's identification, country where cast, the letters "DI" or the word "Ductile", and degrees or fraction of bends.
   - **c.** All fittings shall be furnished complete with accessories and corrosion resistant bolts.

2. Ductile Iron Compact Fittings.

a. Fittings 3 inch through 24 inch shall be mechanical joint type, ductile iron, rated for 350 psi working pressure, compact bodied and shall conform to ANSI/AWWA C153/A21.53, latest revision, with the joints conforming to ANSI/AWWA C111/A21.11, latest revision, with the bolt holes bored straddle vertical centerline and plain end gage push-on.

b. Cast marking shall be: pressure rating, nominal diameter, manufacturer's identification, country where cast, the letters "DI" or the word "Ductile", and the degrees or fraction of bends.

C. General Accessory Standards.

1. Fire Hydrants.

a. Fire hydrants shall be dry-barrel, traffic model type conforming to Specification ANSI/AWWA C502, latest revision. Hydrants shall have a minimum main valve opening of 5 1/4 inches, 6 foot bury, three ports, aluminum color, 1 1/2 inches point to flat National Standard pentagon tapered operating nut, pumper thread 4 1/2 inches National Standard, 5 3/4 inches O.D. with four threads per inch; two 2 1/2 inches hose ports with thread 3 3/16 inches O.D. six threads per inch. Hydrants shall be marked with manufacturer's identification, size of main valve opening and year of manufacture.

b. Approved fire hydrants are:

- Mueller Centurion 250 #A423
- Waterous Pacer (#WB-67) DR
- Clow Medallion or approved equal

c. The hydrant bonnet, weather shield and operating nut shall be coated according to the following marking scheme:

Flow (gpm at 20psi)	*Color*
Greater than 1000	Green

d. The hydrant bonnet shall be coated with a one of the following:

- Mueller Centurion: Polane SP Polyurethane Enamel
- Waterous Pacer: Polyurethane Enamel
- Clow Medallion: Triglycidyl Isocyanurate (TGIC)

2. Resilient-Seated Gate Valves.

a. Resilient-seated gate valves shall have a fusion-bonded powder epoxy coating both interior and exterior that conforms to AWWA C550 and be NSF 61 approved, and shall be manufactured in accordance with ANSI/AWWA C509 / C515, latest revision, and shall be designed for 200 psig water working pressure for 12 inches NPS and smaller and 150 psig water working pressure for 16 inches NPS and larger. Valves shall be suitable for approximately level settings on buried water distribution pipe lines. Valves shall have mechanical joint ends and a clear water way equal to the full nominal diameter of the valve. Drawing descriptions shall have precedence over this section.

b. Valves shall be a 2 inch operating nut as approved by the Contracting Authority.

c. Valves shall be also be marked with-year of manufacture.

3. Valve Boxes.

Cast iron valve boxes shall be Tyler 6860, Item D with No. 6 round base; or Tyler 6850 or East Jordan Iron Works 8550 Series, two piece screw type, Sigma two piece screw type or approved equal. Valve box adapters shall be installed with each valve to provide an adaptor seal between the valve box and the valve bonnet.

4. Tapping Sleeve.

Tapping sleeves shall consist of one section of heavy welded stainless steel which bolts together on the pipe. The branch shall have a stainless steel MJ face to mate with

standard MJ valves. The branch shall also have a 3/4 inch NPT test plug. Tapping sleeve shall be supplied with stainless steel heavy hex nuts, stud bolts and washers and coated to prevent galling.

5. Mechanical Joint Restraint Gland or Gasket.

a. The mechanical joint restraint shall consist of individually actuated wedges that increase their resistance to pull-out as pressure or external forces increase. Torque limiting twist-off nuts shall be used to insure proper actuation of the restraining wedges.

b. They shall have a rated working pressure of 350 psi in sizes 16 inch and smaller, and 250 psi in sizes 18 inch through 24 inch.

6. Threaded Rod.

Threaded rod used for thrust restraint shall be 3/4 inch low carbon steel rods which conform to ASTM A307. The minimum yield strength shall be 36,000 psi and the tensile strength shall be at least 60,000 psi. All rods shall be zinc coated.

7. T-Head Bolts and Nuts.

All t-head bolts and nuts shall be Cor-Blue or stainless steel T-Bolts and Nuts manufactured in conformance with ANSI/AWWA C111/A21.11, current revision and be corrosion resistant, or an approved equal.

8. Tracer Wire.

a. Tracer wire shall be No.12 insulated solid copper single strand, coating type of high molecular weight polyethylene (HMWPE) and buried along water mains and services.

b. Splices or junctions in tracer wire shall be made with split-bolt and wrapped with waterproof dielectric wrap.

9. Tracer Wire Test Station.

Test stations shall be installed at all hydrants and any other location identified in the plans. The test stations shall be Little Fink® Cathodic Protection Test Station, Trace-O- Flex by Carsonite, Snake Pit XL Duty Rhino Triview or approved equal.

10. Magnesium Anode.

Magnesium anodes shall be high potential 3 pound anodes and shall be installed on the tracer wire at the locations indicated on the plans.

152016.03 CONSTRUCTION.

A. Scope.

These standards cover the installation procedures for Contracting Authority approved mains and their appurtenances for water distribution. These procedures comply with ANSI/AWWA Standards, the Recommended Standards for Water Works, commonly known as the Ten States Standards, and the Iowa Administrative Code. To the extent of any conflict between Standards, the Ten States Standards, Iowa Administrative Code 43.3(2), and 43.3(7) to 43.3(9) shall prevail.

B. Materials Inspection.

1. Valve Inspection.

Inspection of the valves to verify they are in working order and they meet the specifications should be conduct after they are unloaded.

a. Operation.

Valves 12 inches and larger should be cycled through one complete opening and closing cycle in the position in which they are to be installed. This process will confirm:

- Ease of operation
- Complete travel of the shutoff mechanism direction

- Correct direction of opening
- Required number of turns

b. Specifications.
The initial inspection also should verify compliance with specifications, including the following:

- Size and Pressure Class
- Direction of opening
- Size and shape of operation nut
- Number of turns to open and close
- Type of end connections

c. Shipping Damage.
Inspection should also include test for shipping damage such as: Scoring of the seated surfaces

- Bent stems Cracked parts
- Missing parts or accessories
- Missing lubrication on the exterior actuators

d. All materials shall be inspected by Contracting Authority prior to installation, complying with ANSI/AWWA Standard C600, Section 5.1, current revision. All rejected materials shall be promptly removed from the site.

2. Hydrant Inspection.
Hydrants should be inspected at the time of delivery to verify compliance with specifications and to check for damage during shipment.

a. Operation.
The hydrant should be cycled to full open and full closed positions to ensure that no internal damage or breakage has occurred during shipment and handling. All external bolts should be checked for tightness.

b. Specifications.

- Size and shape of operating nut
- Direction to open
- Depth of bury
- Size and type of inlet connection
- Size of main valve
- Outlet nozzle sizes and configuration
- Nozzle threads per Section III-a

c. Storage.
The fire hydrant valve should be closed and the outlet nozzle caps replaced to prevent entry of foreign matter. Hydrants should be stored with the inlets facing down. Whenever possible, hydrants in storage should be protected from weather and the elements.

C. Material Unloading, Handling and Storage.

1. All materials shall be unloaded, handled and stored in accordance with ANSI/AWWA C600, Section 6.1, current revision, and materials manufacturer's instructions.

2. Polyethylene pipe shall be unloaded, handled and stored in accordance with Chapter 2 of Plastics Pipe Institute's "Handbook of Polyethylene Pipe", latest addition.

3. All pipe, fittings, valves, hydrants, and accessories shall be loaded and unloaded by lifting with lift hoists or skidding in order to avoid shock or damage. Under no circumstances shall this material be dropped. Pipe handled on skidways shall not be rolled or skidded against other pipe.

4. Unloading of materials shall be done by lifting with a fork truck, a crane, or other suitable

lifting device. Pipe shall never be rolled off the truck. When pipe is being unloaded one at a time, or in single layers, the restraining bands or straps shall be removed only from the layer being unloaded.

5. Slings, hooks, or pipe tongs shall be padded, and the padding shall be used to prevent damage to the exterior surface or internal lining of the pipe, fitting, or related product.

6. If stored, materials shall be kept safe from damage. The interior of all pipe, fittings, and other appurtenances shall be kept from dirt or foreign matter at all times.

D. Trench Construction.

1. The width of the trench at the top of the pipe shall equal the single-pass capabilities of normally available equipment. The width shall permit the pipe to be laid and joined properly and to allow the backfill to be placed in accordance with the contract documents. Trench widths shown may be used as a guideline.

Nominal Pipe Size	Trench Width
6 inches	30 inches
16 inches	40 inches

2. When required, trenches shall be wider to permit the placement of supports, sheeting, bracing, and appurtenances as required by the safety requirements.

3. Holes for the bells shall be provided at each end joint, and they shall be no larger than necessary to allow joint assembly and to ensure that the pipe barrel will lie flat on the trench bottom.

4. The trench bottom shall be true and even to provide support the full length of the pipe barrel.

5. If the trench passes over a previous excavation, the trench bottom shall be sufficiently compacted to provide support equal to that of the native soil in a manner that will prevent damage to the existing installation.

6. Not more than 200 lineal feet of trench shall be dug in advance of the completed pipe installation operation.

E. Valve Operation.

All contractors shall make arrangements with the Contracting Authority to open and close water distribution valves as required.

F. Shoring.

1. Excavation in unstable materials shall be braced according to the rules and regulations of the Occupational Health and Safety Administration (OSHA). The width of excavation shall be increased when shoring is employed.

2. If space permits, the sides of any excavation may be sloped back to prevent cave-ins. Such sloping shall start no lower than the top of the pipe and go to the ground surface.

G. Ductile Iron Pipe (DIP) Installation.

1. **Field Cutting DIP.**

When cut pipe ends are to be used in place of manufactures spigot ends, the cut end shall be filed or ground to produce a slight bevel of about 30 degrees from the vertical. No sharp edges shall be permitted which can cut the gaskets during assembly.

2. Push Joint Ductile Iron Pipe Assembly.

a. Clean mating surfaces. Insert a single rubber gasket with the small bulb of rubber to the outside of the bell. Lubricate the spigot, insert spigot in the bell, and push home to complete the joint.

b. After the joint is assembled, use a feeler gauge to verify the gasket is in its retaining groove. If the gasket is out of the groove, the pipe shall be pulled apart, the gasket removed and disposed of, a new gasket inserted, and the pipes reassembled as directed above.

c. If a deflection is required, the pipe shall be deflected after the pipe spigot is pushed home. The maximum permissible deflection per length of pipe shall not exceed recommendations listed below.

Nominal Pipe Size	Deflection Angle - ɵ	Maximum Offset – S (in.)		Approx. Radius of Curve – R Produce by succession of joints	
(in.)	(degrees)	Length=18'	Length=20'	Length=18'	Length=20'
6	5	19	21	205'	230'
16	3	11	12	340'	380'

3. Mechanical Joint Ductile Iron Pipe Assembly.

Mechanical joints shall be assembled as follows:

a. Clean the bell and spigot.

b. Lightly coat both the bell and spigot with joint lubricant.

c. Slip the ductile iron gland over the spigot. The lip extension of the gland shall extend toward the end of the spigot.

d. Slip a rubber gasket over the spigot with the thick edge of the gasket toward the gland.

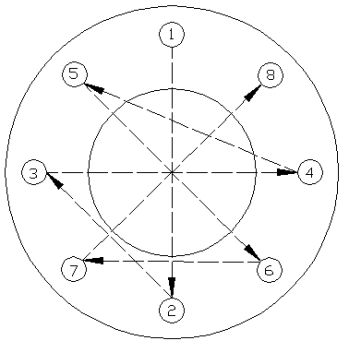
e. Insert the spigot into the bell.

f. Press the gasket into place into bell. Installed properly, the gasket will be evenly located around the entire joint.

g. Slide the gland into position for bolting. Align the bolt holes in the gland and the bell.

h. Insert the bolts and screw on the nuts finger tight.

i. Tighten bolts and nuts by using the crossover method shown below. Tighten the bolts and nuts across the connection from each other in order until the joint is uniformly tight (do not tighten the bolts and nuts in rotation). This crossover method will load both pipe and valve evenly and eliminate any concentrated stresses.



j. Tighten the bolts with a torque limiting wrench to the valves listed below:

Bolt Diameter (inches)	Torque (foot-pounds)
5/8	45-60
3/4	75-90

1	85-100
1 1/4	105-120

If a deflection is required, the pipe shall be deflected after step 8 and before step 9 of the assembly procedures. The maximum permissible deflection per length of pipe shall not exceed recommendations listed below.

Nominal Pipe Size	Deflection Angle - ɵ	Maximum Offset – S (in.)		Approx. Radius of Curve – R Produce by succession of joints	
(in.)	(degrees&minutes)	Length=18'	Length=20'	Length=18'	Length=20'
6	7-07	27	30	145'	160'
16	3-35	13.5	15	285'	320'

4. Tracer System.

a. Tracer wire shall be No. 12 insulated solid copper single strand, coating type of high molecular weight polyethylene (HMWPE) and applied to all buried water main.

b. Splices or junctions in tracer wire shall be made with split-bolts connectors covered with waterproof dielectric wrap and shall be inspected by Contracting Authority prior to backfill. At all fire hydrants, the tracer wire shall be installed in a 1 1/4 inch triangular conduit with a support bracket bolted to the fire hydrant. The conduit shall have a blue test station cap.

c. A 3 pound magnesium anode shall be installed at each fire hydrant and terminal points of water main installation.

d. Care shall be taken to not damage the insulation or kink the wire. Damaged insulation shall be removed and the bare wire shall be coated with waterproof dielectric protective wrap. Kinked wire shall not be used.

e. Prior to any final contractor payment, the Contracting Authority will verify that the tracer wire is continuous and allows for the proper tracing of the water main. If locations where the tracer wire is not continuous is identified, the contractor, at no additional cost to the Contracting Authority, shall make necessary repairs.

5. Polyethylene Encasement.

a. Ductile iron pipe, valves, valve boxes, hydrants and ductile iron fittings shall be encased with 8 MIL cross laminated high density polyethylene in accordance with AWWA Standard C105. Remove dirt, debris, etc. from the surface of the pipe or fitting before installation. The polyethylene encasement shall extend 2 feet beyond the pipe or fitting. Secure in place every 3 feet with approved tape. Repair all tears or cuts with tape or additional polyethylene encasement.

b. Polyethylene installation shall prevent soil from contacting the pipe of fitting. The installation does not need to be water tight.

H. Valve and Fitting Installation.

1. The installation of valves and fittings shall be in conformance with ANSI/AWWA Standards C504, Section A.5; C509, Section A.5; C600, C906 and AWWA Manual M44, current revisions, and ASTM Standards D2774, current revisions, and recommended valve and fitting manufacturer's instructions.

2. Visually inspect each valve/fitting and remove any foreign materials in the interior portion. Foreign material left in the valve can damage internal working parts.

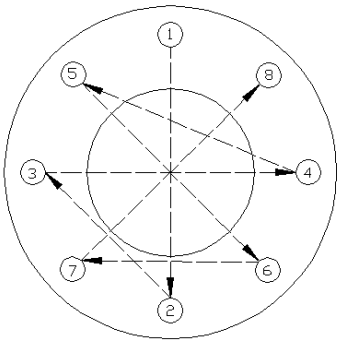
3. Support piping systems and align components to minimize bending at the valve/fitting

connections.

4. Install valves in the closed position to prevent any foreign materials from entering the valve. Place the valve/fitting on firm footing in the trench to prevent settling.

5. Valves 12 inches and larger, should be provided with special support, such as treated timbers, crushed stone, concrete pads, or sufficiently tamped trench bottom so that the pipe will not be required to support the weight of the valve.

6. Install the valve/fitting in alignment with the pipe to prohibit excessive strain on the connection to the pipe. Preventing any strain on the connection is critical in flanged installations. Flange fracture can result from unequal strains set up by improper makeup and tightening of the joints. See the following figure for proper technique for installing and tightening flanged valves.
   a. Support and Align valves/fittings.
   b. Clean dirt and grit particles from all parts.
   c. Insert bolts and nuts and tighten by hand.
   d. Tighten bolts and nuts by using the crossover method shown below. Tighten the bolts and nuts across the connection from each other in order until the joint is uniformly tight (do not tighten the bolts and nuts in rotation). This crossover method will load both pipe and valve evenly and eliminate any concentrated stresses.



7. The valve box should be installed so as not to transmit shock loads or stress to the valve. Center the valve box over the operating nut of the valve. The box cover should be flush with the surface of the finished area. The operating nut should be accessible from the top opening of the box with a valve key.

8. If the valve must be buried in an unusually deep trench, install an extension on the valve box and make a notation in the valve records that a long key will be required for operations.

I. Hydrant Installation.

Hydrant installation shall be in conformance with ANSI/AWWA C600, and AWWA Manual M17, current revision. General hydrant installation is as follows:

1. Install hydrants as plumb as possible.

2. Hydrants shall be located at 300 foot intervals and on property lines whenever possible.

3. Hydrants shall be installed a minimum of 4 foot from the face of the curb to the point on the hydrant nearest to the curb to avoid damage from or to vehicles.

4. Hydrants shall be installed a minimum of 18 inches from the edge of a sidewalk or bike path to the point on the hydrant nearest to the sidewalk or bike path.

5. Install the hydrant with the pumper outlet nozzle facing the street in order to provide a quick connection to the fire pumper.

6. Install the hydrant so that the outlet nozzles are a minimum of 18 inches above the ground line to allow for attachment of hoses and operation of the hydrant wrench. There should be no obstructions that prevent or retard hydrant operation or hinder removal of outlet nozzle caps. Minimum clear radius to the nearest obstruction shall be 3 feet.

7. A 6 inch hydrant valve shall be installed between the hydrant and the supply main to permit isolation of the hydrant for maintenance purposes. The hydrant valve shall be restraint so that the hydrant may be removed without shutting down the main.

8. Provide for thrust restraint for the hydrant assembly as shown in the plans.

9. When sitting a hydrant, use a firm footing, such as stone slabs or a concrete base on firm ground, to prevent settling and strain on the hydrant lead joints.

10. If concrete thrust blocking is poured, exercise care not to plug or block the drain holes.

11. When installing break-away hydrants, use extra care to ensure that there is adequate soil resistance to avoid transmitting shock to the hydrant's lower barrel and hydrant inlet. In loose or poor loading-bearing soil install a concrete collar about 6 inches thick, with a diameter of 2 foot around the hydrant lower barrel at or near the ground line.

12. Provide for drainage from hydrants. Excavate the area around the hydrant base, then place 1 cubic yard of clean 1 inch rock to a level 6 inches above the drain outlets. The rock should extend at least 1 foot on all sides of the hydrant. To keep the drainage pit from clogging, the stone should be covered with 8 mil polyethylene or similar waterproof material before backfilling.

13. Where groundwater rises above the drain port or when the hydrant is located within 10 feet of a sanitary sewer or storm drain, or where drainage is not permitted by the Iowa Department of Natural Resources, the drain port shall be plugged and water pumped from the hydrant when freezing may occur.

14. The hydrant bonnet, weather shield and operating nut shall be painted according to the following marking scheme:

Flow (gpm at 20psi)	*Color*
Greater than 1000	Green

15. Hydrants installed on an existing main shall be disinfected by spraying a solution of 300 mg/L chlorine into the inlet and through the outlet nozzle openings. The chlorine solution shall be flushed from the hydrant immediately after installation.

16. Operate all hydrants to flush out any foreign materials that may have been left in the newly laid mains or hydrant leads.

17. Tighten the outlet-nozzle caps. Back them off slightly so they will not be excessively tight, but tight enough to prevent their removal by hand.

J. Mechanical Thrust Restraint.

1. Mechanical joint restraint shall not be used on sections of pipe that are less than 2 1/2 times the pipe diameter or 30 inches in length, whichever is greater. Sections of pipe less than the required length but needing restraint can either be rodded or concrete thrust blocking

may be used.

2. Mechanical thrust restraints shall be installed following the manufacturers recommendations.

K. Backfilling.

1. Backfill material shall comply with Section 2552 of the Standard Specifications modified as follows:

Article 2552.02, B, Bedding (Class I) Material: Add the following: 1 inch or 1 1/2 inch clean crushed stone may be substituted for the Class 1 Bedding Material.

2. The top 6 inches of backfill material shall be suitable to establish vegetation if applicable.

3. All backfill material shall be free from cinders, ashes, refuse, vegetable or organic material, boulders, rocks or stones, frozen soil, or other unsuitable material. From 12 inches above the top of the pipe to grade material containing stones up to 8 inches in their greatest dimension may be used. Excavated material consisting of loam, clay, sand, gravel, or other suitable material may be used as backfill.

4. All rock greater the 8 inches in diameter, pieces of concrete or masonry, or other debris and subterranean structures shall be removed to provide a clearance below and on each side of the all pipe, valves, and fittings of at least 6 inches.

5. When frozen material exists in the trench, backfilling with frozen material is prohibited. Authorization by the Contracting Authority may permit backfilling with soil free of frozen material in freezing weather.

6. All pipe shall be installed to a depth to provide 5 1/2 feet of earth cover from the permanent grade set by the Engineer. Pipe installed under pavement shall receive 6 feet of earth cover measured from the permanent pavement grade.

7. Special care shall be used in placing the backfill the full width of the trench, filling each side of the pipe simultaneously, to avoid damaging or moving the pipe.

8. Complete compaction of all backfill is required in 12 inch layers. Tests will be conducted to assure compliance with 95% Standard Proctor density.

9. When pipe-laying is not in progress, the open ends of the pipe shall be closed by a watertight plug. The plug shall be fitted with a means for venting. The plug shall remain in place until the trench is pumped completely dry. Any air and water pressure in the line shall be released prior to removal of the plug.

L. Disinfection.

1. The application of calcium hypochlorite shall be applied in granular form at a rate required to produce a minimum concentration of 25 mg/L of free chlorine for a 24 hour period. The hypochlorite shall be applied to each length of pipe.

2. The water will be tested for chlorine residual after the 24 hour period. Additional chlorine will be added at hydrant locations if 25 mg/L of free chlorine is not remaining after the 24 hour period. After a minimum of 24 hours the water will be retested. This procedure will be repeated until the desired chlorine residual is present.

3. After the 24 hour retention period, the heavily chlorinated water shall be flushed from the main until the chlorine concentration in the water leaving the main is no higher than that

generally prevailing in the system. The new system should be flushed as soon as possible because prolonged exposure to high concentrations of chlorine might damage the asphaltic seal coating.

4. If there is any possibility that the heavily chlorinated water discharge will cause damage to the environment, then a neutralizing chemical shall be applied to the water to be wasted to thoroughly neutralize the residual chlorine. Dechlorination shall be in conformance with ANSI/AWWA Standard C651, Subsection 4.5.2.

5. Two bacteriological samples will be collected by the Contracting Authority or qualified Contractor for testing. The two samples shall be taken 24 hours apart. Satisfactory results are requisite for authority to place the main into service.

6. When disinfecting polyethylene pipe the solutions must not exceed 12% active chlorine.

M. Separation of Water Mains and Sanitary or Storm Sewer Manholes.

Water main shall not pass through or come in contact with any part of a storm or sanitary sewer manhole.

N. Underwater Crossings.

Unless otherwise specified in the contract documents, the pipe for underwater crossings shall be ductile iron pipe with restraint joints or ball and socket pipe which will deflect up to 15 degrees.

O. Service Taps.

Connection of tap service lines to the water main shall be made with the tap being at an angle of not more than 22 degrees from the horizontal (the ten o'clock or two o'clock position). A double wrap of Teflon tape shall be placed on the corporation stop threads prior to installation on the main.

1. **Taps On Cast Iron or Ductile Iron Pipe.**
   - **a.** On cast iron or ductile iron pipe, when water service taps are required close to each other, the taps shall be staggered around the circumference of the pipe a minimum of 12 inches apart, measured horizontally, and not in a straight line.
   - **b.** Water mains that are 12 inch in diameter or larger, or that are Class 52 pipe may be direct tapped.
   - **c.** Water taps larger than 1 inch on water main less than 12 inches in diameter shall be completed using a service saddle.

2. **Corporations.**
   - **a.** On ductile iron and cast iron mains, all corporations shall be AWWA tapered thread x flared or compression type connections unless otherwise noted in the contact documents.
   - **b.** On PE mains, using the service saddle, all corporations shall be standard thread x flared or compression type connections unless otherwise noted in the contract documents.

3. **Water Service Pipes.**

   Water service pipe of less than 3 inches in inside diameter shall conform to the requirements of ASTM B 88 for Seamless Copper Water Tube, Type K, soft annealed temper pipe.

4. **Service Saddles.**

   Service saddles shall conform to AWWA C800. The body shall be constructed with stainless steel. Services saddles shall be supplied in two sections and have a double strap. Straps shall be constructed with forged alloy steel. O-ring gaskets shall be made of nitrile. Outlet threads shall be AWWA taper (C.C.). Maximum working pressure shall be at least 200 PSI.

152016.04 METHOD OF MEASUREMENT.
Refer to Article 2554.04 of the Standard Specifications for Method of Measurement.

152016.05 BASIS OF PAYMENT.
Refer to Article 2554.05 of the Standard Specifications for Basis of Payment.