Iowa Department of Transportation

SPECIAL PROVISIONS
FOR
WATER MAIN

Polk County
STP-A-006-4(149)--86-77

Effective Date
May 17, 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 two weeks prior to water main construction. The Contractor shall submit these shop drawings to:

Des Moines Water Works
Attn.: Jenny Puffer
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 survey 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

Expose existing buried pipe at locations that will be connected to new piping. Confirm

location, depth, orientation, type of pipe, outside diameter, and type and location of joints.

Connections to the existing DMWW's 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 (50 mm) 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 hydrant assemblies 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 specification 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 specification, 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

Trenching, 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.

1.3 Quality Assurance

A. Prior to the placement of excavated or borrowed soils, each soil type shall be approved by the Engineer for use as backfill.

B. DMWW will commission and compensate a qualified soils engineer to develop Proctor curves indicating moisture-density relationships, as necessary, for soils to be used as backfill in water main trenches.

C. Proctor curves and soil analysis information shall be used in determining proper compaction of the soils placed.

1.4 References

A. ASTM D 2922 – Test Methods for Density of Soil and Soil-Aggregate Mixtures in Place by Nuclear Methods (Shallow Depth).

B. ASTM D 3017 – Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

C. ASTM D 698 – 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.

1.5 General Safety

A. Blasting will not be permitted.

B. Safety and Protection:
   1. Shoring, sheeting, and bracing shall be provided, as required, to protect the work, adjacent property, private or public utilities, and workers.
   2. Laws and ordinances regulating health and safety measures shall be strictly observed.
   3. All excavations, which the Engineer is required to enter, shall comply with OSHA standards.

1.6 Soil Testing

A. Field tests for density and moisture content will be performed by the Engineer to ensure that the specified density is being obtained. Testing will be done using ASTM D 2922 nuclear methods or another method approved by the Engineer.

B. Density tests will be taken at finished grade, at 3 feet below finished grade, and as directed by the Engineer under special conditions. Test locations will be selected by the Engineer immediately prior to performing tests. The Contractor shall excavate, as directed by the Engineer, for tests at intermediate depths. As a minimum, density tests will be taken at approximately 200 foot intervals along the trench. Additional tests will be required at the following locations:
   1. Over jacking pits where casing was installed.
   2. Immediately adjacent to all structures.

C. When test results indicate compaction is not as specified:
   1. Additional tests shall be required in both directions from the failed test until satisfactory results are obtained.
   2. All material between the satisfactory tests shall be removed, replaced, and recompacted in lifts to meet Specifications. No additional compensation will be paid for compaction corrections.
   3. Recompacted areas shall receive density tests provided at the same frequency as the original tests.

D. If petroleum-based materials are detected in the soils, the Contractor shall notify the Engineer. Appropriate action will be taken by the Contracting Authority.

E. Any tests that are not conducted in the presence of the Engineer, or are conducted at locations not selected by the Engineer, will be rejected.

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. Class A material shall be used for backfill under primary roads.
   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 human-made debris.
   6. Material that is not frozen.

2.2 Bedding Material

A. Bed pipe using selected material taken from the excavation except under primary roads (see Section 2.5 of this specification).

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 human-made debris.
   4. At or near optimum moisture content.
   5. Material that is not frozen.

2.3 Stabilization Material

When required by field conditions, stabilization material shall be crushed limestone, dolomite, or quartzite generally meeting the following characteristics:

A. 2 inch nominal maximum size.

B. 95% retained on a 3/4 inch screen.

C. 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 of this specification.

C. Topsoil borrow material 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 human-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. Composed of less than 0.5 percent clay.

2.5 Backfill Under Primary Roads

For bedding and backfill purposes under Primary roads, use material complying with Article 4120.04 of the Standard Specifications for all bedding and backfill. Place and compact the material according to Article 2435.03, A, of the Standard Specifications.

Part 3 Execution

3.1 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 24 inches 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 24 inches of over-excavation, 12 inches 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% 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% 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. In extended runs, the length of trench to be opened at one time shall not exceed 100 feet.

F. Excavated material shall be placed:
   1. As approved by the Engineer when this Special Provision 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.

3.2 Pipe Bedding

A. All 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 tamped in the immediate vicinity of the pipe to

assure uniform support of the pipe beneath the springline.

D. All bedding shall be compacted to 90% Standard Proctor Density.

E. Obtain required compaction within a soil moisture range of optimum moisture to four percentage points above optimum moisture content.

3.3 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. All 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 at, or near, optimum moisture to a level 12 inches above the pipe.
   3. Compacted to 95% Standard Proctor Density in the rest of the trench.
   4. Within a soil moisture range of optimum moisture to four percentage points above optimum moisture content.

E. Protect pipe coating or pipe wrapping system from damage during backfill operations.

F. Hydraulic compaction or water jetting of the pipe trenches will not be permitted.

G. Adjust moisture content of material that exceeds optimum moisture, 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.

H. 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.

3.4 Grading

A. All 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.

3.5 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 proper construction.
   2. When large quantities of groundwater are encountered, trenches shall be stabilized with the specified stabilization material, and pipe shall be bedded as specified.

3.6 Disposal of Unsuitable or Excess Material

Surplus material and all 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.

3.7 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. All 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.

SECTION 02600 PROTECTION OF WATER SUPPLY

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Part 1 General

1.1 Summary of Work

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.

1.3 References

Iowa Water Supply Facilities Design Standards.

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 all 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 all 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 feet horizontal clearance and 18 inches 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 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 Utility Accesses

1. No water pipe shall pass through or come in contact with any part of a sewer utility access.
2. Provide a horizontal separation distance of at least 10 feet between water mains and sewer utility accesses.

E. Exceptions

Should physical conditions exist such that exceptions to Part 3.2 of this Section are necessary, the Contracting Authority 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 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. Insulate water mains as shown on the Standard Detail Sheet where conditions prevent adequate earth cover.

C. Provide a trench width adequate to lay and joint pipe properly but not more than 1 foot on either side of the pipe.

SECTION 02610 DUCTILE IRON AND POLYVINYL CHLORIDE PIPE FOR WATER MAINS

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Part 1 General

1.1 Summary of Work

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 02674 – Pressure Testing Water Mains.

D. Section 02675 – Disinfection of Water Distribution Systems.

1.3 References

A. ANSI B16.1 – Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250, and 800.

B. AWWA C104 – Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.

C. AWWA C105 – Polyethylene Encasement for Ductile-Iron Pipe Systems.

D. AWWA C110 – Ductile-Iron and Gray-Iron Fittings, 3 inch Through 48 inch, for Water and Other Liquids.

E. AWWA C111 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

F. AWWA C115 – Flanged Ductile-Iron Pipe with Threaded Flanges.

G. AWWA C150 – Thickness Design for Ductile-Iron Pipe.

H. AWWA C151 – Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids.

I. AWWA C153 – Ductile-Iron Compact Fittings 3 inch Through 24 inch and 54 inch Through 64 inch for Water Service.

J. AWWA C600 – Installation of Ductile-Iron Water Mains and Their Appurtenances.

K. AWWA C605 – Underground Installation of Polyvinyl Chloride Pressure Pipe and Fittings.

L. AWWA C900 – Polyvinyl Chloride Pressure Pipe, 4 inch Through 12 inch, for Water Distribution.

1.4 Measurement and Payment

A. Water main will be measured to the nearest 0.1 foot of pipe of each size and type specified.

B. Open-cut water main with casing pipe shall include the casing pipe and carrier pipe, measured to the nearest 0.1 foot, properly installed along centerline of casing.

C. Water main fittings will be measured by the pound based on size and type of fitting installed in the Project.

D. Tapping sleeve, tapping valve, and valve box shall be considered one item measured per each installed.

1.5 Submittals

A. The following items shall also be submitted for materials provided by the Contractor:
   1. Manufacturer's certification that all materials furnished are in compliance with this Special Provision and the applicable requirements of the Standards referenced in Part 1.3 above.
   2. Drawings and manufacturer's data showing details of the pipe and fittings to comply with this Special Provision.
   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 all pipe and equipment to prove complete compliance with the contract documents.

1.6 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. All 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.

Part 2 Products

2.1 Ductile Iron Pipe

A. Pipe shall be manufactured in accordance with AWWA C151.

B. Special Thickness Class 52 pipe per AWWA C150.

C. Provide asphalt 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. Manufacture 12-inch and smaller pipe in accordance with AWWA C900.

B. Pipe shall be Class 235 (DR 18) with cast iron pipe equivalent outside diameters.

C. Pipe installed utilizing horizontal directional drilling shall be Restrained Joint PVC.

D. Pipe shall be blue in color.

2.3 Fittings for Ductile Iron Pipe and Polyvinyl Chloride Pipe

A. Material of construction shall be ductile iron in accordance with AWWA C110.

B. Provide compact ductile iron fittings, per AWWA C153.

C. Joints shall be mechanical in accordance with AWWA C111, or restrained as indicated on the plans.

D. Pressure Rating:

SIZE	PRESSURE RATING
3 inch to 24 inch	350 psi
30 inch to 48 inch	250 psi
54 inch to 64 inch	150 psi

E. Provide asphalt 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 plastomeric or Buna-N nitrile gasket, mechanical in accordance with AWWA C111, or restrained joints as indicated on the plans.

B. Follower glands for mechanical joints shall be ductile iron.

C. Restrained joints for ductile iron pipe to consist of a mechanical joint with retainer gland or manufacturer's proprietary restrained joint having minimum 250 psi pressure rating.

D. Restrained joints for PVC pipe to consist of mechanical joint with retainer gland or manufacturer's proprietary restrained joint having a minimum 150 psi pressure rating.

E. All T-bolts and hex-head nuts for mechanical joints shall be Teflon coated Cor-Ten steel, or approved equal.

F. 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 for ductile iron pipe and 150 psi for PVC pipe.
   5. Coating shall be cationic epoxy based coating, or approved equal.

B. Groove and Spline Joints
   1. Restraint for in-line PVC pipe joints shall be provided through the use of grove and spline pipe and couplings that provide full circumferential restrained joints.
   2. Use grove dimensions and splines recommended by the manufacturer to obtain minimum 150 psi working pressure.

2.6 Polyethylene Pipe Encasement Material

A. Polyethylene encasement shall be manufactured in accordance with AWWA C105.

B. Linear low-density polyethylene film.

C. Minimum thickness shall be 8 mils.

D. Color: Blue.

E. Physical Properties:
   1. Tensile strength 3600 psi, minimum.
   2. Elongation 800%, minimum.
   3. Dielectric strength 800 V/mil, minimum.
   4. Impact resistance 600 g, minimum.
   5. Propagation tear resistance 2550 gf, minimum.

F. Flat-width tubing of the following sizes shall be used:

Pipe Size	Tubing Width
3 inches	14 inches
4 inches	14 inches
6 inches	16 inches
8 inches	20 inches
12 inches	27 inches
16 inches	34 inches
20 inches	41 inches
24 inches	54 inches
30 inches	67 inches
36 inches	81 inches

G. Markings shall contain the following information spaced every 2 feet apart:
   1. Name of manufacturer.
   2. Year of manufacture.
   3. ANSI/AWWA C150-A21.5.
   4. 8 mil linear low-density polyethylene (LLDPE).
   5. Applicable range of nominal pipe diameter.
   6. Warning – Corrosion Protection – Repair Any Damage.

H. Sheet material can be used to wrap irregular-shaped valves and fittings.

I. 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 type copper conductor.

   1. Insulation material: LLDPE insulation suitable for direct burial applications.
   2. Insulation thickness: 0.045 inches, minimum.
   3. Insulation color: Blue.

B. Conduit: rigid metal conduit: low carbon steel, zinc electroplated or hot-dip coated inside and outside; threaded joints.

C. Ground Rod: 3/8 inch diameter, 60 inch long steel rod uniformly coated with metallically bonded electrolytic copper.

D. Ground-rod Clamp: high-strength, corrosion-resistant copper alloy.

E. 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.

F. 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 7/8 inch by 14 inch custom-vinyl decal No. SD-5594C.
   5. Tri-grip anchor.

Part 3 Execution

3.1 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. Before the pipe is installed, the trench bottom shall have been prepared with sufficient exactness so that only minor movement of the pipe will be necessary after installation.

G. Clean pipe interior prior to placement in the trench.

H. All pipe shall be installed to the line and grade shown on the plans with an allowable tolerance of 6 inches, plus or minus.

I. Uniform bearing along the full length of the pipe barrel shall be maintained at all times. Blocking the pipe up will not be acceptable. 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.

J. Clean joint surfaces of dirt and foreign matter using a wire brush before jointing pipe.

K. 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.

L. Make joints in strict accordance with manufacturer's recommendations.

M. All joint deflections shall be within the manufacturer's specifications for maximum deflections.

N. Bolts on mechanical joints shall be tightened evenly around the pipe by alternating from one side of the pipe to the other.

O. 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.

P. No pipe shall be installed in water, nor shall water be allowed to rise in the trench around the pipe.

Q. Watertight bulkheads shall be placed on the exposed ends of the pipe at all times when the pipe installation is not actually in progress.

R. Backfill and compact around pipe as outlined in Section 02220.

3.2 Installation of Polyethylene Pipe Encasement Material

A. Polyethylene encasement material shall be used on all 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 24 inches longer than pipe section. Overlap tubing 12 inches 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. Damaged polyethylene encasement material shall be repaired using polyethylene tape, or the damaged section shall be replaced.

3.3 Thrust Blocks

A. The Contractor shall provide concrete thrust blocks at changes in alignment, tees, and dead ends. The concrete shall meet the requirements for C4 concrete in Section 2301 of the Standard Specifications.

B. Carry thrust blocks to undisturbed soil that will provide adequate bearing.

C. The bearing area of thrust blocks, in square meters, 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 back 3 inches from all bolts, nuts, glands, or other jointing materials. Ensure joints could be remade without disturbing thrust block.

E. Provide bond breaker between thrust block and pipe. Polyethylene encasement material will be considered an acceptable bond breaker.

F. Provide thrust blocks at all connections to existing water mains.

3.4 Tracer System Installation

A. Install tracer wire with all 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 the plans.

D. Terminate wire in tracer wire in Tri-view (tracer wire test station) next to each fire hydrant, blowoff, or other locations directed by Engineer.

E. Splice tracer wire only if approved by Engineer. Allow Engineer to inspect underground splices prior to backfilling.

F. See details in the plans.

3.5 Testing and Chlorination

A. Perform hydrostatic and leakage tests in accordance with Section 02674 at a test pressure of 150 psi.

B. Disinfect all water mains in accordance with Section 02675.

C. DMWW will conduct an electrical continuity test of the tracer system prior to acceptance of the Project. The Contractor shall correct any discontinuities found, at the Contractor's expense.

SECTION 02640 VALVES AND HYDRANTS

INDEX

****

Part 1 General

1.1 Summary of Work

This Section includes valves and hydrants as shown on the Contract Drawings, 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. ASTM A 320 – Standard Specification for Alloy Steel Bolting Materials for Low-Temperature Service.

C. American Water Works Association (AWWA) C105 – Polyethylene Encasement for Ductile Iron Pipe Systems.

D. American Water Works Association (AWWA) C111 – Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings.

E. American Water Works Association (AWWA) C115 – Flanged Ductile Iron Pipe with Ductile Iron or Gray Iron Flanges.

F. American Water Works Association (AWWA) C502 – Dry-Barrel Fire Hydrants.

G. American Water Works Association (AWWA) C509 – Resilient-Seated Gate Valves for Water Supply Service.

H. American Water Works Association (AWWA) C515 – Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service.

I. American Water Works Association (AWWA) C550 – Protective Epoxy Coatings for Valves and Hydrants.

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

K. American Water Works Association (AWWA) C605 – Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.

1.4 Measurement and Payment

A. Water valves shall be measured per each based on size and type specified.

B. Fire hydrant assembly shall be measured per each installed in accordance with the details on the plans.

1.5 Submittals

A. Submit manufacturer's certification that all materials furnished are in compliance with the applicable requirements of the referenced standards and this Special Provision.

B. Provide dimensional drawings, fabrication details, functional description, and properly identified catalog data on all items to prove complete compliance with the contract documents.

1.6 Handling, Storage, and Shipping

A. Handle valves and hydrants carefully.

B. Use blocking and hold-downs during shipment to prevent movement or shifting.

Part 2 Products

2.1 Gate Valves (4 Inches to 16 Inches)

A. Provide resilient-seated gate valves manufactured in accordance with AWWA C509 or AWWA C515.
   1. Type of service: buried service handling potable water with a pH range of 9.5 to 9.8.
   2. Minimum pressure rating: 250 psi.
   3. Furnish valves with non-rising stem.
   4. Provide 2-inch by 2-inch wrench operating nut that opens valves when turned in clockwise direction (open to the right), unless noted otherwise on the Drawings.

B. Materials of Construction:
   1. Body and bonnet: 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 bolts and nuts: stainless steel.
   6. Joints:
      a. Mechanical in accordance with AWWA C111.
         (1) Gaskets: Buna-N or nitrile.
         (2) Nuts and bolts All T-bolts and hex-head nuts for mechanical joints shall be Teflon coated Cor-Ten steel, or approved equal.
         (3) Gaskets: Buna-N or nitrile, of thickness compatible with machining tolerances of flange faces. Minimum thickness: 1/8-inch.
         (4) Nuts and bolts: Conform to ASTM A320, Type 304.

C. Design valve to:
   1. Allow replacement of upper O-ring while valve is under pressure in the full-open position.
   2. Not permit metal-to-metal contact between gate and body.
   3. Accommodate full-size tapping machine shell cutter.

D. Interior and exterior valve coating shall be minimum 10-mil-thick fusion-bonded epoxy per AWWA C550.

E. 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.

F. Indicate manufacturer, casting year, size, working pressure, and body material (ductile iron) in valve casting.

G. Manufacturers' Models for 4-inch to 16-inch valves:
   1. U.S. Pipe and Foundry Co. Metroseal 250.
   2. Clow Model 2638.
   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. 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.

C. Provide flanged connections for head and base to hydrant barrel.

D. Provide 6 inch mechanical joint shoe with harnessing lugs.

E. Provide 4 1/2-inch minimum-diameter main valve with bronze seat ring. Thread seat ring directly to bronze bushing or drain ring that is securely locked to hydrant shoe.

F. Provide pentagon-shaped operating nut with weather cap. Dimension from point to flat at

top of operating nut: 1 3/16-inch.

G. Provide two 2 1/2-inch hose nozzles and one 4 inch pumper nozzle with caps; nozzle caps shall have nut with dimensions identical to operating nut:
   1. Hose nozzle threads
      a. Outside diameter of male thread: 3 1/16 inch.
      b. Diameter at root of male thread: 2 7/8 inch.
      c. Threads per 1 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 inch.
      b. Diameter at root of male thread: 4 19/32 inch.
      c. Threads per 1 inch: 4.
      d. Length of nozzle threads: 1 1/2 inch.
      e. Cut off at top of threads: 1/4 inch.

H. Provide markings cast in bonnet that indicates direction of opening. Hydrants shall open clockwise (to the right).

I. Provide anti-thrust washers for ease of operation.

J. 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.

K. Painting:
   1. Tnemec epoxy paint system
      a. Prepare surfaces to be coated according to SSPC-SP6, commercial blast cleaning.
      b. Coat hydrant in accordance with AWWA C502 and coating manufacturer's instructions.
      c. Interior surfaces, other than machined surfaces, shall be coated with asphaltic coating.
      d. Exterior surfaces below grade shall be coated with two coats of asphaltic coating.
      e. Exterior surfaces above grade shall be primed using a polyamide epoxy system, Tnemec Series 20, FC20 or 66, and painted using an aliphatic acrylic polyurethane system, Tnemec Series 75, or approved equal. Provide total dry mil thickness of 5 to 7 mils.
      f. Exterior surfaces above grade shall have 2 to 4 mils dry thickness of clear coat applied after paint has been allowed to dry thoroughly.
      g. Color:
         (1) Asphaltic coating: Black.
         (2) Primer: White (AA83).
         (3) Paint: Bright Yellow (SC02).
         (4) Dome: Safety Green (SC07).
         (5) Caps: Bright Yellow (SCO2).
   2. TGIC Protective Coating only with prior approval from Des Moines Water Works.
      a. Color
         (1) Asphaltic coating: Black
         (2) Paint: IF55012 Dandelion Yellow TGIC KPE84214P60
         (3) Dome: T-PTG80083 Des Moines Water Works Green TGIC
         (4) Caps: IF55012 Dandelion Yellow TGIC KPE84214P60
   3. Approved Equal
      a. System must be approved by DMWW prior to bid opening.

L. Materials of Construction:
   1. Breakaway stem coupling: steel, cast iron, or stainless steel.
   2. Bonnet barrel, shoe, gate, and nozzle caps: cast iron.
   3. Threaded internal components exposed to water, valve seats, and nozzles: bronze.
   4. Cotter pins, drive pins, bolts, and screws exposed to water: stainless steel or brass.
   5. Exterior bolts, nuts, set screws, and other miscellaneous fasteners: stainless steel or bronze.

M. Manufacturers:
   1. Mueller Centurion.
   2. Clow Medallion.
   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. Bolts:
   1. All T-bolts and hex-head nuts for mechanical joints shall be ductile iron, Cor-Ten steel, Teflon coated Cor-Ten steel, or approved equal.
   2. All bolts and hex nuts for flanged joints shall be stainless steel.

E. Flange joints shall have 1/8-inch rubber ring gaskets for nominal diameters of 24 inches or less and 1/8-inch rubber ring gaskets for nominal diameter greater than 24 inches.

F. Gaskets shall be those specified in AWWA C111.

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 shall be manufactured in accordance with AWWA C105.

B. Linear low-density polyethylene film.

C. Minimum thickness shall be 8 mils.

D. Color: Blue.

E. Physical Properties:

1. Tensile strength 3600 psi, minimum.
2. Elongation 800%, minimum.
3. Dielectric strength 800 V/mil, minimum.
4. Impact resistance 600 g, minimum.
5. Propagation tear resistance 2550 gf, minimum.

F. Sheet material can be used to wrap irregular-shaped valves and fittings.

G. 2-inch-wide, 10-mil-thick pressure-sensitive polyethylene tape shall be used to close seams and hold overlaps.

Part 3 Execution

3.1 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 valve or hydrant interior 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.

3.2 Valve Installation

A. Ensure that valve box is centered over operating nut.

B. Do not support valves off of piping.

3.3 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 all restrained joints in hydrant branch.

D. Set hydrant on a solid concrete cinder block not smaller than 8 inches by 16 inches by 4 inches.

E. Provide poured concrete thrust blocks behind hydrant and hydrant tee.

F. Ensure hydrant drain is free-flowing and unobstructed.

G. Provide not less than 1 cubic yard of open-graded granular fill around base of hydrant for drainage.

3.4 Installation of Polyethylene Pipe Encasement Material

A. Polyethylene encasement material shall be used on all buried valves and the buried portion of all 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 all 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 in a good quality manner using polyethylene tape, or the damaged section shall be replaced.

3.5 Thrust Blocks

A. The Contractor shall provide concrete thrust blocks at hydrants and hydrant tees.

B. Carry thrust blocks to undisturbed soil, which will provide adequate bearing.

C. The bearing area of thrust blocks, in square meters, 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 back 3 inches from all bolts, nuts, glands, or other jointing materials. Ensure joints could be remade without disturbing thrust block.

E. Provide bond breaker between thrust block and pipe or hydrant. Polyethylene encasement material will be considered an acceptable bond breaker.

SECTION 02660 WATER SERVICE TRANSFERS

INDEX

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Part 1 General

1.1 Summary of Work

This Section includes transferring existing water services from existing water mains to new water mains to the extent shown in the plans.

1.2 Related Sections

A. Section 02220 – Excavating, Backfilling, and Compacting.

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. ASTM B 62 – Standard Specifications for Composition Bronze or Ounce Metal Casting.

C. ASTM B 88 – 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. In addition to those submittals identified in the General Provisions, the following items shall also 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.

B. Provide dimensional drawings, fabrication details, functional description, and properly identified catalog data on all equipment to prove complete compliance with Drawings and specifications.

1.5 Measurement and Payment

A. Payment for installation of water service transfer shall be made as a unit, including the connection to new water main with insulated corporation and corporation 90, installation of new curb stop and stop box, installation of pipe, connection to existing water service, excavation, backfill, and compaction.

B. All work related to water service transfer shall be considered incidental to the installation of the water service transfer.

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, which prevents the passage of electric current. Ford service insulator, or approved equal.

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 B 62.

2.2 Copper Pipe and Fittings

A. Copper Tubing: ASTM B 88, Type K, annealed.

B. Fittings: ASME B16.26, cast bronze.

C. Joints: flared.

2.3 Curb Stop

A. Type: "T" handle, quarter-turn, Minneapolis pattern ball valves conforming to AWWA C800, with AWWA standard inlet threads and flared copper outlet connection.

B. Provide pre-drilled valve head for attaching stationary shutoff rod.

C. 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 (Operate right to shut off).

D. Material: copper alloy containing nominally 85 percent copper, 5 percent tin, 5 percent lead, and 5 percent zinc per ASTM B62.

2.4 Curb Box

A. Body
1. Base section: Arch base pattern, with telescoping 1 inch upper section, stainless steel rod and pin, and lid.
2. Adjust to accommodate:
   a. 5 foot minimum service depth.
   b. 7 foot maximum service depth.
3. 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 1/2 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 24 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 Large Water Service Transfers (4 Inches and larger)

A. Products shall be those listed in Sections 02610 and 02640.

B. All pipe shall be ductile iron.

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 and licensed in accordance with local plumbing codes.
   2. Contractors will not be permitted to make their own 1-inch direct taps on mains installed under this Contract. Contact Des Moines Water Works 24 hours in advance to schedule taps.

B. Plumbing Permits and Inspections
   1. Obtain permits necessary for service transfers.
   2. Arrange for and schedule required plumbing inspections in accordance with local plumbing codes.

C. Scheduling
   Install services only after the new water main passes pressure test per Section 02674 and disinfection per Section 02675.

3.2 Examination

A. Install services only after new water main has passed pressure test as specified in Section 02674 and disinfection as specified in Section 02675.

B. Confirm location / alignment of new service line prior to start of excavating.

3.3 Size of Service Lines and Taps

A. Transfer water service lines according to plans and specifications as follows:
   1. Complete 1/2-inch, 3/4-inch, and 1-inch service transfers with 1-inch taps and 1-inch pipe needed to make connection.

B. Complete 4-inch and larger service transfers with valve, pipe, and fittings needed to make connection.

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 Owner 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 the Owner'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.

C. Use trenchless construction methods when installing water service lines underneath roads, driveways, shoulders, or other traffic-carrying surfaces.

D. Corporation:
   1. Install corporations no closer than 1 foot 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.

E. Pipe:
   1. Maintain 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 without Owner's authorization.

F. 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.
      b. 1 foot to 6 feet from property line in the City of Des Moines.
      c. 1 foot from property line in Polk County.
      d. Not within driveway or sidewalk.

G. Repair leaks that develop in new service lines or water mains due to water service installation operations.

H. Coordinate necessary inspections to satisfaction of jurisdictional authority for water service lines.

I. Install large service transfers in accordance with Section 02610.

3.6 Backfill and Compaction

Excavations shall be backfilled and compacted as specified in Section 02220 for trenches.

3.7 Restoration

Restore affected areas as specified elsewhere and as shown on plans.

SECTION 02674 PRESSURE TESTING WATER MAINS

INDEX

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Part 1 General

1.1 Summary of Work
All water mains shall be pressure-tested in accordance with this Section.

1.2 Related Sections
Section 02610 – Ductile Iron and Polyvinyl Chloride Pipe for Water Mains

1.3 References

A. AWWA C600 – Installation of Ductile Iron Water Mains and Their Appurtenances.

B. AWWA C605 – Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.

1.4 Quality Assurance
Perform Work in accordance with AWWA C600.

Part 2 Products

2.1 Materials
No permanent materials are required.

Part 3 Execution

3.1 Pressure Testing

A. Perform Work in accordance with AWWA C600 and AWWA C605.

B. Piping shall be tested at 150 psi for 2 hours.

C. Fill and flush new piping with potable water, ensuring that trapped air is removed.

D. Isolate new piping from the existing system.

E. Pressurize the new piping to the test pressure at the highest point in the isolated system unless the pressure exceeds the design pressure limit for any pipe, thrust restraint, valve,

or fitting of the section being tested Do not pressurize to more than 5 psi over the test pressure at the highest point in the isolated system.

F. Monitor pressure in the line being tested for a period of not less than 2 hours.

G. 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.

H. 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.

I. Allowable leakage in gallons, 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

J. 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.

K. If the average leakage per hour is less than the allowable leakage, the pressure test is acceptable.

L. 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.

M. Visible leaks are to be repaired regardless of the amount of leakage.

SECTION 02675 DISINFECTION OF WATER DISTRIBUTION SYSTEMS

INDEX

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Part 1 General

1.1 Summary of Work

Disinfect water mains and 2-inch and larger water service 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 Quality Assurance

A. Perform Work in accordance with AWWA C651.

B. Bacteriological samples will be taken and tested by DMWW to ensure satisfactory disinfection.

1.5 General

A. Contractor shall provide all equipment and materials necessary to complete chlorination.

B. Water for disinfection will be provided by DMWW 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.

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 Examination

A. 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.

B. Disinfection of piping shall take place only after satisfactory pressure testing.

C. Ensure piping to be disinfected is isolated from portion of the distribution system that is in service.

D. Review procedures and coordinate disinfection with Owner.

E. Perform Work in accordance with AWWA C651.

F. Bacteriological samples shall be taken and tested by the Owner to ensure satisfactory disinfection.

3.2 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 feet per 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 any 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 all metering and feed equipment and temporary chlorination taps. Remove the temporary chlorination taps and cap the main once the main passes.

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.

3.3 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 dechlorinated and disposed of so not to cause damage to the environment. Conform to state and federal requirements.

E. De-chlorinate all water from flushing activities and testing before it is released into the ground or storm sewers. Method to be approved by the Owner prior to any flushing activities.

3.4 Bacteriological Testing

A. Immediately following flushing of pipelines and again at least 24 hours after flushing pipelines and first sampling, samples shall be taken and tested by Owner.

B. The Owner reserves the right to take and test additional samples 48 hours after flushing.

C. Approximately one sample will be taken for each 1,200 feet of new water main.

D. Additional samples may be taken at the discretion of the Owner.

E. 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.

F. If any sample is not satisfactory with either sampling, the piping represented by that sample must be flushed and rechlorinated by the Contractor at the discretion of, and as directed by, the Owner.

SECTION 13210 CATHODIC PROTECTION FOR SMALL DIAMETER (8”-16”) WATER MAINS

INDEX

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Part 1 General

1.1 Summary of Work

Provide labor, equipment, and the materials necessary to install cathodic protection for 16-inch and smaller diameter ductile iron pipe with field-applied polyethylene encasement.

1.2 Related Sections

A. Section 01000 – General Requirements for the Project.

B. Section 02220 – Excavating, Backfilling, and Compacting for Water Mains.

C. Section 02610 – Ductile Iron Pipe for Water Mains.

1.3 References

A. American Society for Testing and Materials (ASTM) – Applicable testing methods and materials.

B. National Electrical Code (NEC), latest edition.

C. National Electrical Manufacturers Association (NEMA) – Standards and Specifications.

D. Underwriters Laboratories, Inc. (UL) – Standards for safety.

1.4 Submittals

A. Product Data
   1. Submit manufacturer's specifications, recommendations, and installation instructions for each of the following products specified in this Section:
      a. Electrical Continuity Bond Cables
      b. Corrosion Monitoring Test Stations
      c. Electrical Isolation Devices
      d. Sacrificial Anodes and Accessories
      e. Test Wires for Cathodic Protection System Monitoring
      f. Exothermic Welds and Repair Coatings

1.5 Measurement and Payment

A. Install bonding cables across all pipe joints. Costs of material, equipment, and labor shall be included in pipe, valve, or fitting installation.

B. Install corrosion monitoring test stations with test wires as shown on plans. Include costs for material, equipment, and labor in Cathodic Protection Test Station bid item.

C. Install isolation pipe couplings as shown on plans. Include costs for materials, equipment, and labor in Pipe Isolation Coupling bid item.

D. Install electric isolators in all corporation stops. Cost of isolators shall be included in water service price.

E. Install anodes at locations determined by Engineer according to spacing by pipe size shown in Cathodic Protection Detail Sheet of plans. Include costs for materials, equipment, and labor in 32 lb Magnesium Anode bid item.

Part 2 Products

2.1 Warranty on Contractor-Provided Materials

A. All Contractor-provided materials shall be guaranteed for a period of two years.

B. The two-year period shall commence at the time of the final installation of all components by the Contractor and after the system has been tested and properly adjusted for operation by the Owner's Corrosion Engineer.

2.2 Electrical Continuity Bond Cables

A. Factory prefabricated high molecular weight polyethylene insulated stranded copper continuity bond cables shall be installed across all pipe joints of mechanically-coupled pipe. Insulation shall conform to ASTM D 1248 – Specification for Plastic Molding and Extrusion Materials, Type 1, Class C, Grade 5.
   1. Pipe joint continuity bond cables shall be sized as follows:
      a. Wire Gauge: No. 4
      b. No. of Strands: 7
      c. Outer Jacket: 0.110 inch thickness

d. Length: 18 inch (min.)
e. Number of Bonds: 1 across each pipe joint

2.3 Corrosion Monitoring Test Stations

A. Monitoring stations shall be as follows:
1. Tube of the test station shall be Acrylonitrile Butadiene Styrene.
2. Test station shall be a minimum of 24 inches in height and 6 1/8 inch in diameter.
3. Shall have cast iron collar and lid.
4. Lid shall have stainless steel hold down bolt with stainless steel nut.
5. Minimum weight of 22.0 pounds.
6. Minimum load test of 35,000 LBF.
7. Test station shall be furnished with a terminal board equipped with terminal posts to permit ready access and testing and shall be constructed as follows:
a. Terminal Board: polycarbonate plastic.
b. Binding/Terminal Posts: nickel-plated marine brass (5 minimum).
c. Shunt between two posts.
d. Terminal Board shall set in the top of test station.

B. Subject to meeting the requirements of this specification, acceptable manufacturer's products which may be incorporated into the work may include the following:
1. C.P. Test Services #668 Roadway Test Station with Locking Cast Iron Lid and Collar with five terminal board and shunt.

2.4 Electrical Isolation Devices

A. Electrically isolating pipe couplings shall be constructed as follows:
1. Follower rings shall meet requirements of AISI C1012 carbon steel or ASME SA36 ductile iron.
2. Middle ring shall meet requirements of ASTM A 513, ASTM A 635, or ASME SA675 GR60.
3. Bolts and nuts shall be Stainless Steel.
4. Gaskets shall be Nitrile Grade 27 Buna-S compounded to resist aliphatic hydrocarbons within a temperature range of -20°F and 180°F.
5. Coating shall be fusion-bonded epoxy.
6. Subject to meeting the requirements of this specification, acceptable manufacturer's products which may be incorporated into the work may include the following:
a. Dresser Industries, Style 39 Pipe Isolation Coupling.
b. Smith Blair, Style 416 Insulating Coupling.

B. Electrically isolating corporation stops shall be used for all 2-inch and smaller service connection. See Section 02660.

2.5 Sacrificial Anodes and Accessories

A. Magnesium Anodes
1. Magnesium anodes shall be capable of delivering a minimum efficiency of 500 amp-hours per pound of magnesium and shall have the following metallurgical analysis and physical properties:
a. Bare Ingot Weight: 32 pounds.
b. Metallurgy:
(1) Aluminum: 0.01% (max.)
(2) Manganese: 0.50% - 1.3%
(3) Copper: 0.02% (max.)
(4) Nickel: 0.001% (max.)

(5) Iron: 0.03% (max.)
(6) Other (each): 0.05% (max.)
(7) Other (total): 0.30% (max.)
(8) Magnesium: Balance

B. Packaged Magnesium Anode Backfill
   1. Magnesium anodes shall be packaged within a cotton sack in a special chemical backfill having the following proportions:
      a. Ground Hydrated Gypsum: 75%
      b. Powdered Bentonite: 20%
      c. Anhydrous Sodium Sulfate: 5%
   2. Backfill shall have a grain size such that 100% is capable of passing a 20-mesh screen and a 100-mesh screen shall retain 50 %.
      a. Backfill shall completely surround the anode ingot without voids.
      b. Package Dimensions: 8-inch diameter by 28-inches long.
      c. Package Weight: 76 pounds (nominal).

C. Anode Lead Wire
   1. The standard lead wire for a magnesium anode shall be a minimum 10-foot length of No. 12 AWG solid copper wire with Type TW (red) thermoplastic insulation.
   2. Lead Wire Connection to Anode Core
      a. Magnesium anodes shall be cast with a minimum 20 gauge galvanized steel core.
      b. One end of the anode shall be recessed to expose the core for silver-soldering the lead wire.
      c. The silver-soldered lead wire connection and anode recess shall be filled with an electrical potting compound before packaging.

2.6 Test Wires for Cathodic Protection System Monitoring

A. Oil and gas resistant insulated/jacketed stranded copper wire shall be used for structure connections as part of the system's monitoring circuits. Insulation shall conform to ASTM Standard UL-83 for Thermoplastic Insulated Wires.
   1. Test wires shall be sized as follows:
      a. No. of Strands: 19
      b. Primary Insulation: 0.015-inch thick thermoplastic
      c. Outer Jacket: 0.004-inch thick nylon

2.7 Exothermic Welds and Repair Coatings

A. Exothermic Weld Connections:
   1. All connections used within the DC cathodic protection system circuit shall be by exothermic welds. The proper size welders, metal charges, and wire sleeves shall be used in accordance with the manufacturer's recommendations.
   2. Subject to meeting the requirements of this specification, acceptable manufacturer's products which may be incorporated into the work may include the following:
      a. Continental Industries, Model Therm-O-Weld.
      b. Erico Products, Model Cadweld.

B. Repair Coatings:
   1. An oil and gas-resistant, cold-applied, coal tar mastic compound shall be applied to exothermic weld connections.
   2. Subject to meeting the requirements of this specification, acceptable manufacturer's products which may be incorporated into the work may include the following:
      a. Tapecoat Company, Royston Roskote A51.
      b. Koppers Company, Bitumastic No. 50.

c. Berry Plastics, Polyken 937/938.

Part 3 Execution

3.1 Regulatory Requirements

Conform to applicable federal, state, and local regulations for safe installation of the system.

3.2 Description of Work

A. General: Refer to additional notes and Cathodic Protect Details included in the Plans.

B. Examination: Examine the areas and conditions under which cathodic protection materials are to be installed, and notify Engineer in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.3 Installation of Electrical Continuity Bond Cables

A. General:
1. Inspect each cable to ensure a continuous electrical conductor with no cuts or tears in the cable insulation.
2. Do not install continuity bonds across points of connection to existing structures or across electrical isolation devices.

B. Method:
1. Attach cable to water main by the exothermic welding process.
2. Perform exothermic welding of bond cables in accordance with the manufacturer's instructions.
3. Coat all exothermic welds with a cold-applied coal tar mastic as described in this Section.

C. Post-Installation Inspection:
1. Inspect electrical continuity bond cables by visually examining each exothermic weld connection for strength and suitable coating prior to backfilling.
2. If, in the opinion of the Engineer, the exothermic weld is deficient, the Contractor shall remove and replace the weld at no expense to the Owner.

D. Backfilling of Bond Cables:
1. Perform backfilling that will prevent damage to the bond cables and connections to the water main.
2. If construction activity damages a bond cable, the Contractor shall remove and replace the bond cable at no expense to the Owner.

3.4 Installation of Corrosion Monitoring Test Stations

A. Test Wires:
1. Provide test station lead wire that is continuous with no cuts or tears in the insulation covering the conductor.
2. Attach test lead to the water main by the exothermic welding process.
3. Route test wire into test station and attach wire nut or tape exposed end of copper conductor.
4. Thoroughly backfill and compact the area immediately surrounding the test station to prevent settling or tipping.

B. Backfilling of Test Station:
   1. Protect test leads during the backfilling operation to avoid damage to the wire insulation and integrity of the conductor.
   2. If, in the opinion of the Engineer, the installation of the test station wires is deficient, the Contractor shall remove and replace the test wires at no expense to the Owner.
   3. Install corrosion-monitoring test stations at the locations shown on the plans or as directed by the Engineer.

3.5 Installation of Electrical Isolation Devices

A. General: Follow manufacturer's written instructions for the specific device to be installed.

B. Acceptance:
   1. Immediately after an electrical isolation device has been installed, an electrical isolation test will be conducted by the Engineer.
   2. If, in the opinion of the Engineer, the installation of the isolation device is deficient, the Contractor shall remove and replace these components at the Contractor's expense.

3.6 Installation of Galvanic Anodes

A. General: Install the required number of anodes at the locations shown on the plans or as directed by the Engineer.

B. Method:
   1. Remove plastic or paper shipping bags from around prepackaged anodes prior to installation.
   2. Install in the manner and at the dimensions from the water main as shown on the CP Installation Details. Field modifications shall be made only with the approval of the Engineer.
   3. Handle galvanic anodes in such a manner to avoid damaging anode materials and wire connections.
   4. Attach anode lead wire directly to the pipe. Splices are not permitted within the lead wire of an anode except to repair damaged lead wires.
   5. Install prepackaged anodes with compacted backfill material, such that no voids exist between the anode material and the backfill.
   6. In very dry or coarse soils, pour 5 gallons of water over the anode after backfilling and tamping have been completed to a point about 6 inches above the anode. After the water has been absorbed by the earth, backfilling shall be completed to the ground surface level.

3.7 Installation of Wire, Cable, and Splices

Install underground wires, cables, and connections at a minimum 24 inches below final grade with a minimum separation of 6 inches from other underground structures.

3.8 Installation of Exothermic Welds and Connection Devices

A. All exothermic welding shall be performed in accordance with the manufacturer's recommendations for welding equipment, weld metal charge size, and applicability to the metallurgy of the structure.

B. Do not use exothermic weld equipment if the graphite mold is wet. Follow manufacturer's MSDS for storage and handling.
   1. Structure Surface Preparation

a. All metal shall be free of dust, dirt, grease, oil and other foreign matter by either power or hand wire brushing to expose bright shiny metal free of any coating, soil residue, or oxidation.
b. Grinding or filing shall remove sharp edges or burrs.

2. Installation of Elastomeric Cover over Exothermic Welds
   a. After cooling, remove all slag from the exothermic weld connection.
   b. Clean the pipe surface which is to be covered by removing all moisture, dirt, grease and other contaminants.
   c. Coat the welded connection to completely cover all exposed copper or damaged pipe coating.

3.9 Field Quality Control

A. Contractor's Quality Control System
   1. The Contractor shall implement a quality control system to ensure the cathodic protection system components conform to the applicable plans and specifications established by the Contract Documents.
   2. The quality control system shall ensure that standards for materials, workmanship, construction, and functional performance are adhered to throughout the course of the Work.
   3. The Contractor's superintendent shall be used to monitor the Contractor's quality control system.