



**SPECIAL PROVISIONS
FOR
WATER MAIN**

**Linn County
HDP-4775(646)--71-57**

**Effective Date
August 18, 2026**

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

236072.01 DESCRIPTION.

A. Section Includes.

- Water Mains.
- Water Services.
- Bolts and Fittings.
- Valves and Valve Boxes.
- Fire Hydrant Assemblies.
- Blowoff Assemblies.
- Air Release Assemblies.

B. Description.

1. Water Mains.

This item includes furnishing and installing water pipe in accordance with the contract documents.

2. Water Services.

This item includes furnishing and installing water services, and constructing a water service tap on an existing water main which does not have an existing service connection in the required location, in accordance with the contract documents.

3. Bolts and Fittings.

This item includes furnishing and installing bolts and fittings in accordance with the contract documents.

4. Valves and Valve Boxes.

This item includes furnishing and installing valves and valve boxes, including gate valves, butterfly valves, and tapping valves and sleeves, in accordance with the contract documents.

5. Fire Hydrant Assemblies.

This item includes installing fire hydrant assemblies in accordance with the contract documents. The fire hydrant assemblies will be supplied by the Marion Water Department.

6. Blowoff Assemblies.

This item includes furnishing and installing blowoff assemblies associated with a water main, in accordance with the contract documents.

7. Air Release Assemblies.

This item includes furnishing and installing air release assemblies associated with a water main, in accordance with the contract documents.

C. Submittals.

1. Submit test results as set forth in the contract documents.
2. Submit certificate of compliance indicating the materials incorporated into the work comply with the contract documents.
3. Submit joint restraint system.

D. Delivery, Storage and Handling.

1. Delivery.

Packing slips for steel and iron water main items shall include certificates from the manufacturer that the material is in compliance with these Special Provisions.

2. Storage and Handling.

Store material in accordance with the manufacturers' recommendations and in locations that will minimize the interference with operations, minimize environmental damage, and protect adjacent areas from flooding, runoff and sediment disposition.

E. Scheduling and Conflicts.

1. Schedule work to minimize disruption of public streets and facilities.
2. Discontinue work that will be affected by any conflicts discovered or any changes needed to accommodate unknown or changed conditions and notify the Engineer.

F. Special Requirements.

1. The use of explosives is not permitted.
2. Unless noted otherwise in the contract documents, all materials are to be furnished and installed by the Contractor.
3. Unless noted otherwise in the contract documents, all labor & equipment is to be furnished by the Contractor.

236072.02 MATERIALS.

A. Water Mains.

1. Ductile Iron Pipe.

a. Minimum thickness class.

- 1) 4 inch through 12 inch: Class 52 per ANSI/AWWA C151/A21.51.

- 2) Over 12 inch: Class 50 per ANSI/AWWA C151/A21.51.
- b. Cement-mortar lined, per ANSI/AWWA C104/A21.4 with asphaltic seal coat.
- c. External coating: asphaltic.
- d. Joint Type: Use push-on type, except where specifically authorized by Engineer.
 - 1) Push-on: per ANSI/AWWA C111/A21.11.
 - 2) Mechanical: per ANSI/AWWA C111/A21.11.
 - 3) Restrained, buried: Pipe manufacturer's standard field removable system.
 - 4) Restrained, in structures: Restraining gland, flanged or grooved.
 - 5) Flanged: ANSI/AWWA C111/A21.11.
 - 6) Grooved: ANSI/AWWA C606.
 - 7) Gaskets: Per ANSI/AWWA C111/A21.11.
- e. Markings on pipe: Name of manufacturer; size and class; and spigot insertion depth gauge.

2. Polyvinyl Chloride (PVC) Pipe.

- a. Conform to ANSI/AWWA C900 or C905 with cast iron pipe equivalent outside diameters.
- b. Wall thicknesses:
 - 1) 4 inch through 12 inch sizes: DR 18.
 - 2) Sizes over 12 inches: Refer to Plans.
- c. Markings on pipe: Name of manufacturer; size and class; spigot insertion depth gauge; and National Sanitation Foundation (NSF) seal.
- d. Integral elastomeric gasket in bell end.

B. Water Services.

- 1. **Controlling standards:** Local water service, plumbing and fire codes.
- 2. **Materials:**
 - a. Copper Pipe: Conform to ASTM B88. Wall thickness: Type K.
 - b. Ductile Iron Pipe: As specified in Article 236072.02, A, 1. Polyethylene wrap is required.
- 3. **Corporation stop:** 1 inch minimum. Stop inlet with AWWA threads. Marion approved manufacturer and model numbers:
 - a. Mueller H-15000
 - b. AY McDonald 74701
- 4. **Curb stop:** 1 inch minimum ball valve. Valve size same as service size. Quarter-turn check. Marion approved manufacturers and model numbers:
 - a. Mueller H-25204N
 - b. AY McDonald 76100
- 5. **Curb box:** 1 inch diameter upper half. Stem arch pattern. Height adjustable from 4 feet to 6 feet. All curb boxes shall have a stainless steel valve operator extension rod, 1/2 inch in diameter by 42 inches long. Stop box lids shall have center pentagon access with bolt on bottom of lid to attach locate wire for plastic service lines. Marion approved manufacturers and model numbers:
 - a. Mueller H-10334
 - b. AY McDonald 5607
- 6. **Tapping Saddle:** Ductile iron bodies with fusion bonded epoxy coating. Double stainless steel straps with Buna-N gasket seal. Marion approved manufacturer and model number: Smith Blair Model 317

C. Bolts for Water Main Pipe and Fittings.

Corrosion resistant fluorocarbon coated Cor-Ten steel bolts.

D. Fittings.

1. For Ductile Iron Pipe:

- a. Fittings shall comply with ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53.
 - b. Joint Type: Mechanical or restrained, as required by Engineer.
 - c. Cement-mortar lined per ANSI/AWWA C104/A21.4 with asphaltic coating or unlined with fusion bonded epoxy per AWWA C116.
 - d. Restrained Joints
 - e. Restrained Mechanical Joints: Pipe manufacturer's standard field-removable system.
 - f. Flanged: ANSI/AWWA C110/A21.10. Nuts shall conform to ASTM A 563, Grade A, heavy hex head. Gaskets shall be rubber or approved composition; 0.125 inch thick; full face.
 - g. Grooved: ANSI/AWWA C606. Face to face dimensions shall be equivalent to flanged, ANSI/AWWA C110/A21.10.
 - h. Wall thickness: ANSI/AWWA C153/A21.53.
 - i. Gaskets: Per ANSI/AWWA C111/A21.11.
 - j. Fittings shall be smooth and pit free. Coatings shall be uniform and undamaged.
2. For PVC Pipe use only ductile iron mechanical joint fittings as specified elsewhere in this section.

E. Special Fittings.

1. Flange Adapter.

- a. Use where noted in contract documents to allow for ease of dismantling piping in the future.
- b. Model: Style 127 as manufactured by Dresser Manufacturing Division, Bradford, Pennsylvania; 912 as manufactured by Smith-Blair.
- c. Substitutions: Approved equal.

2. Ductile Iron Sleeve.

- a. Use on buried piping to allow for dismantling piping in future or for connecting two buried plain end pipes.
- b. Long body sleeves are required.
- c. Mechanical joint, ANSI/AWWA C110/A21.10.

3. Restrained Joints.

- a. Use to restrain mechanical joint where required by Engineer.
- b. Manufacturer: Ebaa Iron, Inc.; Megalug; One Bolt, Oxford, AL; Romac "Grip Ring."
- c. Substitutions: Pipe manufacturer's standard field removable restraint system.
- d. Suitable for buried service.
- e. Corrosion resistant components.
- f. Designed by pipe manufacturer, conforming to DIPRA "Thrust Restraint Design for Ductile Iron Pipe", latest edition.
- g. Joint restraint system to be field installable, field removable and reinstallable.
- h. Restraint systems involving pipe clamps and connecting rods are not acceptable unless specifically required in the contract documents.
- i. Joint restraint system approval; in writing from Engineer.
- j. Contract documents shall identify locations and number of joints to be restrained.

4. Couplings.

- a. Use to join two spigot ends of two pieces of pipe
- b. Ductile Iron couplings are to be used for joining pipe sizes up to and including 12 inch.
- c. Carbon Steel couplings are to be used for joining pipes greater than 12 inch. Minimum laying length shall be 14 inches. Minimum yield strength of 30,000 psi.
- d. Bodies of all couplings are to be epoxy coated inside and outside per AWWA C213
- e. All bolts, nuts, and hardware are to be grade 304 stainless steel or better.

F. Concrete Thrust Blocks.

1. Application.

- a. For use with pipe sizes up to 16 inch diameter unless approved by Engineer.
- b. For pipe sizes greater than 16 inch diameter, use restraining glands or manufacturers standard restraint system per Article 236072.02, D.

2. Refer to plans for dimensions and installation of thrust blocks.

3. Concrete minimum compressive strength is 3000 psi.

G. Pipe Line Accessories.

1. Polyethylene Wrap.

Minimum thickness 8 mils. Conform to ANSI/AWWA C105/A21.5. Use polyethylene wrap on all fittings and valves in buried service.

2. Tracer System.

- a. Use on ductile iron pipe larger than 16 inch diameter and on all PVC pipe.
- b. **Tracer Wire:** No. 12 solid single strand, type TW or THHN with 0.045 mil of insulation.
- c. **Ground Rod:** 3/8 inch diameter, 60 inch long steel rod uniformly coated with metallicity bonded electrolytic copper. Ground-rod clamp: High-strength, corrosion-resistant copper alloy.
- d. **Splice Kit:** Buried service wire splice.
- e. Receptacle Post: 1 pound per foot channel post 4 feet long. UP-1 by Grimco, Inc., or equal.
- f. One Piece VALVCO Tracer Wire Access Box or equal (Box will be supplied and billed with the hydrant assembly and installed by all new hydrants.)
- g. **Terminations:** Scotchcast terminating kit or equal.
- h. **Splice Bolt:** No. 8F brass split bolt must be Burndy KS15 Copper split bolt, manufactured by Reliable Power Products, Inc, or approved equal.
- i. All connectors must be wrapped with tapecoat T-tape and inspected prior to burying.

3. Insulation.

Extruded polystyrene conforming to ASTM C 578; high-density, moisture resistant, suitable for underground installation. Owens Corning or equal

H. Gaskets, Special.

Use special pipe gaskets in contaminated soils if so directed by Engineer. In soils contaminated with gasoline, use nitrile material; for other soil contaminants, use material as required by Engineer.

I. Valves.

1. General.

- a. Same size as pipeline in which it is installed, unless noted otherwise on plans.
- b. Manufacturer's name or initial and working pressure cast on valve body.
- c. Open when turned left. Opening direction arrow shall be cast on operating nut.
- d. Factory tested to twice the rated working pressure.
- e. Buried service: Mechanical joints, unless noted otherwise.
- f. Service within structure: Flanged, per ANSI/AWWA C110/A21.10. Flanges drilled to conform to ASME/ANSI B16.1 class 125, unless noted otherwise. All valve operators to be supplied by valve supplier.
- g. Bolts for joints: Refer to Article 236072.02, D, 1.

2. Butterfly Valves, Buried Service.

- a. **Use:** 16 inch diameter and larger
 - b. **Type:** Rubber seat.
 - c. **Pressure rating:** 150 psi working pressure.
 - d. Bubble-tight at rated pressures with flow in either direction.
 - e. **Comply with:** ANSI/AWWA C504 class 150B.
 - f. **Body:** Cast iron per ASTM A 126 class B; two trunnions for shaft bearings.
 - g. **Ends:** Mechanical joint, except as otherwise shown in the plans.
 - h. **Disc:** Cast iron ASTM A126 class B, with plasma-applied nickel-chromium edge; connected to shaft by mechanically fixed stainless steel pins.
 - i. **Shaft:** Type 304 stainless steel; turned, ground and polished.
 - j. **Seat:** Synthetic rubber compound; simultaneously molded in, vulcanized and bonded to body.
 - k. **Bearings:** Corrosion resistant and self-lubricating, sleeve type. Bearing load not greater than 1/5 the compressive strength of the bearing or shaft material.
 - l. **Packing:** O-ring type
 - m. **Operator:**
 - 1) Type: Buried service.
 - 2) 2 inch square nut.
 - 3) Three bolt minimum mounting to valve.
 - 4) Hold valve in any intermediate position between fully open and fully closed without creeping or fluttering. Equipped with mechanical stop-limiting devices to prevent overtravel of the disc in the open and closed positions.
 - 5) Fully enclosed, gasketed and grease packed.
 - 6) Designed to operate the valve under full rated working pressure with a maximum of 80 foot-pounds applied force. Withstand an input of 450 foot-pounds at extreme operator position without damage.
 - n. **Finish:** In accordance with ANSI/AWWA C504; Fusion bonded epoxy per AWWA C550, interior and exterior.
 - o. **Exposed bolts and hex nuts:** Per Article 236072.02, C of this section.
 - p. **Approved Manufacturers:** DeZurik; Mueller; M&H.
3. **Gate Valves, Buried Service.**
- a. **Type:** Non-rising stem, resilient seat. 2 inch square nut operator. Comply with: ANSI/AWWA C509.
 - b. **Pressure rating:** 200 psi working pressure up to and including 12 inch and 150 psi over 12 inch.
 - c. **Body, Bonnet and Gate:** Cast iron per ASTM A 126 class B or Ductile Iron per ASTM A536.
 - d. **Ends:** Mechanical joint, except as otherwise noted.
 - e. **Seat, disc rings, stem and spindle:** solid bronze bearing against bronze surface.
 - f. **Shaft seals:** Double O-rings permanently lubricated between seals. Lubricant certified for use in potable water.
 - g. **Mechanism design:** travel of discs ceases before discs begin to seat in closing; travel of discs commences after disc is fully unseated in opening.
 - h. **Exterior finish:** Fusion bonded epoxy per AWWA C550.
 - i. **Interior finish:** In accordance with AWWA C550.
 - j. **Approved Manufacturers:** Mueller (Decatur, IL); Clow (Oskaloosa, IA); Kennedy (Elmira, NY); U.S. Pipe.
 - k. Open when turned left.
 - l. Body, bonnet, and operating hold down bolts and nuts to be SS.
 - m. Operating nut to be attached to valve stem by bolt or nut type connection.
 - n. Valve stem shall be removable without removing valve bonnet.
4. **Tapping Valve Assemblies.**
- a. **Valve:** Tapping valve conforming to ANSI/AWWA C509 and C515.
 - b. **Gasket:** To completely surround pipe; minimum thickness 0.125 inch; material: nitrile

rubber.

- c. **Bolts:** Per Article 236072.02, D, 1.
 - d. **Tapping Sleeve shall be made of:**
 - 1) Minimum 18-8 stainless steel.
 - 2) 12 gauge on 4 inch through 8 inch diameters.
 - 3) 11 gauge on 10 inch through 12 inch diameters.
 - 4) Gasket- nitrile NSF-61 Approved.
 - 5) Flange shall be 18-8 stainless steel type (304) with ANSI class 150# drilling pattern per AWWA C207 Class "D".
 - 6) Flange shall be machined with a recess MSS SP-60 to accept tapping valves.
 - 7) Nuts, Bolts and Washers shall be 304 stainless steel.
 - 8) Nuts and bolts shall be coated to prevent galling.
 - 9) Test port shall be 3/4 inch welded stainless steel with IPS stainless steel pipe plug.
 - 10) Tapping sleeves shall follow ASTM A380-06 and ASTM A967-05 for cleaning, de-scaling, and passivation treatment.
 - 11) Acceptable tapping sleeves are Mueller H-304SS, Smith-Blair 665, Triple Tap series TS.
 - e. **Tapping Sleeve (Tap size one-half pipe size or less):**
 - 1) Sleeves shall have fusion bonded epoxy coating per AWWA C213, interior and exterior.
 - 2) Sleeves shall be furnished with type 304 stainless steel bolts and accessories.
 - 3) Smith-Blair Tapping Sleeve 622, Romac FTS 420, Dresser, or equal.
 - f. **Tapping Sleeves on PVC:**
 - 1) Stainless steel.
 - 2) Approved sleeves: Romac SST, Mueller 304 SS, or approved equal.
 - g. Tapping sleeve shall be tested prior to tapping, in accordance with department rules.
5. **Valve Box.**
- a. **Applicability:** For all buried gate or butterfly valves.
 - b. **Type.**
 - 1) In driveways and sidewalks: slide type.
 - 2) In all other areas; screw extension.
 - 3) Material: Cast iron. Cast iron cover labeled "WATER".
 - 4) Wall thickness: 3/16 inch, minimum.
 - 5) Inside diameter: 5 inches, minimum.
 - 6) Length: Adequate to bring top to ground surface.
 - 7) Factory finish: Asphalt coating.
 - 8) Manufacturer: East Jordan Iron Works, Sigma HD, Tyler, or approved equal. Tyler valve box extensions only. Tyler Domestic 26T 6855 slip top sections and Tyler Domestic 5 1/4 drop lid allowed.

J. Fire Hydrant.

- 1. Conform to ANSI/AWWA C502, as modified herein.
- 2. Marion approved manufacturer and model numbers: Mueller Super Centurion 250.
- 3. **Hydrant Characteristics.**
 - a. Main Valve Size 5 1/4 inch
 - b. Inlet Connection Type 6 inch flanged
 - c. Direction of Opening Left
 - d. Pumper Nozzle Size 4 1/2 inch
 - e. Pumper Nozzle Thread 5.7659 inch Diameter National Standard Thread
 - f. Hose Nozzle Number/Size Two each - 2 1/2 inch
 - g. Hose Nozzle Thread 3.078 inch OD Male, 3.140 inch OD Female 6 tpi
 - h. Operating Nut 1 1/4 inch pentagon

- i. Nominal Bury Depth 6 feet 0 inches
 - j. Remarks Word "OPEN" and arrow to be cast on top. Two coats of fire hydrant red paint. Dry top design with provision for lubricating operating mechanism. Bronze-bronze seat/seat ring. Weather cap for operating nut.
- 4. Break-away stem coupling.
 - 5. Painting: Shop coating; per ANSI/AWWA C502. Field coating above grade; exterior coating type and color selection by Engineer.
 - 6. Provide auxiliary gate valve with valve box conforming to Articles 236072.02, I, 3 and 5.
 - 7. Exposed bolts and hex nuts: Steel.

K. Blowoff and Air Release Assemblies.

- 1. Construct according to plans. Locations as shown in plans.
- 2. Nominal size: 2 inch
- 3. Components: Pipe, valve, curb box, thrust block, elbow, pipe cap and miscellaneous fittings, all as specified or shown. All components shall have iron threads.
- 4. Drain-back holes are not acceptable

236072.03 CONSTRUCTION.

A. General Pipe Installation.

- 1. Lot pins to be placed prior to constructing water main, as required for the Project.
- 2. Install only approved materials. Items installed by the Contractor which cannot be verified as meeting the FHWA Buy America policy shall be removed and replaced with FHWA Buy America certified materials at the Contractor's expense.
- 3. Protect pipe joints and valves from damage while handling and storing.
- 4. Use no deformed, defective, gouged, or otherwise damaged pipe or fittings.
- 5. Excavate and prepare trench as outlined in Section 2552 of the Standard Specifications.
- 6. Prepare the trench bottom with sufficient exactness so that only minor movement of the pipe will be necessary after installation.
- 7. Clean pipe interior prior to placement in the trench.
- 8. Install pipe with fittings and valves to the lines and grades shown in the plans, with a maximum allowable variation of 3 inches.
- 9. Provide uniform bearing along the full length of the pipe barrel. Provide bell holes.
- 10. Clean joint surfaces thoroughly and apply lubricant approved for use with potable water.
- 11. Make joints according to pipe manufacturer's recommendations and these Specifications.
- 12. Tighten bolts in a joint evenly around the pipe.

13. Install concrete thrust blocks or joint restraints at all bends. Refer to plans.
14. Install remaining pipe bedding in accordance with plans using material conforming to these Specifications.
15. Do not install pipe in water. Keep trench free of water. Refer to ANSI/AWWA C651 for wet trench installation procedures, if Engineer approves such installation.
16. Close ends of installed pipe with water-tight plugs when pipe installation is not underway.
17. Do not allow any water from the new pipeline to enter existing distribution system piping.
18. Do not locate water service lines under proposed driveway locations and sidewalks.
19. The Contractor shall install water stops in the trench at locations set forth in the contract documents. They shall be constructed of clayey excavated material compacted to 95% of optimum density (ASTM D698).
20. Water main shall not be installed by directional drilling or horizontal boring without a casing pipe, unless specified otherwise in the contract documents.

B. Additional Requirements for Ductile Iron Pipe Installation.

1. Install in accordance with AWWA C600.
2. Install with cover per pipe size as follows:
 - a. 10 inch and smaller - 5 feet 6 inches cover
 - b. 12 inch to 20 inch - 5 feet 0 inches cover
 - c. 24 inch to 30 inch - 4 feet 6 inches cover
 - d. 36 inch to 54 inch - 4 feet 0 inches cover
3. Cut pipe perpendicular to pipe barrel. Do not damage cement lining. Bevel cut ends for push-on joints according to AWWA C600.
4. Encase pipe, valves and fittings with polyethylene wrap.

C. Pipe Insulation.

Install where shown or specified. Minimum Thickness: 4 inches.

D. Additional Requirements for PVC Pipe Installation.

1. Cut pipe perpendicular to pipe barrel.
2. Install with minimum 5 feet 6 inches cover.
3. Bevel cut end of pipe barrel per pipe manufacturer's recommendation.

E. Polyethylene Encasement Installation.

1. Application: All buried ductile iron pipe, fittings, and appurtenances.
2. Install in accordance with AWWA C105.
3. The polyethylene encasement is to prevent contact between the pipe and the bedding material but need not be airtight or watertight.

F. Tracer System Installation.

1. Begin and terminate system at all connections to existing mains.
2. Install wire continuously along lower quadrant of pipe. Do not install wire along bottom of pipe.
3. Attach wire to pipe at midpoint of each pipe length; use 2 inch wide 10 mil thickness polyethylene pressure-sensitive tape.
4. Install splices only as authorized by Engineer. Allow Engineer to inspect all below grade splices of tracer wire prior to backfill.
5. Install ground rods at locations shown on plans or as required by Engineer.
6. Bring double run of wire to surface at each mainline and hydrant valve location; strip ends of wire and connect together with split bolt.
7. Terminate exposed tracer wire in receptacle box.
8. Location of Receptacles: As indicated in the contract documents or as required by Engineer.
9. The Engineer will conduct final inspection of the tracer system at the completion of the Project and prior to acceptance. Verify the electrical continuity of the system. Repair any discontinuities.
10. Refer to plans for tracer wire installation.

G. Transitions in Piping Systems.

Where the specified material of piping system entering or exiting a structure changes, the change shall occur at the outside of the structure wall, beyond any wall pipe or wall fitting required, unless otherwise shown or specified.

H. Structure Penetrations.

1. Wall Pipes.

- a. Install where pipes penetrate and terminate at a wall or floor surface of a concrete structure, or where the pipe protrudes through the concrete wall or floor and the protrusion is otherwise unsupported.
- b. Provide a waterstop flange near the center of the embedment length. Waterstop is to be cast integral with the wall pipe, or fully welded to it around the pipe circumference.

2. Wall Sleeves.

- a. Install where a pipe passes through a structure wall.
- b. Sleeves in concrete walls are to be supplied with a waterstop collar, fully welded, and shall be cast in place in the concrete.

I. Service Taps and Connections.

1. Provide service tap and connection for each lot or property or as otherwise shown on the plans.
2. Construct service in conformance with plans.
3. Consult with Jurisdictional Water Department.
4. Prepare the Site and make preparatory excavation at the location for the tap. Preparatory

work must be in conformance with Marion Water Department guidelines.

5. Blanket main during PVC taps.
6. Close the tap site in accordance with this Specification and City of Marion guidelines.
7. **Coordination.**
 - a. Water main to be in service and all tests passed prior to ordering taps.
 - b. Lot pins to be placed prior to making tap.
 - c. Call at least 24 hours ahead of need for taps for all taps.
8. **Additional Guidelines.**
 - a. Taps 2 inches and smaller are made by the Marion Water Department.
 - b. Taps larger than 2 inches shall be made by the Contractor.

J. Testing.

1. **Special Requirements.**
 - a. Testing performed by the Contractor or by the Engineer indicating acceptable results does not relieve the Contractor of the responsibility to construct the Work in accordance with the contract documents or responsibility to correct any defects that are present.
 - b. The test results submitted by the Contractor must meet the minimum requirements as established by the contract documents. If test results do not indicate compliance with the contract documents, additional tests in the area following the Contractor's re-work will be provided to the Engineer at the Contractor's expense.
 - c. The Contractor shall give the Engineer 24 hours notice prior to performing assurance testing.
2. **Disinfection Agent.**
 - a. Meet requirements for
 - 1) Calcium Hypochlorite Granules (HTH), per ANSI/AWWA B300, approximately 65% available chlorine by weight.
 - 2) Liquid Chlorine, per ANSI/AWWA B301, 100% available chlorine.
 - 3) Sodium Hypochlorite Solution, approximately 5 to 15% available chlorine by weight.
 - b. Chlorine containers must have AWWA stamp.
3. **Testing and Quality Control.**

The Contractor shall be responsible to perform quality assurance testing in accordance with the contract documents. The intent of the testing is to provide an indication of the effectiveness of the means and methods being employed by the Contractor.
4. **Water Main Testing.**
 - a. Tests shall be performed by the Contractor.
 - b. **Scheduling.**
 - 1) Notify Engineer one working day in advance of testing or disinfection operations to coordinate the operations.
 - 2) Engineer or his representative must be in attendance during testing or disinfection.
 - c. Regulatory Requirements: Conform to Iowa DNR "Iowa Water Supply Facilities Design Standards."
 - d. **Sequence of Operation.**
 - 1) Perform operations in the following sequence:
 - a) Remove any debris from within pipe. Clean and swab out pipe if required.
 - b) Secure any unrestrained pipe ends against uncontrolled movement.
 - c) Fill the main and add chlorine.
 - d) Wait 24 hours to check the chlorine content. Must be over 25 mg/l.
 - e) Dispose of highly chlorinated water.

- f) Wait 24 hours for bacteriological testing and turbidity testing.
- g) Perform pressure and leak testing.
- h) Make taps after passing all tests.
- 2) Successfully complete each operation before commencing to the next operation.
- 3) Contracting Authority will provide reasonable quantities of water for flushing and testing.
- e. **Method of Chlorination.**
 - 1) The chlorination will be accomplished in accordance with AWWA C651. The preferred method from that standard shall be the method utilizing HTH granules placed in the water main as it is being installed and then filling the main with potable water when installation is complete.
 - 2) To utilize this method the pipes and appurtenances must be kept clean and dry during construction.
 - 3) During construction, HTH shall be placed at the upstream end of the first section of pipe, at the upstream end of each branch main and at approximately 60 foot intervals in the new pipe as it is laid in accordance with the quantities of granules shown in Table 1 for various pipe sizes.

Table 1: Calcium Hypochlorite Granules

Pipe Diameter (inches)	HTH Granules (oz)
6	1
8	1.5
10	2.5
12	3.5
16	6
20	9
24	13
30	21
36	29
42	44
48	58

- 4) The quantities of calcium hypochlorite granules listed in Table 1 will result in initial chlorine concentrations of 45 to 55 mg/l.
- f. **Filling and Initial Flushing.**
 - 1) When installation is completed, the main shall be slowly filled by opening the inlet valve just enough turns to start the water running. Air release valves and fire hydrants shall be opened to release air pockets at the high points of the line. Check all interconnecting valves to the existing system to be sure they are completely closed. Contractor personnel are permitted to operate valves and hydrants internal to the new main only. Valves which separate the existing city distribution system from the new main are to be operated only by the Marion Water Department.
 - 2) The chlorinated water shall remain in the pipe for at least 24 hours, during which time all valves and hydrants in the section treated shall be operated in order to disinfect the appurtenances. At the end of this 24 hour period, the disinfecting solution shall have a residual of not less than 25 mg/l as free chlorine.
 - 3) After the completion of the 24 hour period, the heavily chlorinated water shall be flushed from the main until the chlorine concentration is less than 4 mg/l. A chlorine residual determination shall be made to ascertain that the chlorine concentration of the water in the new main is compatible with that in the city distribution system.
 - 4) The Contractor shall furnish and install all hoses, equipment, and appurtenances necessary to direct the flushing water to the proper discharge point.
 - 5) Highly chlorinated water shall be discharged to sanitary sewers. If sanitary sewers are not available in the area, the highly chlorinated water shall be trucked to a sanitary sewer, or neutralized by treating with one of the chemicals listed in Appendix B of AWWA C651. The rate of discharge to sanitary sewers shall be controlled to

prevent surcharging the sewer. The Marion Sewer Department shall be contacted a minimum of 48 hours prior to discharge into the sanitary sewer.

g. Final Flushing.

- 1) Once the chlorine content of the flushing water has declined to less than 4 mg/l as determined by the Marion Water Department, the water shall be directed to natural water ways or storm sewer intakes. The Contractor is responsible to direct the flushing water away from the Site in a safe and non-destructive manner. The Contractor shall continue flushing to remove debris and sediment from the new main until preliminary grab samples indicate that the turbidity has been reduced sufficiently to warrant samples to be taken for laboratory testing. In addition to the end of the new main, hydrants at intermediate points along the main and all blowoffs on branches shall be opened and flushed.
- 2) Where the water main consists of looped water mains, the Contractor shall develop a plan, subject to prior approval of the Engineer, for closing valves and flushing the loop to ensure that all parts of the loop are flushed completely.
- 3) The flushing velocity for mains 16 inches in diameter and smaller shall be 2.5 feet per second. For larger mains, the flow shall be as required by the Engineer. The rate of flow required to produce a velocity of 2.5 feet per second is shown in Table 2 along with the required openings at 40 psi residual pressure to produce this flow.

Table 2. Required Openings to Flush Pipelines (40 psi residual pressure)

Pipe Size (inches)	Flow Required for 2.5 fps Velocity (gpm)	Orifice Size (inches)	Number	Hydrant Nozzle Size (inches)
4	100	1 5/16	1	2 1/2
6	220	1 3/8	1	2 1/2
8	390	1 7/8	1	2 1/2
10	610	2 5/16	1	2 1/2
12	880	2 13/16	1	2 1/2
16	1565	3 5/8	2	2 1/2

- 4) With 40 psi residual pressure, one 2 1/2 inch hydrant nozzle will discharge approximately 1000 gpm and a 4 1/2 inch hydrant nozzle will discharge approximately 2500 gpm.
- h. Sampling Procedure:** Once preliminary samples indicate that turbidity has been reduced sufficiently to warrant laboratory testing, samples shall be collected from blowoffs and hydrants at the end of the main, and at intermediate branches and hydrants. In the case of looped mains, valves shall be operated to ensure that samples are drawn from all parts of the new main. Samples shall be collected by Marion Water Department personnel in sterile bottles treated with sodium thiosulfate as required by Standard Methods. No hose shall be used in the collection of samples.
- i. Special Conditions:** If, during construction, trench water has entered the main, or if in the opinion of the Engineer, excessive quantities of dirt or debris have entered the main, bacteriological samples shall be taken at intervals of approximately 200 feet and shall be identified as to location. Samples shall be taken of water that has stood in the main for at least 16 hours after final flushing has been completed.
- j. Turbidity and Bacteriological Testing.**
- 1) Samples shall be tested by the Engineer for turbidity and bacteriological quality in accordance with Standard Methods procedures. Turbidity shall be 1.0 ftu or less, and bacteriological tests shall show the absence of coliform organisms. A standard plate count may be required at the option of the Engineer.
 - 2) If satisfactory turbidity and bacteriological test results are obtained from the initial disinfection process, no further disinfection is required and the Contractor may proceed with pressure testing of the main.
 - 3) If the test results are not satisfactory, further flushing and testing of the main is required.
- k. Redisinfection:** If the initial disinfection fails to produce satisfactory bacteriological

samples, the main shall be reflushed and resampled. If check samples show the presence of coliform organisms, then the main shall be rechlorinated by the continuous feed or slug method of chlorination until satisfactory results are obtained.

I. Pressure and Leak Testing.

- 1) Isolate new piping from the existing water system.
- 2) Fill and flush all new piping with potable water. Ensure that all trapped air is removed.
- 3) Pressurize the new pipe to the test pressure at the highest point in the isolated system. Do not pressurize to more than five psi over the test pressure at the highest point in the isolated system.
- 4) Test the completed piping system at 1 1/2 times the system working pressure or 150 psi, whichever is greater, for two hours.
- 5) Monitor the pressure in the line for a period of not less than two hours.
- 6) If at any time during the test the pressure drops to five 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.
- 7) Accurately measure the amount of water required to repressurize the system to the test pressure.

Table 3. Maximum Allowable Leakage Rate

Pipe Diameter (inches)	Maximum Allowable Leakage Rate (gallons per hour per 1000 feet of pipe)
4	0.37
6	0.55
8	0.74
10	0.92
12	1.10
14	1.29
16	1.47
18	1.66
20	1.84
24	2.21
30	2.76
36	3.31

Note: For unusual conditions or for water lines shorter than 500 feet, consult Engineer for allowable leakage rate. The following formula shall apply:

$$L = \frac{(S)(D)(P)^{1/2}}{133,200}$$

Where:

- L = leakage, allowable
- S = length of pipe test section, in feet.
- D = pipe diameter, in inches.
- P = average test pressure, psig.

- 8) If the average measured leakage per hour exceeds the maximum allowable leakage rate, repair and retest the water line.
- 9) Repair all visible leaks regardless of the amount of leakage.

m. Continuous Feed Method of Chlorination.

- 1) Prepare a chlorine-water solution by dissolving granules of calcium hypochlorite in water in the proportion required for the desired concentration. A 1% chlorine solution requires approximately 1 pound of calcium hypochlorite in 8 gallons of water.
- 2) The chlorine solution shall be applied to the water main with a pump suitable for pumping chlorine solutions and the head conditions at the point of application. The

point of application shall be through a tap in the new main within 10 feet downstream of the valve to be used for turning water into the new pipe. Water from the existing distribution system shall be turned into the new pipe at a constant measured rate. The rate may be measured with a hydrant meter mounted on the discharge outlet. The chlorine solution shall be fed at a rate to produce a chlorine concentration in the pipe of at least 25 mg/l free chlorine. Table 4 shows the minimum rate of chlorine solution to feed to obtain a 25-mg/l chlorine residual at various water flow rates. Feed rates may need to be adjusted upward to compensate for ammonia content of the water.

Table 4. Minimum Feed Rates

Water Flow Rate in Water Main (gpm)	1.0% Chlorine Solution Feed Rate (gpm)
100	0.25
200	0.50
300	0.75
400 (max. for meter)	1.00

- 3) During application of the chlorine, valves shall be positioned to prevent the strong chlorine solution from contacting water in the existing distribution system. Chlorine application shall not cease until the main is completely filled with the chlorine solution. The chlorine solution shall remain in the main for at least 24 hours, during which period all valves and hydrants in the section being treated shall be operated in order to disinfect the appurtenances. At the end of this 24 hour period, the treated water in all parts of the main shall have a residual of not less than 10 mg/l free chlorine.
 - 4) After the applicable retention period, the heavily chlorinated water shall be flushed from the main as specified above.
- n. Disinfection Procedures When Cutting into or Repairing Existing Mains.**
- 1) The following procedures apply primarily when mains are wholly or partially dewatered. After the appropriate procedures have been completed, the main may be returned to service prior to completion of bacteriological testing in order to minimize the time customers are out of water.
 - 2) Leaks or breaks that are repaired with clamping devices while the mains remain full of water under pressure present little danger of contamination and require no disinfection.
 - a) Trench Treatment: When an old main is opened, either by accident or design, the excavation will likely be wet and may be badly contaminated from nearby sewers. Liberal quantities of hypochlorite applied to open trench areas will lessen the danger from such pollution. Tablets have the advantage in such a situation because they dissolve slowly and continue to release hypochlorite as water is pumped from the excavation.
 - b) Swabbing with hypochlorite solution: The interior of all pipe and fittings used in making the repair (particularly couplings and sleeves) shall be swabbed or sprayed with a one percent hypochlorite solution before they are installed.
 - c) Flushing: Thorough flushing is the most practical means of removing contamination introduced during repairs. If valve and hydrant locations permit, flushing toward the nearest downstream hydrant or blow-off point at a velocity sufficient to scour the main.
 - o. Work location from both directions is recommended. Flushing shall be started as soon as the repairs are completed and shall be continued until discolored water is eliminated.
 - p. Putting Water Main in Service: Obtain Engineer's approval to put the completed water system in service.

K. Flushing.

1. Method of flushing is subject to prior approval of Engineer. Flush in accordance with approved method under the supervision of the Engineer. Refer to Article 236072.03, J.

2. Disinfection: According to Article 236072.03, J.

L. General Requirements for Installation of Valves and Appurtenances.

1. Install only approved materials.
2. Install in accordance with the contract documents.
3. Test and disinfect all valves, hydrants and appurtenances as components of the completed water main in accordance with Article 236072.03, J.
4. Apply polyethylene wrap to all valves, valve boxes, hydrants and fittings.
5. Set tops of valve boxes to finish grade in paved areas and 2 inches below finish grade in nonpaved areas unless otherwise directed by Engineer.
6. Check the working order of all valves by opening and closing through entire range.

M. Flushing Device (Blowoff).

1. Install where shown on the plans, in accordance with the plans.
2. Install gravel backfill.
3. Install thrust block, bearing on perpendicular excavation face of undisturbed earth.

N. Fire Hydrant.

1. If auxiliary valve is positioned adjacent to water main, attach it to anchoring tee.
2. If auxiliary valve is positioned away from water main, restrain all joints between valve and water main.
3. Fire hydrant depth setting:
 - a. Use adjacent finish grade to determine setting depth. If finish grade is not to be obtained during the current Project, consult with Jurisdiction Engineer for proper setting dimension.
 - b. Not lower than manufacturer's minimum setting dimension, and not lower than 18 inches, measured from nozzle to grade.
 - c. Nominal Bury Depth 6 feet 0 inches.
4. Coordinate installation with tracer wire installation.
5. Hydrant set perpendicular to Main – see plan details.
6. Tee, isolation valve, and associated piping (but NOT barrel) shall be wrapped with polyethylene sheeting.
7. Hydrant extensions will not be allowed. If possible, adjust height by deflection of joints; if necessary, adjust height by use of fittings.

O. Required Separations of Water Mains, Sanitary Sewers, and Storm Sewers.

1. **General:** The following specifications are derived from the 1997 edition of the 10 State "Recommended Standards for Water Works." Updates to the 10 States Standards, by reference herein, shall also apply to these specifications.

2. **The following factors should be considered in providing adequate separation:**
 - a. Materials and types of joints for water and sewer pipes.
 - b. Soil conditions.
 - c. Service and branch connections into the water main and sewer line.
 - d. Compensating variations in the horizontal and vertical separations.
 - e. Space for repair and alterations of water and sewer pipes.
 - f. Off-setting of pipes around manholes.
3. **Parallel installation:** Water mains shall be laid at least 10 feet horizontally from any existing or proposed sewer or septic tank absorption field trench. The distance shall be measured edge to edge. In cases where it is not practical to maintain a 10 foot separation, the reviewing authority may allow deviation on a case-by-case basis, if supported by data from the design engineer. Such deviation may allow installation of the water main closer to a sewer, provided that the water main is laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer.
4. **Crossings:** Water mains crossing sewers shall be laid to provide a minimum vertical distance of 18 inches between the outside of the water main and the outside of the sewer. This shall be the case where the water main is either above or below the sewer with preference to the water main located above the sewer. At crossings, one full length of water pipe shall be located so both joints will be as far from the sewer as possible. Special structural support for the water and sewer pipes may be required.
5. **Exception:** The reviewing authority must specifically approve any variance from the requirements of Articles 236072.03, O, 3 and 4 when it is impossible to obtain the specified separation distances. Where sewers are being installed and these paragraphs cannot be met, the sewer materials shall be waterworks-grade 150 psi pressure-rated pipe or equivalent and shall be pressure-tested to insure watertightness.
6. **Force mains:** There shall be at least a 10 foot horizontal separation between water mains and sanitary sewer force mains. There shall be an 18 inch vertical separation at crossings as required in Article 236072.03, O, 4.
7. **Sewer manholes:** No water pipe shall pass through or come in contact with any part of a sewer manhole.

P. Service Taps.

1. Made at ten o'clock or two o'clock position unless corporation would have less than 5 feet of cover. When 5 feet of cover is not available, tap may be rotated downward no farther than midpoint of pipe. Taps shall be no closer than 18 inches apart and staggered around the circumference of pipe.
2. Taps on A-C pipe: purge valve of tapping machines opened so chips will be flushed from pipe.
3. Tapping saddle is required for taps 1 1/2 inches and larger, on mains 4 inches or smaller, and on PVC pipe.

Q. Water Main Abandonment.

1. Water mains must be abandoned in place by using mechanical devices manufactured specifically for such purposes to completely seal the ends of the pipe.
2. Mechanical joint plugs or mechanical joint caps with watertight gaskets must be installed at the termination points of the abandoned water main.

3. Specially fabricated, watertight gaskets are required at the request of the Engineer where water main exists in contaminated soil areas.
4. Oversized mechanical joint caps or plugs may be required depending upon the outside diameter of the existing water pipe.
5. The Contracting Authority may require the existing water main to be removed from the ground in lieu of abandonment "in place". Unless such removal is called for in the contract documents, a change order to the contract price will be negotiated.
6. Remove valve boxes on valves on abandoned mains to a minimum of 1 foot below top of grade in unpaved areas, or to bottom of sub-grade in paved areas.
7. Fill remainder of valve box and excavation with sand to a minimum of 1 foot below grade in unpaved areas, or to bottom of sub-grade in paved areas.

R. Water Service Line Abandonment.

1. The Contractor shall disconnect water service at the main. The location of mains, where known, will be provided by the Contracting Authority. The Contractor may be required to schedule excavations in certain streets in accordance with the requirements of the local jurisdiction. Methods of work on mains and services will be subject to prior approval and inspection by the Engineer. The work shall be subject to approval by the Engineer prior to backfilling.
2. Those water services controlled by a corporation stop on the main shall be disconnected at the main by closing the corporation stop and disconnecting the service line. A cap or corporation nut shall be installed on the corporation stop. Upon completion of a water service disconnect, and inspection of the same, the Contractor shall backfill the excavation. The backfill shall be compacted to 95% of the Standard Proctor Density as set forth in ASTM D698.
3. Curb stops and risers must be completely removed from all abandoned service lines. The remaining service line must be terminated in the following fashion:
 - a. **Copper:** Install a copper cap using a silver soldering method.
 - b. **Lead:** Flatten a minimum of 8 inches of lead pipe end, fold a minimum of 2 inches of flattened end back 180 degrees, then re-flatten forming a folded seal on the tail of the lead service line material.
4. All service lines larger than 2 inch, or manufactured from materials other than copper or lead, must be terminated at a point closest to the water main. Tapping valves shall be removed from its associated tapping sleeves. A blind flange shall be installed on the tapping sleeve, where possible, after the tapping valve is removed.
5. If a blind flange cannot be installed, then one of the following methods of abandonment must be used at the direction of the Engineer:
 - a. The tapping sleeve must be cut out of the water main and a new spigot piece of water pipe must be inserted in its place.
 - b. A cast iron split repair sleeve shall be installed on the water main to seal the tapped opening in the pipe.
 - c. A full body cast iron tapping sleeve with blind flange shall be installed on the water main to seal the tapped opening in the pipe.
 - d. Unless one of these approaches is called for in the contract documents, a change order to the contract price will be negotiated.
6. Service lines that are terminated at a tee must be sealed by installing a mechanical plug, cap,

or flange, at the outlet of the tee. If this method of abandonment is not possible then at the Engineer's direction the tee must be cut out of the water main and a new spigot piece of pipe must be inserted in its place. Unless this approach is called for in the contract documents, a change order to the contract price will be negotiated.

236072.04 METHOD OF MEASUREMENT.

- A. Water Main, Trenched:** paid on a lineal feet basis, not including fittings, for each type and size as set forth in the contract documents, as measured by the Engineer.
- B. Fittings by Weight, DIP:** paid on a weight basis. The quantity paid shall be fittings as counted by the Engineer and converted to a weight basis in accordance with standard fitting weights as published in AWWA C153.
- C. Valve, Gate:** paid on a count basis for each type and size as set forth in the contract documents, as counted by the Engineer. Polyethylene wrap, other piping materials required for installation, and adjustment to finished grade are incidental.
- D. Fire Hydrant Assembly:** paid on a count basis for each type and size as set forth in the contract documents. The quantity paid shall be as indicated in the contract documents. Hydrant gate valve, mainline tee, valve box, material delivery, other piping materials required for installation, and rotating hydrant for proper direction of nozzles are incidental.
- E. Flushing Device (Blowoff), As Per Plan:** paid on a count basis for each type and size as set forth in the contract documents. The quantity paid shall be as indicated in the contract documents.

236072.05 BASIS OF PAYMENT.

- A. Water Main, Trenched:** For the number of lineal feet of water main of each size and type furnished and installed, the Contractor shall be paid the contract unit price. Polyethylene wrap and tracer wire are incidental.
- B. Fittings by Weight, DIP:** For the number of pounds of water main fittings furnished and installed, the Contractor shall be paid the contract unit price. Nuts bolts, retainer glands, and restraining rods are incidental.
- C. Valve, Gate:** For the number of gate valves plus valve boxes of each type and size furnished and installed, the Contractor shall be paid the contract unit price. Polyethylene wrap, other piping materials required for installation, and adjustment to finished grade are incidental.
- D. Fire Hydrant Assembly:** For the number of fire hydrant assemblies furnished and installed, the Contractor shall be paid the contract unit price. Hydrant gate valve, mainline tee, valve box, material delivery, other piping materials required for installation, and rotating hydrant for proper direction of nozzles are incidental.
- E. Flushing Device (Blowoff), As Per Plan:** For the number of blowoff assemblies furnished and installed, the Contractor shall be paid the contract unit price. Polyethylene wrap and other piping materials required for installation are incidental.
- F. The following shall be considered incidental to bid items:**
 - Submittals.
 - Finish grading.
 - Trench excavation and backfill with suitable native material.
 - Sheeting, shoring and bracing.
 - Bedding.

- Dewatering.
- Measures required to protect subgrades.
- Measures required to provide positive drainage during construction.
- Measures required to protect existing features including existing utilities, of the project site.
- Testing and Disinfection.