

SP-091022
(New)



**SPECIAL PROVISIONS
FOR
WATER MAIN**

Polk County
STP-S-C077(173)--5E-77

Effective Date
December 20, 2011

**THE STANDARD SPECIFICATIONS, SERIES 2009, ARE AMENDED BY THE FOLLOWING
MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL
PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.**

I. GENERAL INFORMATION

A. Submittals

The Des Moines Water Works (DMWW) will review all Shop Drawings for materials related to water main construction. Shop Drawings shall be provided to DMWW 2 weeks prior to any water main construction. The Contractor shall submit these Shop Drawings to:

Des Moines Water Works
Attn.: Katie Kinsey
2201 George Flagg Parkway
Des Moines, Iowa 50321

B. Preparation

Notify DMWW (515-283-8729) 48 hours prior to the start of any water main related construction.

Verify proposed grades prior to construction to ensure adequate finished cover will be provided over all water mains.

The Contractor shall arrange for all surveys required to install water main on line and grade as shown on the plans.

The Contractor shall arrange with DMWW for all valves and hydrants to be operated only by DMWW's personnel.

C. Connections to the Existing Water System

Connections to the existing DMWW system shall be coordinated with the Engineer and scheduled a minimum of 48 hours in advance. Customers who will be without water shall be notified by the Contractor a minimum of 24 hours in advance. Water main shutdowns may need to be completed outside normal working hours to minimize impact on affected customers. No additional compensation will be paid for work outside normal working hours.

Taps larger than 2 inches required for connections to existing mains shall be made by DMWW. The Contractor shall schedule the taps a minimum of 24 hours in advance and prepare the necessary excavation, including shoring. DMWW will provide the tapping sleeve, valve, and valve box.

Field locate tapping sleeves so that the tap is centered 3 to 6 feet from the joint that will be capped/plugged.

D. Abandonment of Existing Facilities

Existing water mains shall be abandoned as shown on the plans; mains shall be capped and valve boxes shall be removed incidental to water main construction.

II. WARRANTY

The Contractor shall protect and save harmless the Des Moines Water Works Board from claims and damages of any kind caused by the operation of the Contractor, warranty materials, and quality of work to be free of defects for a period of 2 years after the date of successful completion of testing as stated in Sections 02674 and 02675, and Part 3.7 of Section 02220 all contained within this Special Provision and shall otherwise in all respects comply with Chapter 573, Code of Iowa. Should defects be discovered during this period, the Contractor shall repair the defect at its sole cost and expense upon notice from DMWW.

Submit written report stating intentions and schedule for completing repairs within 7 calendar days after being notified of need for repairs.

If Contractor fails to make needed repairs, DMWW will contact the Office of Contracts, and their bidding qualifications may be jeopardized according to Article 1102.03 of the Standard Specifications.

DMWW reserves the right to make emergency repairs that are necessary to keep the water main facilities serviceable or to provide immediate action to prevent further damage to the water main or surrounding area. The Contractor shall reimburse the cost incurred by DMWW for any emergency repairs.

III. BASIS OF PAYMENT

No other payment will be made for work covered by this Special Provision, but will be considered incidental to the contract unit price bid for the individual items for which the work was done. Payment for each item shall be considered full compensation for furnishing all material, equipment, tools, labor, and warranty for the construction of each item including excavation, backfill, compaction, and other incidental work to complete the construction in accordance with the Contract Documents.

SECTION 02220 EXCAVATING, BACKFILLING, AND COMPACTING FOR WATER MAINS

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Part 1 General

1.1 Summary of Work

- A. Excavating, backfilling, and compacting Specifications as applicable for installation of water main.

1.2 Related Sections

- A. Section 02610 – Ductile Iron and Polyvinyl Chloride Pipe for Water Mains.
- B. Section 02640 – Valves and Hydrants.
- C. Section 02660 – Water Service Line Transfers.
- D. Section 03410 – Structural Precast/Prestressed Concrete.

1.3 References

- A. American Society for Testing and Materials (ASTM) D2922 – Test Methods for Density of Soil and Soil-Aggregate Mixtures in Place by Nuclear Methods (Shallow Depth).
- B. American Society for Testing and Materials (ASTM) D3017 – Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.
- C. American Society for Testing and Materials (ASTM) D698 – Test Method for Moisture Density Relations of Soils and Soil Aggregate Mixtures, Using 5.5 lb. Rammer and 12" Drop (Standard Proctor Method).
- D. Federal Register – Occupational Safety and Health Administration (OSHA), Occupational Safety and Health Standards - Excavations.
- E. Iowa Department of Transportation (IDOT) Standard Specifications for Highway and Bridge Construction – Series 2009, including Supplemental Specification.

1.4 Submittals (Not used)**1.5 Measurement and Payment (Not used)****Part 2 Products****2.1 Excavated Materials**

- A. Topsoil shall be stripped, grubbed, and stockpiled for finished grading.
- B. Backfill material shall be:
 - 1. Approved for use by the Engineer.
 - 2. Selected material taken from the excavation or select borrow material, if sufficient quantities of compliant excavated material are not available.
 - 3. Inorganic clays, clayey sands, or inorganic and clayey silts, compatible with and having an obtainable density no less than adjacent soils.
 - 4. Free of lumps or clods over 3 inches in the largest dimension.
 - 5. Free of foreign debris including rocks, organic materials, and man-made debris.
 - 6. Material that is not frozen.

2.2 Bedding Material

- A. Bed pipe using selected material taken from the excavation.
- B. Bedding material shall be:
 - 1. Inorganic clay, clayey sand, or inorganic and clayey silt.
 - 2. Free of lumps or clods over 3 inches in the largest dimension.
 - 3. Free of foreign debris including rocks, organic materials, and man-made debris.
 - 4. At or near optimum moisture content.
 - 5. Material that is not frozen.

2.3 Stabilization Material

- A. When required by field conditions, stabilization material shall be crushed limestone, dolomite, or quartzite generally meeting the following characteristics:
 - 1. 2 inch nominal maximum size.
 - 2. 95 percent retained on a 3/4 inch screen.
 - 3. Generally free from deleterious substances as determined by the Engineer.

2.4 Borrow Materials

- A. If sufficient quantity of suitable material is not available from excavations, material shall be obtained from approved off-site sources.
- B. Borrow materials, including topsoil and backfill material, shall conform to all Specifications for excavated materials in Part 2.1.
- C. Topsoil borrow material, in addition to conforming to Part 2.1, shall be:
 - 1. Natural loam and humus with characteristics consistent with the existing topsoil on site.
 - 2. Finely graded and free of clumps larger than 2 inches in the largest dimension.
 - 3. Free of man-made materials and debris.
 - 4. Free of rock or organic matter, including wood and roots, greater than 3/4 inch in the largest dimension.
 - 5. Comprised of less than 1/2 of 1 percent clay.

Part 3 Execution

3.1 General

- A. Quality Assurance
 - 1. The Engineer shall be given the opportunity to review excavated or borrowed soils prior to placement as backfill.
 - 2. The Contracting Authority will commission and compensate a qualified soils engineer to develop Proctor curves indicating moisture-density relationships for all soil types used as backfill.
 - 3. Proctor curves and soil analysis information shall be used in determining proper compaction of the soils placed.
- B. General Safety
 - 1. Blasting shall not be permitted.
 - 2. Safety and protection:
 - a. Provide shoring, sheeting, and bracing, as required, to protect the Work, adjacent property, private or public utilities, and workers.
 - b. Strictly observe laws and ordinances regulating health and safety measures.
 - c. Excavations, which Contracting Authority's personnel are required to enter, shall comply with OSHA standards.
- C. Soil Testing
 - 1. Field tests for density and moisture content shall be performed by the soils engineer, defined in Part 1.4 above, to ensure that the specified density is being obtained. Testing shall be done using ASTM D2922 nuclear methods or another method approved by the Engineer.
 - 2. 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 shall be selected by the Engineer immediately prior to performing 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:
 - a. Over jacking pits where casing was installed.
 - b. Immediately adjacent to all structures.
 - 3. When test results indicate compaction is not as specified:
 - a. Additional tests will be required in both directions from the failed test until satisfactory results are obtained.
 - b. All material between the satisfactory tests shall be removed, replaced, and recompacted in lifts to meet specifications. Compaction corrections shall be made at no expense to the Contracting Authority.
 - c. Recompacted areas shall receive density tests provided at the same frequency as the original tests. Testing of recompacted areas shall be at the Contractor's expense.
 - 4. If petroleum-based materials are detected in the soils, the Contractor shall notify the Engineer. Appropriate action will be taken by the Contracting Authority.
 - 5. Tests that are not conducted in the presence of the Engineer, or are conducted at locations not selected by the Engineer, will be rejected.

- D. Protection of Utility Lines
 1. Trenching operations shall be conducted to avoid damaging underground utilities.
 2. Underground utilities that are shown on the Drawings, located or identified for the Contractor prior to trenching, shall be protected. Damage resulting from trenching or backfilling shall be repaired by the Contractor or utility company at Contractor's expense.
 3. Underground utilities discovered by the Contractor shall be protected.

3.2 Trench Excavation

- A. Trenches shall be excavated so as to:
 1. Follow lines and grades as indicated on the plans.
 2. Provide uniform bearing on undisturbed soil and continuous support along the entire length of the pipe.
 3. Prevent over-excavation in locations where suitable subgrade conditions exist.
 4. Provide vertical trench walls to an elevation no less than 12 inches above the pipe.
- B. Unstable trench bottoms, as determined by the Engineer, shall be corrected as follows:
 1. Over-excavate the trench to stable soil or to a maximum of to 2 feet below the bottom of the pipe.
 2. If stable soil is reached, the trench shall be brought back to grade using suitable backfill material or bedding material compacted to 90 percent Standard Proctor Density.
 3. If stable soil is not reached after 2 feet of over-excavation, 1 foot of the specified trench stabilization material shall be placed in the trench bottom and compacted. The trench shall then be brought back to grade using suitable backfill material or bedding material compacted to 90 percent Standard Proctor Density.
 4. Pipe shall be placed only after the trench bottom has been fully stabilized.
- C. Stones encountered during excavation shall be completely removed. When large rocks are encountered, they shall be broken away to an elevation 6 inches below the bottom of the proposed improvement. Voids created through removal of stones shall be filled with approved backfill material and thoroughly compacted to 90 percent Standard Proctor Density.
- D. Trench bottoms shall be excavated deeper at the location of all bell joints to permit the body of the pipe to rest uniformly supported upon the trench bottom. Bell holes shall be no longer than is necessary for practical installation of the pipe.
- E. The length of trench to be opened at one time shall be as follows:
 1. In extended runs, open trench length shall not exceed 100 feet.
 2. In street crossings, trench shall not be open in more than one lane at a time.
 3. Driveways and entrances shall be backfilled immediately after placement of pipe.
- F. Excavated material shall be placed:
 1. As approved by the Engineer when this Special Provisions does not apply.
 2. Compactly along sides of excavation.
 3. To provide continuous access to fire hydrants and utility valves.
 4. To provide as little inconvenience as possible to public travel.
 5. To minimize damage to adjacent lawns and planted areas.

3.3 Pipe Bedding

- A. Piping shall be bedded with the specified bedding material.
- B. Bedding shall be placed alongside of the pipe to an elevation above the springline (no lower than half the height of the pipe).
- C. Bedding material shall be mechanically compacted in the immediate vicinity of the pipe to assure uniform support of the pipe beneath the springline.
- D. Bedding shall be compacted to a minimum of 90 percent Standard Proctor Density.
- E. Obtain required compaction within a soil moisture range of optimum moisture to 4 percentage points above optimum moisture content.

3.4 Backfilling

- A. Backfilling of trenches shall be done only after pipe installation, jointing, and bedding are complete, inspected, and approved.
- B. Backfill material shall comply with Part 2 above.
- C. Backfill shall be mechanically tamped with impact or vibrating compaction equipment.
- D. Backfill shall be:
 - 1. Placed in lifts of 6 inches or less from the bottom of the trench to 12 inches above the top of the pipe.
 - 2. Compacted to 90 percent Standard Proctor Density to a level 1 foot above the pipe.
 - 3. Compacted to 95 percent Standard Proctor Density in the rest of the trench.
 - 4. Within a soil moisture range of optimum moisture to 4 percentage points above optimum moisture content.
- E. Hydraulic compaction or water jetting of the pipe trenches shall not be permitted.
- F. Adjust moisture content of material that exceeds optimum moisture range, but is otherwise acceptable, by spreading and aerating or otherwise drying as necessary until moisture content is within required moisture range and required compaction can be obtained.
- G. Adjust moisture content of material that is below optimum moisture, but is otherwise acceptable, by wetting as necessary until moisture content is within required moisture range and required compaction can be obtained.

3.5 Grading

- A. Surfaces shall be finish-graded with a well-compacted, free-draining uniform surface without obstructive protrusions or depressions.
- B. Place topsoil at a uniform depth equal to the surrounding topsoil, but not less than 4 inches.
- C. Place topsoil to a minimum depth of 6 inches when ample native topsoil is available.
- D. Place topsoil only under lawn and planted areas.

3.6 Control of Water

- A. Pipe shall be installed in the dry.
- B. Dewater as necessary to prevent water from entering the pipe or rising around the pipe.
- C. Water pumped or diverted from the excavation site shall not be:
 - 1. Pooled anywhere on the site.
 - 2. Removed in such a manner as to disperse silt.
 - 3. Placed on surfaces heavily traveled by pedestrian traffic.
- D. Installed pipe shall not be used as a conduit for trench dewatering.
- E. Surface water shall be controlled as follows:
 - 1. Surface water shall be diverted to prevent entry into the pipe trenches.
 - 2. Surface water accumulated in the pipe trenches and other excavations shall be removed prior to continuation of excavation Work.
 - 3. Surface water saturated soil shall be completely removed from the excavation.
- F. Groundwater shall be controlled as follows:
 - 1. Where groundwater is encountered, trenches and other excavations shall be dewatered, as necessary, to permit the proper execution of the Project.
 - 2. When large quantities of groundwater are encountered, trenches shall be stabilized with the specified stabilization material and pipe shall be bedded as specified.

3.7 Disposal of Unsuitable or Excess Material

- A. Surplus material and material not suitable for backfill shall be disposed of off-site at a location provided by the Contractor. Transportation of such material shall be provided by the Contractor.

3.8 Cleanup and Restoration

- A. The site in and around the excavation shall be cleared of mud and construction debris to a condition equal to, or better than, that existing prior to trenching Work.
- B. Construction remnant materials shall be removed completely from the site.
- C. Damage to adjacent property suffered during installation Work shall be repaired to a condition equal to, or better than, that existing prior to trenching Work.

**** END OF SECTION ****

SECTION 02600 PROTECTION OF WATER SUPPLY

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Part 2 Products

No permanent materials are required for this Work.

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- 3.1 General Installation Requirements
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Part 1 General

1.1 Summary of Work

- A. This Section describes Iowa Department of Natural Resources requirements for protection of water supply systems.

1.2 Related Sections

- A. Section 02220 – Excavating, Backfilling, and Compacting for Water Mains.
- B. Section 02610 – Ductile Iron and Polyvinyl Chloride Pipe for Water Mains.
- C. Section 02640 – Valves and Hydrants.
- D. Section 02674 – Pressure Testing Water Mains.
- E. Section 02675 – Disinfection of Water Distribution Systems.

1.3 References

- A. Iowa Water Supply Facilities Design Standards.

1.4 Submittals (Not used)

1.5 Measurement and Payment (Not used)

Part 2 Products

No permanent materials are required for this Work.

Part 3 Execution

3.1 General Installation Requirements

- A. Lay water mains to avoid high points where air can accumulate. Grade piping so that proposed hydrants will be at the highest points.
- B. Do not locate hydrants within 10 feet of sanitary sewers or storm drains.
- C. Plug hydrant drain ports in areas where groundwater rises above the water main and pump the hydrant barrel dry following construction.
- D. Pressure test and disinfect new water mains prior to placing them in service.

3.2 Separation Distance

- A. Horizontal separation of water mains from gravity sewers:
 - 1. Provide a horizontal separation distance of at least 10 feet between water mains and gravity sewer mains unless both of the following conditions can be met:
 - a. The bottom of the water main is at least 18 inches above the top of the sewer.
 - b. The water main is placed in a separate trench at a minimum horizontal separation of 3 feet from the sewer.
 - 2. When it is impossible to obtain the required 3 foot horizontal clearance and 18 inch vertical separation, the sewer must be replaced with water main quality materials having a minimum pressure rating of 150 psi and meeting the requirements of Section 02610. In no case shall the linear separation be less than 2 feet.
- B. Horizontal separation of water mains from sewer force mains:
 - 1. Provide a horizontal separation distance of at least 10 feet between water mains and sewer force mains unless both of the following conditions can be met:
 - a. The force main is constructed of water main quality materials having a minimum pressure rating of 150 psi and meeting the requirements of Section 02610.
 - b. The water main is laid at least 4 linear feet from the sewer force main.
- C. Vertical separation of water mains from sewer crossovers:
 - 1. Provide a vertical separation of at least 18 inches from the bottom of the water main to the top of the sewer whenever possible where water mains cross over sewer mains.
 - 2. Provide a minimum vertical separation of at least 6 inches from the bottom of the water main to the top of the sewer in all cases where water mains cross over sewer mains.
 - 3. Provide a minimum vertical separation of at least 18 inches from the bottom of the sewer to the top of the water main in all cases where water mains cross under sewer mains.
 - 4. Center one full length of water main pipe over the sewer crossing so both joints are as far as possible from the sewer.
 - 5. Adequately support both water and sewer pipes and provide watertight joints.
 - 6. Use a low permeability soil to backfill within 10 feet of the point of crossing.
- D. Separation of water mains from sewer manholes:
 - 1. No water pipe shall pass through or come in contact with any part of a sewer manhole.
 - 2. Provide a horizontal separation distance of at least 10 feet between water mains and sewer manholes.
- E. Exceptions:
 - 1. Should physical conditions exist such that exceptions to Part 3.2 of this Section are necessary, the design engineer must detail how the water main and sewer installation are to be engineered to provide protection equal to that provided by Parts 3.2 A, B, C, and D of this Section.

3.3 Water Crossings

- A. Above-water crossings:
 - 1. Adequately support and anchor pipe used for above-water crossings.
 - 2. Protect pipe from damage and freezing.
 - 3. Ensure pipe is accessible for repair or replacement.
- B. Underwater crossings:
 - 1. Use ductile iron pipe with flexible watertight joints or install water main in a steel casing pipe for water mains entering or crossing streams that drain areas greater than 2 square miles in urban areas and 100 square miles in rural areas.
 - a. Place the top of the water main below the natural bottom of the streambed at least 1 foot when located in rock, 3 feet when located in other materials, or at a greater depth when crossing major streams.
 - b. Securely anchor the water main to prevent movement of the pipe and provide easily accessible shutoff valves located outside the floodway at each end of the water crossing.
 - c. Backfill the trench with crushed rock or gravel.
 - d. Seed, sod, or otherwise protect the stream bank from erosion upon completion of the Project.
 - 2. For smaller streams, the same requirements shall apply except that shutoff valves do not need to be located immediately adjacent to the water crossing.
 - 3. Water crossings in areas where no evidence of erosion exists are excluded from these requirements.

3.4 Depth of Cover and Width of Trench

- A. Provide 5 feet minimum depth of cover from the top of the pipe to the ground surface.
- B. Where possible, provide an additional 1 foot of cover under pavement.
- C. Insulate water mains as shown on the Standard Detail Sheet where conditions prevent adequate earth cover.
- D. Provide a trench width adequate to lay and joint pipe properly but not more than 12 inches on either side of the pipe.

**** END OF SECTION ****

SECTION 02610 DUCTILE IRON AND POLYVINYL CHLORIDE PIPE FOR WATER MAINS

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Part 1 General

1.1 Summary of Work

- A. This Section includes water mains, fittings, and specials as shown on the plans, complete with accessories.

1.2 Related Sections

- A. Section 02220 – Excavating, Backfilling, and Compacting for Water Mains.
- B. Section 02600 – Protection of Water Supply.
- C. Section 02640 – Valves and Hydrants.
- D. Section 02674 – Pressure Testing Water Mains.
- E. Section 02675 – Disinfection of Water Distribution Systems.

1.3 References

- A. American National Standards Institute (ANSI) B16.1 – Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250 and 800.
- B. American Water Works Association (AWWA) C104 – Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
- C. American Water Works Association (AWWA) C105 – Polyethylene Encasement for Ductile Iron Pipe Systems.
- D. American Water Works Association (AWWA) C110 – Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In., for Water and Other Liquids.
- E. American Water Works Association (AWWA) C115 – Flanged Ductile Iron Pipe With Threaded Flanges.

- F. American Water Works Association (AWWA) C150 – Thickness Design for Ductile Iron Pipe.
- G. American Water Works Association (AWWA) C151 – Ductile Iron Pipe, Centrifugally Cast, for Water or Other Liquids.
- H. American Water Works Association (AWWA) C153 – Ductile-Iron Compact Fittings, 3 In. Through 24 In. and 54 In. Through 64 In. for Water Service.
- I. American Water Works Association (AWWA) C600 – Installation of Ductile Iron Water Mains and Their Appurtenances.
- J. American Water Works Association (AWWA) C605 – Underground Installation of Polyvinyl Chloride Pressure Pipe and Fittings.
- K. American Water Works Association (AWWA) C900 – Polyvinyl Chloride Pressure Pipe, 4 In. Through 12 In., for Water Distribution.
- L. American Water Works Association (AWWA) C905 – Polyvinyl Chloride Water Transmission Pipe, Nominal Diameters 14 In. Through 36 In.

1.4 Submittals

- A. The following items shall be submitted for materials provided by the Contractor:
 - 1. Manufacturer's certification that materials furnished is in compliance with the applicable requirements of the referenced standards and this Specification.
 - 2. Drawings and manufacturer's data showing details of the pipe and fittings to comply with this Specification.
 - 3. Design calculations for each class of pipe and fittings.
 - 4. Materials test reports.
 - 5. Restrained joint details for Engineer's approval.
- B. Provide dimensional drawings, fabrication details, functional description, and properly identified catalog data on pipe and equipment to prove complete compliance with Contract Documents.

1.5 Measurement and Payment (Not used)

Part 2 Products

2.1 Ductile Iron Pipe

- A. Pipe shall be manufactured in accordance with AWWA C151.
- B. Special Thickness Class 52 per AWWA C150.
- C. Provide asphaltic outside coating per AWWA C151, 1 mil in thickness.
- D. Cement Mortar Lining:
 - 1. Provide pipe with standard thickness cement mortar lining per AWWA C104.
 - 2. Seal-coat cement mortar lining in accordance with AWWA C104.

2.2 Polyvinyl Chloride Pipe

- A. Pipe 12 inches in diameter or smaller shall be manufactured in accordance with AWWA C900.
- B. Pipe 14 inches in diameter or larger shall be manufactured in accordance with AWWA C905.
- C. Pipe shall be Class 235 (DR 18).
- D. Provide pipe with cast iron pipe equivalent outside diameters.

2.3 Fittings for Ductile Iron and Polyvinyl Chloride Pipe

- A. Fittings shall be compact in accordance with AWWA C153, or full size in accordance with AWWA C110.
- B. Material of construction shall be ductile iron in accordance with AWWA C110.
- C. Joints shall be mechanical in accordance with AWWA C111 and shall be restrained.
- D. Pressure rating:

<u>Size (Inches)</u>	<u>Pressure Rating (psi)</u>
3 – 24	350
30 – 48	250
54 – 64	150

- E. Provide asphaltic outside coating per AWWA C110, 1 mil in thickness.
- F. Cement Mortar Lining:
 1. Provide standard thickness cement mortar lining per AWWA C104.
 2. Seal-coat cement mortar lining in accordance with AWWA C104.

2.4 Joints for Ductile Iron and Polyvinyl Chloride Pipe

- A. Joints shall be push-on using an integral bell with a elastomeric gasket, mechanical in accordance with AWWA C111, or restrained as indicated on the plans.
- B. Follower glands for mechanical joints shall be ductile iron.
- C. Restrained joints to consist of a mechanical joint with retainer gland or manufacturer's proprietary-restrained joint having minimum 250 psi pressure rating.
- D. All T-bolts and hex-head nuts for mechanical joints shall be Teflon coated Cor-Ten steel, or approved equal.
- E. Solvent cement joints are strictly prohibited.

2.5 Restrained Joints

- A. Retainer Glands:
 1. Restraint for mechanical joints shall be incorporated into the design of the follower gland.
 2. Follower gland design shall impart multiple wedging action against the pipe, increasing its resistance as pressure increases.
 3. Twist-off nuts, the same size as nuts for tee-head bolts, shall be incorporated into the design to ensure proper actuating torque is applied during installation.
 4. Retainer glands shall be ductile iron and shall be designed for a minimum working pressure of 250 psi.
 5. Coating: Cationic epoxy-based coating.
- B. PVC Pipe Joints:
 1. Restraint for in-line PVC pipe joints shall be provided through the use of groove and spline pipe and couplings or grip ring located in the bell that provides fully circumferential restrained joints.
 2. Restraint joints to have a minimum pressure rating of 150 psi.

2.6 Polyethylene Pipe Encasement Material

- A. Polyethylene encasement material shall be manufactured in accordance with AWWA C105.
- B. Color: Blue.
- C. Minimum thickness shall be 8 mils.
- D. Tensile strength 1200 psi, minimum.
- E. Elongation 300 percent, minimum.
- F. Dielectric strength 800 v / mil, minimum.
- G. Melt Index 0.4, maximum.
- H. Flat-width tubing of the following sizes shall be used:

<u>Pipe Size</u>	<u>Tubing Width</u>
4 inches	24 inches
6 inches	24 inches
8 inches	24 inches
12 inches	27 inches
16 inches	34 inches
20 inches	41 inches
24 inches	54 inches
30 inches	77 inches
36 inches	81 inches

- I. Sheet material can be used to wrap irregular-shaped valves and fittings.
- J. 2 inch wide, 10 mil thick pressure-sensitive polyethylene tape shall be used to close seams and hold overlaps.

2.7 Tracer System

- A. Tracer Wire: No. 12 solid single strand copper conductor.
 - 1. Insulation material: linear low-density polyethylene (LLDPE) insulation suitable for direct burial applications.
 - 2. Insulation thickness: 0.045 inches, minimum.
 - 3. Insulation color: Blue.
- B. Ground Rod: 3/8 inch diameter, 60 inch long steel rod uniformly coated with metallurgically-bonded electrolytic copper.
- C. Ground-rod Clamp: high-strength, corrosion-resistant copper alloy.
- D. Splice Kit: inline resin splice kit with split bolt for 1kV and 5kV, insulates and seals single conductor and unshielded cable splices for direct bury and submersible applications.
- E. Tracer Wire Test Station:
 - 1. Two internal terminals with shunt.
 - 2. 5 foot white plastic triangular post.
 - 3. Removable top cap with lock.
 - 4. Three 2 7/8 inch by 14 inch custom vinyl decals No. SD-5594K.
 - 5. Tri-grip Anchor.

Part 3 Execution

3.1 Handling, Storage, and Shipping

- A. The pipe shall be handled carefully.
- B. Blocking and hold-downs shall be used during shipment to prevent movement or shifting.
- C. Pipe with damage to the cement mortar lining will be rejected with field-patching not permitted.
- D. For shipment and storage, small pipe shall not be telescoped inside larger pipe.
- E. Pipe materials are to be handled by use of slings, hoists, skids, or other approved means.
- F. Dropping or rolling of pipe material is not permitted.
- G. PVC pipe shall not be stored in direct sunlight for prolonged periods of time.
- H. Pipe shall be protected to prevent dirt entering the pipe.

3.2 General Pipe Installation

- A. Protect pipe joints from injury while handling and storing.
- B. Use no deformed, defective, gouged, or otherwise impaired pipe.
- C. Excavate and prepare trench as specified in Section 02220.
- D. Install ductile iron pipe in accordance with AWWA C600.
- E. Install PVC pipe in accordance with AWWA C605.
- F. Prepare the trench bottom with sufficient exactness before the pipe is installed so that only minor movement of the pipe will be necessary after installation.
- G. Clean pipe interior prior to placement in the trench.
- H. Install pipe to the line and grade shown on the plans with an allowable tolerance of 6 inches, plus or minus.
- I. Maintain uniform bearing along the full length of the pipe barrel at all times. Blocking the pipe up will not be acceptable. Excavate trench bottoms deeper at the location of bell joints to permit the body of the pipe to rest uniformly supported upon the trench bottom.
- J. Bell holes shall be no longer than is necessary for practical installation of the pipe.
- K. Clean joint surfaces of dirt and foreign matter using a wire brush before jointing pipe.
- L. Lubricate gasket and pipe bell. The Contractor shall furnish a vegetable-soap lubricant meeting manufacturer's recommendations. Lubricant shall be approved for use with potable water.
- M. Make joints in strict accordance with manufacturer's recommendations.
- N. Joint deflections shall be within the manufacturer's specifications for maximum deflections.
- O. Bolts on mechanical joints shall be tightened evenly around the pipe by alternating from one side of the pipe to the other.
- P. Cut pipe in a neat manner, without damage to the pipe or the cement mortar lining, if any. Leave a smooth end at right angles to the axis of the pipe. Cut pipe ends shall be beveled for push-on-type joints in accordance with manufacturer's recommendations.
- Q. No pipe shall be installed in water, nor shall water be allowed to rise in the trench around the pipe.
- R. Place watertight bulkheads on the exposed ends of the pipe at all times when the pipe installation is not actually in progress.
- S. Backfill and compact around pipe as outlined in Section 02220.

3.3 Installation of Polyethylene Pipe Encasement Material

- A. Use polyethylene encasement material on buried ductile iron pipe, fittings, rods, and appurtenances in accordance with AWWA C105, Method A.
- B. Use polyethylene tubing to encase pipe.
- C. Cut tubing 2 feet longer than pipe section. Overlap tubing 1 foot at each end of pipe.
- D. Gather and lap tubing to provide a snug fit.
- E. Secure lap at quarter points with polyethylene tape. Secure each end of tube with a complete wrap of polyethylene tape.
- F. The polyethylene encasement shall prevent contact between the pipe and bedding material, but is not intended to be a completely airtight and watertight enclosure.
- G. Repair damaged polyethylene encasement material using polyethylene tape, or replace the damaged section.

3.4 Thrust Blocks

- A. Provide concrete thrust blocks or collars at changes in alignment, tees, and dead ends.
- B. Carry thrust blocks or collars to undisturbed soil that will provide adequate bearing.
- C. The bearing area of thrust blocks or collars, in square feet, shall be as shown on the plans. Minimum thickness for any thrust block shall be 1.5 times outside pipe diameter or 18 inches, whichever is greater.
- D. Hold thrust blocks or collars back 3 inches from all bolts, nuts, glands, or other jointing materials. Ensure joints could be remade without disturbing thrust block or collar.
- E. Provide bond breaker between thrust block or collar and pipe. Polyethylene encasement material will be considered an acceptable bond breaker.
- F. Provide thrust blocks at all connections to existing water mains.

3.5 Tracer System Installation

- A. Install tracer wire with buried piping.
- B. Install wire along lower quadrant of pipe but not under pipe.
- C. Install ground rods adjacent to connections to existing piping and in locations indicated on plans.
- D. Terminate wire in tracer wire test station adjacent to each fire hydrant.
- E. Splice tracer wire only if approved by Engineer. Use specified wire connectors. Allow Engineer to inspect underground splices prior to backfilling.
- F. See details on plans.

**** END OF SECTION ****

SECTION 02640 VALVES AND HYDRANTS

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- 2.3 Joints for Valves and Hydrants
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- 3.1 Handling, Storage, and Shipping
- 3.2 General Installation Requirements
- 3.3 Valve Installation
- 3.4 Hydrant Installation
- 3.5 Installation of Polyethylene Pipe Encasement Material
- 3.6 Thrust Blocks

Part 1 General

1.1 Summary of Work

- A. This Section includes valves and hydrants as shown on the Contract Documents, complete with accessories.

1.2 Related Sections

- A. Section 02220 – Excavating, Backfilling, and Compacting for Water Mains.
- B. Section 02610 – Ductile Iron and Polyvinyl Chloride Pipe for Water Mains.

1.3 References

- A. American National Standards Institute (ANSI) B16.1 – Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250, and 800.
- B. American Water Works Association (AWWA) C105 – Polyethylene Encasement for Ductile Iron Pipe Systems.
- C. American Water Works Association (AWWA) C111 – Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings.
- D. American Water Works Association (AWWA) C115 – Flanged Ductile Iron Pipe with Ductile Iron or Gray Iron Flanges.
- E. American Water Works Association (AWWA) C502 – Dry-Barrel Fire Hydrants.
- F. American Water Works Association (AWWA) C509 – Resilient-Seated Gate Valves for Water and Sewerage Systems.
- G. American Water Works Association (AWWA) C550 – Protective Epoxy Coatings for Valves and Hydrants.
- H. American Water Works Association (AWWA) C600 – Installation of Ductile-Iron Water Mains and Their Appurtenances.

1.4 Submittals

- A. Submit manufacturer's certification that materials furnished is in compliance with the applicable requirements of the referenced standards and this Developmental Specification.
- B. Provide dimensional drawings, fabrication details, functional description, and properly identified catalog data on all items to prove complete compliance with Contract Documents.

1.5 Measurement and Payment (Not used)

Part 2 Products

2.1 Gate Valves

- A. Buried valves shall open clockwise (to the right).
- B. Use gate valves for valves 16 inches in diameter and smaller.
- C. Provide resilient-seated gate valves manufactured in accordance with AWWA C509.
- D. Provide valves with mechanical joint ends.
- E. Provide valves with 2 inch by 2 inch wrench nut.
- F. Coat interior and exterior non-finished surfaces using minimum 10 mil thick fusion-bonded epoxy per AWWA C550.
- G. Materials of Construction:
 - 1. Body and bonnet: cast or ductile iron.
 - 2. Gate: cast or ductile iron fully encapsulated with synthetic rubber.
 - 3. Stem and stem nut: bronze.
 - 4. O-rings: Buna-N.
 - 5. Exposed hex nuts and bolts: stainless steel.
- H. Valve shall be designed to allow replacement of upper O-ring while valve is under pressure in the full-open position.
- I. Operating valve through 500 cycles at rated pressure must not result in disbondment or degradation of the coating. Certification will be required for manufacturers not listed below.
- J. Valve design shall not permit metal-to-metal contact between gate and body.
- K. Indicate manufacturer, casting year, size, and working pressure in valve casting.
- L. Manufacturers:
 - 1. U.S. Pipe and Foundry Co. Metroseal 250.
 - 2. Clow F6100.
 - 3. Mueller A2360.
 - 4. M & H Style 4067.
 - 5. American Flow Control Series 2500.
 - 6. Approved equal.

2.2 Hydrants

- A. Hydrants shall be manufactured in accordance with AWWA C502.
- B. No chains shall be used on nozzle caps.
- C. Hydrants shall be dry-barrel, breakaway type designed to break near the ground line on impact. Breaking ring or flange shall be one piece or split and shall contact retaining ring for its full circumference.
- D. Provide flanged connections for head and base to hydrant barrel.
- E. Provide 6 inch mechanical joint shoe.
- F. Provide 4 1/2 inch minimum diameter main valve with bronze seat ring. Thread seat ring directly to bronze bushing or drain ring, which is securely locked to hydrant shoe.
- G. Provide pentagon-shaped operating nut with weather cap. Dimension from point to flat at top of operating nut: 1 3/16 inch.

- H. Provide two 2 1/2 inch hose nozzles and one 4 inch pumper nozzle with caps and national standard nozzle threads; nozzle caps shall have nut with dimensions identical to operating nut:
1. Hose nozzle threads
 - a. Outside diameter of male thread 3 1/16 inches
 - b. Diameter at root of male thread 2 7/8 inches
 - c. Threads per inch 7 1/2
 - d. Length of nozzle threads 1 inch
 - e. Cut off at top of threads 1/4 inch
 2. Pumper nozzle threads
 - a. Outside diameter of male thread 4 31/32 inches
 - b. Diameter at root of male thread 4 19/32 inches
 - c. Threads per inch 4
 - d. Length of nozzle threads 1 1/2 inches
 - e. Cut off at top of threads 1/4 inch
- I. Provide markings cast on bonnet that indicates direction of opening. Hydrants shall open clockwise (to the right).
- J. Provide thrust washers or thrust bearings for ease of operation.
- K. Provide grease chamber or oil reservoir, sealed by means of O-rings, for lubrication of operation threads. Provide lubricant suitable for contact with potable water.
- L. Painting
1. Prepare surfaces to be coated according to SSPC-SP6, commercial blast cleaning.
 2. Coat hydrant in accordance with AWWA C502 and coating manufacturer's instructions.
 3. Interior surfaces, other than machined surfaces, shall be coated with asphaltic coating.
 4. Exterior surfaces below grade shall be coated with two coats of asphaltic coating.
 5. Exterior surfaces above grade shall be primed using a polyamide epoxy system, similar to Tnemec Series 20, FC20 or 66, and painted using an aliphatic acrylic polyurethane system, similar to Tnemec Series 75, or approved equal. Provide total dry mil thickness of 5 to 7 mils.
 6. Exterior surfaces above grade shall have 2 to 4 mils dry thickness of clear coat applied after paint has been allowed to dry thoroughly.
 7. Color:
 - a. Asphaltic coating: Black.
 - b. Primer: White (AA83).
 - c. Paint: Bright Yellow (SC02).
 - d. Dome: Safety Green (SC07).
- M. Materials of Construction:
1. Breakaway stem coupling: steel, cast iron, or stainless steel.
 2. Bonnet: cast iron.
 3. Barrel, shoe, and nozzle caps: cast or ductile iron.
 4. Threaded internal components exposed to water, valve seats, and nozzles: bronze.
 5. Cotter pins, drive pins, bolts, and screws exposed to water: stainless steel or bronze.
 6. Exterior fasteners:
 - a. Above ground: zinc-plated in accordance with ASTM A307.
 - b. Below ground: stainless steel.
- N. Manufacturers:
1. Clow Medallion.
 2. Mueller Centurion.
 3. Approved equal.

2.3 Joints for Valves and Hydrants

- A. Joints shall be mechanical in accordance with AWWA C111, or restrained as indicated on the plans.
- B. Follower glands for mechanical joints shall be ductile iron.

- C. Restrained joints to consist of a mechanical joint with retainer gland or manufacturer's proprietary restrained joint having minimum 250 psi pressure rating.
- D. All T-bolts and hex-head nuts for mechanical joints shall be Teflon coated Cor-Ten steel, or approved equal.

2.4 Valve Boxes

- A. Provide cast iron screw-type adjustable valve box with cast iron stay-put cover marked "WATER" for each buried valve.
- B. Minimum inside diameter of valve boxes shall be 5 1/8 inches.
- C. All valve boxes shall be installed upon the valve with the use of a rubber valve box adaptor that centers the valve over the operating nut and eliminates settling and shifting of the valve box.

2.5 Polyethylene Encasement Material

- A. Polyethylene encasement material shall be manufactured in accordance with AWWA C105.
- B. Minimum thickness shall be 8 mils.
- C. Tensile strength 1200 psi, minimum.
- D. Elongation 300 percent, minimum.
- E. Dielectric strength 800 v / mil, minimum.
- F. Melt Index 0.4, maximum.
- G. Sheet material shall be used to wrap valves. 24 inch flat-width tubing shall be used to wrap the below-grade portion of hydrants.
- H. 2 inch wide, 10 mil thick pressure-sensitive polyethylene tape shall be used to close seams or hold overlaps.

Part 3 Execution

3.1 Handling, Storage, and Shipping

- A. Handle valves and hydrants carefully.
- B. Use blocking and hold-downs during shipment to prevent movement or shifting.

3.2 General Installation Requirements

- A. Protect valves and hydrants from injury while handling and storing.
- B. Use no defective, damaged, or otherwise impaired materials.
- C. Prepare excavation as outlined in Section 02220.
- D. Install valves and hydrants in accordance with AWWA C600.
- E. Clean interior of valve or hydrant prior to placement in the trench.
- F. Install valves and hydrants to the line and grade as shown on the plans.
- G. Install valves and hydrants plumb.
- H. Clean joint surfaces of dirt and foreign matter using a wire brush before jointing.
- I. Lubricate gasket and bell. The Contractor shall furnish a vegetable-soap lubricant meeting manufacturer's recommendations. Lubricant shall be approved for use with potable water.
- J. Make joints in strict accordance with manufacturer's recommendations.
- K. Bolts on mechanical joints shall be tightened evenly around the pipe by alternating from one side of the pipe to the other.
- L. Backfill and compact around hydrants and valves as outlined in Section 02220.

3.3 Valve Installation

- A. Do not support valves off of piping.
- B. Ensure that valve box is centered over operating nut.

3.4 Hydrant Installation

- A. Anchor auxiliary valve to hydrant tee.
- B. Install hydrant with break flange more than 1 inch and less than 7 inches above finished grade.
- C. Use restrained joints in hydrant branch.
- D. Set hydrant on a solid concrete cinder block not smaller than 8 inch by 16 inch by 4 inch.
- E. Provide poured concrete thrust blocks behind hydrant and hydrant tee.
- F. Ensure hydrant drain is free-flowing and unobstructed in areas where normal groundwater level is below the drain opening.
- G. Provide not less than 1 cubic yard of open-graded granular fill around base of hydrant for drainage.
- H. Plug hydrant drain opening prior to installation in areas with elevated groundwater levels as directed by the Engineer.

3.5 Installation of Polyethylene Pipe Encasement Material

- A. Polyethylene encasement material shall be used on buried valves and the buried portion of hydrants in accordance with AWWA C105.
- B. Wrap valves using polyethylene sheet material to prevent contact with bedding. Secure sheet to adjacent pipe and just below valve operation nut using polyethylene tape.
- C. Wrap buried portions of hydrants using 24 inch flat-width polyethylene tubing. Secure tubing to hydrant barrel just below grade using polyethylene tape.
- D. The polyethylene encasement shall prevent contact with bedding material, but is not intended to be a completely airtight and watertight enclosure.
- E. Damaged polyethylene encasement material shall be repaired using polyethylene tape, or the damaged section shall be replaced.

3.6 Thrust Blocks

- A. The Contractor shall provide concrete thrust blocks at hydrants and hydrant tees.
- B. Carry thrust blocks to undisturbed soil that will provide adequate bearing.
- C. The bearing area of thrust blocks, in square feet, shall be as shown on the plans.
- D. Minimum thickness for thrust block shall be 1.5 times outside pipe diameter or 18 inches, whichever is greater.
- E. Hold thrust blocks back 3 inches from bolts, nuts, glands, or other jointing materials. Ensure joints could be remade without disturbing thrust block.
- F. Provide bond breaker between thrust block and pipe or hydrant. Polyethylene encasement material will be considered an acceptable bond breaker.

**** END OF SECTION ****

SECTION 02660 WATER SERVICE LINE TRANSFERS

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- 3.3 Size of Service Lines and Taps
- 3.4 Preparation
- 3.5 Installation
- 3.6 Retirement of Existing Service Lines
- 3.7 Backfill, Compaction, and Restoration

Part 1 General

1.1 Summary of Work

- A. Transferring water services to new water main.
- B. Substandard service upgrades.
- C. Curb stop/stop box replacement.

1.2 Related Sections

- A. Section 02220 – Excavating, Backfilling, and Compacting for Water Mains.
- B. Section 02610 – Ductile Iron and Polyvinyl Chloride Pipe for Water Mains.
- C. Section 02640 – Valves and Hydrants.
- D. Section 02674 – Pressure Testing Water Mains.
- E. Section 02675 – Disinfection of Water Distribution Systems.

1.3 References

- A. American Society of Mechanical Engineers (ASME) B16.26 – Cast Bronze Fittings for Flared Copper Tubes.
- B. American Society for Testing and Materials (ASTM) B62 – Standard Specifications for Composition Bronze or Ounce Metal Casting.
- C. American Society for Testing and Materials (ASTM) B88 – Standard Specifications for Seamless Copper Water Tube.
- D. American Water Works Association (AWWA) C151 – Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids.
- E. American Water Works Association (AWWA) C800 – Underground Service Line Valves and Fittings.

1.4 Submittals

- A. The following items shall be submitted for materials provided by the Contractor:
 - 1. Manufacturer's certification that materials furnished is in compliance with the applicable requirements of the referenced standards and this Special Provision.
 - 2. Shop Drawings and manufacturer's data showing details of the pipe and fittings to comply with this Special Provision.
- B. Provide dimensional Shop Drawings, fabrication details, functional description, and properly identified catalog data on all equipment to prove complete compliance with the Contract Documents.

1.5 Measurement and Payment (Not used)**Part 2 Products****2.1 Corporation Valves**

- A. Type: one-quarter-turn ball valve in accordance with AWWA C800.
- B. Inlet threads: Standard AWWA corporation valve inlet threads.
- C. Outlet threads: for flared copper connection.
- D. Corporations to be used on iron pipe shall be provided with a dielectric insulator that prevents the passage of electric current.
- E. Pressure class: high – 150 psi.
- F. Material: copper alloy containing nominally 85 percent copper, 5 percent tin, 5 percent lead, and 5 percent zinc per ASTM B62.

2.2 Copper Pipe and Fittings

- A. Copper tubing: ASTM B88, Type K, annealed.
- B. Fittings: ASME B16.26, cast bronze,
- C. Joints: flared.

2.3 Curb Stop

- A. Type: one-quarter-turn, straight-through ball valve in accordance with AWWA C800.
- B. Inlet and outlet threads for flared copper connection.
- C. Provide Minneapolis pattern top threads for attaching curb box.
- D. Provide pre-drilled valve head for attaching stationary shutoff rod.
- E. Provide valve head checks that limit rotation to 90 degrees. Valve head parallel to valve body when open, valve head perpendicular to valve body when closed.
- F. Material: copper alloy containing nominally 85 percent copper, 5 percent tin, 5 percent lead, and 5 percent zinc per ASTM B 62.

2.4 Curb Box

- A. Body:
 - 1. Upper section: 1 inch inside diameter steel pipe.
 - 2. Base section: cast iron tapped for attachment to curb stop with Minneapolis pattern top thread.
 - 3. Adjust to accommodate:
 - a. 5 foot minimum service depth to proposed grade.
 - b. 7 foot maximum service depth to proposed grade.
 - 4. Provide a positive means of preventing rotation of upper section during removal of lid.

- B. Lid:
 - 1. Material: cast iron.
 - 2. Style: two-hole Erie pattern, to fit spanner wrench.
 - 3. Provide 1 inch NPT female-threaded brass bushing to screw onto curb box with 1 inch diameter upper section. Bushing shall be secure and rotate integrally with lid.
 - 4. Acceptable lids:
 - a. 5601L (A.Y. McDonald Mfg. Co., Dubuque, Iowa).
 - b. Type HS (The Ford Meter Box Company, Inc., Wabash, Indiana).
 - c. Part No. 89982 (Mueller Co., Decatur, Illinois).
 - d. Approved equal.
- C. Stationary Shutoff Rod:
 - 1. Material: 304 stainless steel, single-piece construction.
 - 2. Diameter: Approximately 5/8 inch.
 - 3. Rod shall:
 - a. Self-center in curb box.
 - b. Extend above curb box joint. Distance between top of rod and top of box shall be:
 - (1) No less than 12 inches.
 - (2) No greater than 30 inches.
 - 4. Provide a blade at the upper end of rod in a plane parallel to the curb stop valve head with thickness appropriate for operation using a stationary rod key.
 - 5. Provide a fork at the lower end of rod to fit over and operate the valve head of a standard curb stop. Provide holes in fork to align with hole in curb stop valve head.
 - 6. Connect rod to curb stop using stainless steel cotter pin, or approved equal, inserted through holes in rod fork and curb stop valve head.

2.5 Piping for Services Larger than 2 Inches

- A. Pipe and fittings for services larger than 2 inch diameter shall be ductile iron as specified in Section 02610.
- B. Valves for services larger than 2 inch diameter shall be gate valves as specified in Section 02640.

Part 3 Execution

3.1 General

- A. Qualifications
 - 1. Plumbing work covered by this Section shall be completed by a plumber who is bonded with Des Moines Water Works (DMWW) and licensed in accordance to local plumbing codes.
 - 2. Contractors will be permitted to make their own 1 inch direct taps on mains installed, provided the installer demonstrates proficiency to the satisfaction of DMWW. Contractors unable to qualify will be charged the standard rate for each tap made by DMWW.
- B. Plumbing Permits and Inspections
 - 1. The Contractor will be responsible for obtaining permits necessary for service transfers.
 - 2. The Contractor shall arrange for and schedule required plumbing inspections in accordance with local plumbing codes.

C. Scheduling

1. Services shall be transferred only after the new water main passes pressure test per Section 02674 and disinfection per Section 02675.
2. The Contractor shall notify residential customers 24 hours in advance when their water service will be interrupted for service transfer.
3. The Contractor shall notify commercial and industrial customers a minimum of 24 hours in advance when water service will be interrupted for service transfer and shall coordinate the interruption completely with the customer. Commercial and industrial service transfers may need to be completed outside normal working hours to minimize impact on the affected customers. No additional compensation will be paid for work outside normal working hours.

3.2 Examination

- A. Verify location of existing service line prior to excavation.
- B. Verify size of existing service line prior to installation of new tap.

3.3 Size of Service Lines and Taps

- A. In general, new service lines shall be the same size as the existing service line.
- B. Existing service lines less than 1 inch diameter shall be transferred using 1 inch corporation and piping.
- C. Existing 1 1/4 inch diameter service lines shall be transferred using 1 inch corporation and 1 1/4 inch piping.
- D. Existing service lines larger than 1 1/4 inch up to 2 inch diameter shall be transferred using 2 inch corporation, and piping same size as existing.
- E. Existing service lines larger than 4 inch diameter shall be transferred using piping same size as existing.

3.4 Preparation

- A. Excavate in accordance with Section 02220.
- B. Cut pipe ends square, ream tube ends to full pipe diameter, and remove burrs.
- C. Remove scale and dirt on inside and outside before assembly.

3.5 Installation

- A. Schedule taps to be made by DMWW a minimum of 24 hours in advance. Such taps will be made only between the hours of 8 a.m. and 3:30 p.m. and only on DMWW's normal work days. Shore excavations for taps to be made by Owner according to OSHA Trench Shoring Standards. Provide 12 inch clear behind and below main to be tapped for 24 inches along the main. Provide 48 inch clear in front of the main to be tapped.
- B. Install service lines in accordance with local plumbing codes.
 1. Install corporations no closer than 18 inches from a pipe joint or other corporation.
 2. 1 inch corporations will be installed at a 45 degree angle above horizontal; 2 inch corporations will be installed horizontal.
 3. Corporation shall face the property to be served.
 4. Corporation taps will not be allowed on dry mains.
- C. Pipe:
 1. Maintain 18 inch minimum separation between water piping and sewer piping in accordance with IDNR requirements.
 2. Maintain 5 foot minimum cover below final grade. Do not exceed 7 foot cover unless the plans show greater depth of cover.
 3. Install 4 inch SDR 26 PVC encasement for all 1 inch water services installed under storm sewer as indicated in the plans.

- D. Curb Stop:
 - 1. Set curb stop on solid bearing.
 - 2. Center and plumb curb box over curb stop.
 - 3. Install stationary shutoff rod. Attach shutoff rod to curb stop as specified above.
 - 4. Set box cover flush with finished grade and plumb.
 - 5. Location:
 - a. In public right-of-way 1 foot to 6 feet from property line.
 - b. Not within driveway or sidewalk.
- E. Repair leaks that develop in new service lines or water mains due to water service installation operations.
- F. Coordinate necessary inspections to satisfaction of jurisdictional authority for water service lines.
- G. Install large service transfers in accordance with Section 02610.

3.6 Retirement of Existing Service Lines

- A. Effectively cap existing service stub after service is transferred to new main.
- B. The Contractor shall be responsible for repairing leaks that develop in existing service lines or mains due to service transfer operations.

3.7 Backfill, Compaction, and Restoration

- A. Excavations shall be backfilled and compacted as specified in Section 02220 for trenches.
- B. Restore affected areas as specified elsewhere and as shown on plans.

**** END OF SECTION ****

SECTION 02674 PRESSURE TESTING WATER MAINS

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- 1.5 Measurement and Payment (Not used)

Part 2 Products

No permanent materials are required for this Work.

Part 3 Execution

- 3.1 Quality Assurance
- 3.2 Pressure Testing

Part 1 General

1.1 Summary of Work

- A. Water mains shall be pressure-tested in accordance with this Section.

1.2 Related Sections

- A. Section 02610 – Ductile Iron and Polyvinyl Chloride Pipe for Water Mains.

1.3 References

- A. American Water Works Association (AWWA) C600 – Installation of Ductile Iron Water Mains and Their Appurtenances.

1.4 Submittals (Not used)

1.5 Measurement and Payment (Not used)

Part 2 Products

No permanent materials are required for this Work.

Part 3 Execution

3.1 Quality Assurance

- A. Perform Work in accordance with AWWA C600.

3.2 Pressure Testing

- A. Piping shall be tested at 150 psi for 2 hours.
- B. Fill and flush new piping with potable water, ensuring that all trapped air is removed.
- C. Isolate new piping from the existing system.
- D. Pressurize the new piping to the test pressure at the highest point in the isolated system. Do not pressurize to more than 5 psi over the test pressure at the highest point in the isolated system.
- E. Monitor pressure in the line being tested for a period of not less than 2 hours.
- F. If at any point during that 2 hour period the pressure drops to 5 psi below the test pressure, re-pressurize by pumping water into the line in sufficient quantity to bring the pressure back to between the test pressure and 5 psi above the test pressure. Accurately measure the amount of water required to re-pressurize the main.
- G. At the end of the 2 hour period, if pressure in the line has dropped below the test pressure, re-pressurize to the test pressure. Accurately measure the amount of water required to re-pressurize the main.
- H. Allowable leakage per hour of testing shall equal $(ND(P)^{1/2}) / 7,400$.
 - N = number of joints in the length of pipe to be tested
 - D = nominal diameter of pipe in inches
 - P = average test pressure in psig
- I. Leakage equals the total amount of water required to keep the line pressurized during the 2 hour test period and re-pressurize the line at the end of the test period.
- J. If the average leakage per hour is less than the allowable leakage, the pressure test is acceptable.
- K. If the average leakage per hour is more than the allowable leakage, the pressure test is not acceptable. The Contractor shall, at his own expense, locate and make approved repairs as necessary until leakage is within the specific allowance.
- L. If pressure in the isolated line never drops to the test pressure, having started no more than 5 psi above the test pressure, the pressure test is acceptable.
- M. Visible leaks are to be repaired regardless of the amount of leakage.

**** END OF SECTION ****

SECTION 02675 DISINFECTION OF WATER DISTRIBUTION SYSTEMS

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Part 3 Execution

- 3.1 General
- 3.2 Examination
- 3.3 Chlorination of Piping
- 3.4 Flushing Chlorinated Piping
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Part 1 General

1.1 Summary of Work

- A. Water mains shall be disinfected in accordance with this Section.

1.2 Related Sections

- A. Section 02220 – Excavating, Backfilling, and Compacting for Water Mains.
- B. Section 02610 – Ductile Iron and Polyvinyl Chloride Pipe for Water Mains.

1.3 References

- A. American Water Works Association (AWWA) B300 – Standard for Hypochlorites.
- B. American Water Works Association (AWWA) B301 – Standard for Liquid Chlorine.
- C. American Water Works Association (AWWA) C651 – Standard for Disinfecting Water Mains.

1.4 Submittals (Not used)

1.5 Measurement and Payment (Not used)

Part 2 Products

2.1 Chlorine

- A. Calcium hypochlorite granules conforming to AWWA B300.
- B. Liquid chlorine conforming to AWWA B301.

Part 3 Execution

3.1 General

- A. Perform Work in accordance with AWWA C651.
- B. Bacteriological samples shall be taken and tested by the Owner to ensure satisfactory disinfection.
- C. Contractor to provide equipment and materials necessary to complete chlorination.
- D. Water for disinfection will be provided by Owner for two disinfection attempts. If additional attempts are necessary, the Contractor will be billed for water used at the normal rate set for industrial customers.

3.2 Examination

- A. Disinfection of piping shall take place only after satisfactory pressure testing.
- B. Ensure piping to be disinfected is isolated from portion of the distribution system that is in service.
- C. Review procedures and coordinate disinfection with Owner.

3.3 Chlorination of Piping

- A. Use the continuous feed method as outlined in Section 5.2 of AWWA C651.
- B. Prior to feeding chlorine, fill and flush new piping to remove trapped air and particulates. Provide equipment and materials necessary to obtain a minimum flushing velocity of 2.5 ft/second in piping to be disinfected.
- C. Induce flow of potable water through the new piping at required flushing velocity. Make provisions for diverting and disposing of flushing water in manner that does not damage surroundings. Repair damage caused by flushing activities.
- D. At a point within five pipe diameters of the connection to the existing distribution system, introduce highly chlorinated water in sufficient quantity to provide at least 25 mg / L free chlorine in the new piping. Provide metering and feed equipment.
- E. Introduce highly chlorinated water continuously until the entire section of new piping contains a minimum of 25 mg / L free chlorine. Do not exceed 100 mg / L free chlorine.
- F. Isolate the newly chlorinated piping for a contact period of at least 24 hours, and not more than 48 hours, taking care not to backflow chlorinated water into the existing potable water system.
- G. After the contact period, water in the new piping must have a residual-free chlorine content of not less than 10 mg / L. If the residual is less than 10 mg / L, rechlorinate as outlined in Part 3.2.

3.4 Flushing Chlorinated Piping

- A. After the contact period, flush the recently chlorinated piping with potable water.
- B. Continue flushing until the chlorine residual in the new piping is equal to the chlorine residual in the existing distribution system.
- C. Isolate the new piping from the existing distribution system for a period of not less than 24 hours.
- D. Chlorinated water, which is flushed from the new piping, shall be disposed of in such a manner as to not cause damage to the environment. Conform with Part 3.5 of Section 02220 and any other state or federal requirements.
- E. De-chlorinate all water from flushing activities and testing before it is released into the ground, streams, or sewers. Method to be approved by the Owner prior to any flushing activities.

3.5 Bacteriological Testing

- A. Immediately following flushing of pipelines, and again at least 24 hours after flushing pipelines, samples will be taken and tested by Owner.
- B. Approximately one sample will be taken for each 1200 feet of new water main.
- C. Additional samples may be taken at the discretion of Owner.
- D. Samples must show the absence of coliform organisms and other contaminants and meet requirements of the Iowa Department of Natural Resources to be considered acceptable.
- E. If any sample is not satisfactory, the piping represented by that sample must be flushed and rechlorinated by the Contractor at the discretion of, and as directed by, the Owner.

**** END OF SECTION ****

**SECTION 03410 STRUCTURAL PRECAST/PRESTRESSED CONCRETE
INDEX**

Part 1 General

- 1.1 Summary of Work
- 1.2 Related Sections
- 1.3 Submittals
- 1.4 Measurement and Payment (Not Used)
- 1.5 Quality Assurance
- 1.6 Design

Part 2 Products

- 2.1 Materials

Part 3 Execution

- 3.1 Fabrication
- 3.2 Finish
- 3.3 Transportation and Storage
- 3.4 Installation

Part 1 General

1.1 Summary of Work

- A. This Section covers structural precast/prestressed concrete construction including manufacture, delivery, and installation of precast valve vault riser and lid as shown on the Drawings.

1.2 Related Sections

- A. Section 02220 – Excavating, Backfilling, and Compacting for Water Mains.
- B. Section 05500 – Metal Fabrications.

1.3 Submittals

- A. Shop Drawings
 - 1. Prepare and submit Shop Drawings and erection drawings for the Engineer's approval.
 - 2. Indicate all sections, reinforcement, openings, dimensions, and miscellaneous details on Shop Drawings.
- B. Engineering design:
 - 1. Submit complete design calculations for the reinforcing and wall and roof thickness.
 - 2. Submit calculations prepared, certified, and sealed by an engineer licensed in the State of Iowa.
- C. Submit list of tests used for quality assurance.

1.4 Measurement and Payment (Not Used)

1.5 Quality Assurance

- A. Qualifications of manufacturer:
 - 1. Produce all structural precast units using a manufacturer thoroughly experienced and qualified in this type of work.
 - 2. Manufacturer's facilities: capable of producing the structural precast units under controlled conditions and at a sufficient rate to meet the required delivery schedule.
- B. Qualifications of workers:
 - 1. Fabricate and erect/install all structural precast units using qualified personnel familiar with these materials and methods.
 - 2. Welders: Previously qualified by testing, as prescribed in "Standard Qualification Procedures" of the American Welding Society for the work required.
 - 3. Submit copy of the operator's certification prior to any field welding.
- C. Codes and Standards: Conform to the latest editions of the following standards:
 - 1. American Concrete Institute (ACI) 318, Building Code Requirements for Reinforced Concrete.
 - 2. American Concrete Institute (ACI) 301, Specifications for Structural Concrete for Buildings.
 - 3. American Welding Society (AWS) D1.0, Code for Welding in Building Construction.
 - 4. American Welding Society (AWS) D12.1, Recommended Practices for Welding Reinforcing Steel, Metal Inserts & Connections in Reinforced Concrete Construction.
 - 5. Prestressed Concrete Institute (PCI) PCI MNL-116, Manual for Quality Control for Plants and Production of Precast Prestressed Concrete Products.
- D. Sampling and testing: in accordance with the manufacturer's standard procedures, subject to the approval of the Engineer. Submit a list of tests to be performed.

1.6 Design

- A. General: in accordance with ACI 318.
- B. Design deviations:
 - 1. Permitted to enable more manufacturers to make submittals.
 - 2. Permitted only with the Engineer's prior approval.
 - 3. Support manufacturer's proposed design by completed design calculations bearing the certification, seal, and signature of an engineer licensed in the State of Iowa.
 - 4. Provide an installation equivalent to the basic intent without incurring additional cost to the Contracting Authority.
- C. Design to withstand site earth loads and AASHTO H-20 wheel loads.

Part 2 Products

2.1 Materials

- A. All materials shall be as outlined in ACI 318-89 and AISC Manual of Steel Construction, conforming to latest ASTM Specifications as listed below.
 - 1. Reinforcing:
 - a. Prestressing strand: ASTM A416, Grade 270.
 - b. Reinforcing ties and stirrups: ASTM A615, Grade 40.
 - c. Reinforcing bars: ASTM A615, Grade 60.
 - d. Reinforcing bars: ASTM A615, Grade 60.
 - 2. Sand and gravel: ASTM C33.
 - 3. Cement: ASTM C150.
 - 4. Structural steel: ASTM A36.
 - 5. Concrete: All concrete shall conform to ACI 318-83 with the following properties:
 - a. Release strength: 3,500 psi.
 - b. Minimum 28 day strength: 5,000 psi.
 - c. Maximum coarse aggregate: 3/4 inch.
 - d. Portland cement: Type I.

Part 3 Execution

3.1 Fabrication

- A. Shop fabricate to sizes shown on Drawings. Use rubber ring gasket or O-ring gasket per ASTM C443.
- B. Cast members in accurate steel forms. Set and secure reinforcing steel, anchors, and access hatch according to details.
- C. Recess lifting hooks and inserts.
- D. Cure in accordance with the requirements of the plant standards for the manufacture of prestressed concrete given in PCI manual 116 and so that strength and finish of the units is not impaired.

3.2 Finish

- A. Form and finish using good industry practice in cleaning of forms, design of concrete mix, placing, and curing.
- B. Furnish without surface holes, unsightly imperfections, honeycomb, or structural defects.
- C. Minor patching at shop will be acceptable provided structural adequacy of product and appearance is not impaired.

3.3 Transportation and Storage

- A. Exercise care in transporting precast units to job site; handle to prevent excessive stresses, spalling, or cracking.
- B. Load, transport, and unload at job site; prevent damage.

3.4 Installation

- A. Expose possible conflicts in advance of construction.
- B. Confirm elevations and locations of possible conflicts.
- C. Pipe access hatch drain along wall to a point near the floor.
- D. Backfill as specified in Section 02220.

**** END OF SECTION ****

SECTION 05500 METAL FABRICATIONS
INDEX

Part 1 General

- 1.1 Summary of Work
- 1.2 Related Sections
- 1.3 References (Not Used)
- 1.4 Submittals
- 1.5 Measurement and Payment (Not Used)

Part 2 Products

- 2.1 Ladders
- 2.2 Access Hatch
- 2.3 Anchors, Bolts, and Fastening Devices

Part 3 Execution

- 3.1 General
- 3.2 Surface Conditions
- 3.3 Fabrication
- 3.4 Erection

Part 1 General

1.1 Summary of Work

- A. This Section includes Specifications for the ladders, aluminum access hatch, ladder up safety post, and anchorages.

1.2 Related Sections

- A. Section 03410 – Structural Precast/Prestressed Concrete.

1.3 References (Not Used)

1.4 Submittals

- A. Shop Drawings;
 - 1. Show pertinent information without reference to the Contract Drawings.
 - 2. Include information necessary for the fabrication of component parts of the structure. Indicate sizes and weights of members, type and location of members and components, type and location of shop and field connections, type size and extent of welds, and welding sequence when required.
 - 3. Use welding symbols adopted by the American Welding Society.

1.5 Measurement and Payment (Not Used)

Part 2 Products

2.1 Ladders

- A. Fabricate aluminum ladders in accordance with ANSI A14.3 – Safety Requirements for Fixed Ladders.
 - 1. Fabricate side rails from Schedule 80 continuous aluminum extruded pipe. Minimum inside diameter: 1 1/2 inches.
 - 2. Fabricate rungs from extruded aluminum shapes with a serrated tread.
 - 3. Fabricate supports in manner to provide sufficient wall clearance for clear, direct, and easy access to ladder rungs.
 - 4. Vertical distance between rungs: 12 inches.
 - 5. Mount ladder as shown on Drawings.
- B. Provide mounting and anchoring accessories as required for complete installation.
 - 1. Mount ladder to wall and floor with aluminum L 3/8 inch by 8 inch by 3 inch w/ 5/8 inch diameter stainless steel drilled insert (4 per ladder).
 - 2. Maintain ladder centerline 7 inches from wall.
- C. Provide aluminum safety post at top of each ladder to assist mounting and dismounting the ladder.
 - 1. Provide adjustable mounting brackets to fit ladder rung spacing up to 14 inches on center.
 - 2. Provide tubular post that locks automatically when fully extended. Control movement of post with a stainless steel spring balancing mechanism.
 - 3. On hollow round rung ladders, insert a solid round bar into the top two rungs to provide strength and prevent crushing when safety post is fastened.

2.2 Access Hatch

- A. Single-leaf, aluminum access door with insulated cover; minimum clear opening as shown on Drawings.
- B. Door: reinforced 1/4 inch aluminum diamond pattern plate designed to withstand an AASHTO H-20 wheel load with maximum deflection of 1/150 of the span.
- C. Frame: 1/4 inch extruded aluminum shaped to provide drainage channel and with 1 1/2 inch pipe coupling.
- D. Hardware: heavy forged brass hinges with stainless steel pins and fasteners, stainless steel snap lock with removable handle, fit with stainless steel torsion bar mechanism to assist in operation through entire arc of opening, fit with flush-mounted deadbolt lock with capability to use interchangeable cylinders.
- E. Hold-open Device: zinc-plated and chrome-sealed heavy steel automatic hold-open arm with vinyl grip.
- F. Insulation: 1 inch thick fiberglass insulation covered and protected by 18 gage aluminum liner.

2.3 Anchors, Bolts, and Fastening Devices

- A. Furnish anchors, bolts, and fastening devices necessary for installation of the Work in this Section.
- B. Compound Masonry Anchors: “two unit” type.
- C. Attach aluminum and stainless steel to concrete by means of stainless steel machine bolts.
- D. Anchor Bolt: Provide length of bolt sufficient to place wedge portion of bolt minimum of 1 inch behind reinforcing steel within concrete wall. Use galvanized steel.
- E. Bolts and Nuts: hexagon type conforming to Federal Specification FF-B-575C. Use AISI Type 316 stainless steel.

Part 3 Execution

3.1 General

- A. Quality Assurance
 - 1. Qualifications of suppliers and personnel:
 - a. Use a thoroughly experienced fabricator and erectors qualified in this type of work and having satisfactorily performed work of a similar magnitude and complexity.
 - b. Make welds only by operators who have been previously qualified by testing, as prescribed in "Standard Qualification Procedures" of the American Welding Society to the type of work required.
 - c. Prior to field welding, submit a copy of the operator's certification to the Engineer's office and maintain a copy on site for the Engineer's view, if so requested.
 - 2. Codes and standards: In addition to complying with pertinent codes and regulations, comply with the latest edition of:
 - a. "Code for Arc and Gas Welding in Building Construction", American Welding Society.
 - b. "Metal Stair Manual", The National Association of Architectural Metal Manufacturers.
 - c. "Specification for Aluminum Structures", The Aluminum Association.
- B. Product Handling
 - 1. Protection: Use all means necessary to protect fabrications before, during, and after installation and to protect the installed work and materials of other trades.
 - 2. Replacements: In the event of damage, immediately make repairs and replacements necessary to the approval of the Engineer.

3.2 Surface Conditions

- A. Prior to installation of the Work in this Section, carefully inspect the installed work of other trades and verify that such work is complete to the point where this installation may properly commence.

3.3 Fabrication

- A. Fabricate in strict accordance with the approved Shop Drawings and referenced standards.
- B. Weld or bolt shop connections.
- C. Set and secure members to prevent movement during casting of structural precast concrete units.

3.4 Erection

- A. Erect fabrications in strict accordance with the Drawings, the approved Shop Drawings, and pertinent regulations and standards.

**** END OF SECTION ****