SP- 127031
(New)

Iowa Department of Transportation

SPECIAL PROVISIONS
FOR
WATER MAIN

Polk County
TAP-T-8477(613)--8V-77

Effective Date
May 19, 2015

THE STANDARD SPECIFICATIONS, SERIES 2012, 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, P.E.
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 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 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.

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

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

INDEX

****

Part 1 General

1.1 Summary of Work

A. Excavating, backfilling, and compacting specifications as applicable for installation of water main and appurtenances.

1.2 Related Sections

A. Section 02610 – Ductile Iron and Polyvinyl Chloride Pipe for Water Mains.
B. Section 02640 – Valves and Hydrants.

1.3 References

A. American Society for Testing and Materials (ASTM) D2922 – Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
B. American Society for Testing and Materials (ASTM) D3017 – Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
C. American Society for Testing and Materials (ASTM) D698 – Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3).
D. Federal Register – Occupational Safety and Health Administration (OSHA), Occupational Safety and Health Standards - Excavations.

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. Steel Pipe: Bed pipe using sand free of frozen material, foreign debris, including rocks, organic materials, and man-made debris.
- B. Ductile iron pipe, prestressed concrete cylinder pipe, polyvinyl pipe, and corrugated steel pipe: Bed pipe using material taken from the excavation with the following characteristics:
  1. Inorganic clay, clayey sand, or inorganic and clayey silt.
  2. Free of lumps or clods over 2 inches in the largest dimension.
  3. Free of foreign debris including rocks, organic materials, and man-made debris.
  4. With a soil moisture range of optimum moisture to 4% above 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% 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. Off-site sources must hold a National Pollutant Discharge Elimination System (NPDES) permit from the IDNR for storm water discharge associated with construction activity.
- B. Borrow materials, including topsoil and backfill material, shall conform to specifications for excavated materials in Part 2.1.
- 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 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 0.5% clay.

2.5 Special Pipe Embedment and Encasement Material
- A. When directed by Engineer, Contractor shall install controlled low-strength material to provide support to existing utilities.
  1. Controlled Low-Strength Material (CLSM):
     a. Approximate quantities per cubic yard:
        (1) Cement: 50 pounds.
        (2) Fly ash: 250 pounds.
        (3) Fine aggregate: 2910 pounds.
        (4) Water: 60 gallons.

b. A compressive strength of at least 50 psi compressive strength at 28 calendar days.
c. Comply with material requirements of Article 2506.02 of the Standard Specifications.

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 that 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 3.1.B 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. 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. Conduct trenching operations to avoid damaging underground utilities.
2. Underground utilities that are shown on the plans, 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 Disposal of Excavated Material

A. Remove excess material excavated for the water main trench from the site and in compliance with environmental regulations.
B. Backfill consisting of suitable material, which comes from an off-site source, must conform to Part 2.1.

3.3 Trench Excavation
A. Strip and stockpile topsoil for finished grading. A minimum of 12 inches of topsoil must be segregated from other materials in agricultural areas.
B. 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.
C. 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% 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% Standard Proctor Density.
   4. Pipe shall be placed only after the trench bottom has been fully stabilized.
D. Remove stones encountered during excavation. 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.
E. Trench bottoms shall be excavated deeper at the location of 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.
F. 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, unless specified differently in traffic control plan.
   3. Backfill driveways and entrances immediately after placement of pipe.
G. 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.

3.4 Pipe Bedding
A. Bed pipe with 4 inch thick layer of specified bedding material for pipes 20 inch and larger.
B. Place bedding alongside of the pipe to an elevation above the springline (no lower than half the height of the pipe).
C. Compact bedding to a minimum of 90% Standard Proctor Density.
D. Obtain required compaction within a soil moisture range of optimum moisture to 4% above optimum moisture content.
E. Do not damage pipe coating or wrapping system during bedding placement and compaction.

3.5 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. Place backfill in layers and compact to the required density.
E. Backfill shall be:
    1. Compacted to 90% Standard Proctor Density to a level 1 foot above the pipe.
    2. For the remainder of the trench:
        a. Public rights-of-way shall be compacted to 95% Standard Proctor Density.
        b. Easement areas shall be compacted to 90% Standard Proctor Density.
    3. Within a soil moisture range of optimum moisture to 4% above optimum moisture content.
F. Protect pipe coating or pipe wrapping system from damage during backfill operations.
G. Hydraulic compaction or water jetting of the pipe trenches shall not be permitted.
H. 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.
I. 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.

3.6 Grading
A. Finish-grade surfaces 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.

3.7 Control of Water
A. Install pipe 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. Divert surface water to prevent entry into the pipe trenches.
    2. Remove surface water accumulated in the pipe trenches and other excavations prior to continuation of excavation work.
    3. Remove surface water saturated soil from the excavation.
F. Control groundwater 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.

3.8 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 Contractor.
    1. Off-site disposal locations must hold a National Pollutant Discharge Elimination System (NPDES) permit from the IDNR for storm water discharge associated with construction activity.
    2. Transportation of such material shall be provided by Contractor.

3.9 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. Remove construction remnant materials 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

INDEX

****

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 Wastewater Facilities Design Standards.

1.4 Submittals (Not used)

1.5 Measurement and Payment (Not used)

Part 2 Products

Not used.

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 with a minimum 3-foot horizontal separation.
   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 sanitary sewer crossovers:
   1. Provide a vertical separation of at least 18 inches from the bottom of the water main to the top of the sanitary sewer whenever possible where water mains cross over sanitary sewers. If 18 inches cannot be met, provide a minimum vertical separation of 6 inches and place the water main inside 20 feet of a larger diameter polyvinyl chloride water main casing pipe with no casing chocks centered on the sanitary sewer.
   2. Provide a vertical separation of at least 18 inches from the bottom of the sanitary sewer to the top of the water main in cases where water mains cross under the sanitary sewer. Place the water main inside 20 feet of a larger diameter polyvinyl chloride water main casing pipe with no casing chocks centered on the sanitary sewer.
   3. Adequately support both water and sanitary sewer pipes and provide watertight joints.

D. Vertical separation of water mains from storm sewer crossovers:
   1. Provide a vertical separation of at least 18 inches from the bottom of the water main to the top of the storm sewer whenever possible where water mains cross over storm sewers. If 18 inches cannot be met, provide a minimum vertical separation of 6 inches and construct one of the following:
      a. Verify the storm sewer has gasketed joints.
      b. The water main shall be 20 feet of ductile iron pipe material with nitrile gaskets.
      c. Encase the storm sewer.
      d. Encase the water main.
   2. Provide a minimum vertical separation of at least 18 inches from the bottom of the storm sewer to the top of the water main in cases where water mains cross under storm sewer mains and construct one of the following:
      a. Verify the storm sewer has gasketed joints.
      b. The water main shall be 20 feet of ductile iron pipe material with nitrile gaskets.
      c. Encase the storm sewer.
      d. Encase the water main.
   3. Adequately support both water and storm sewer pipes and provide watertight joints.

E. 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.

F. Advise Engineer should physical conditions exist such that exceptions to Part 3.2 of this Section are necessary.

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 restrained joint pipe for water mains entering or crossing streams.
      a. Place the top of the water main a minimum of 5 feet below the natural bottom of the streambed.
      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 streambank 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 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.

SECTION 02610 DUCTILE IRON AND POLYVINYL CHLORIDE PIPE FOR WATER MAINS

INDEX

****

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.
B. American Society for Testing and Materials (ASTM) A320 – Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service.
C. American Society for Testing and Materials (ASTM) A536 – Standard Specification for Ductile Iron Castings.
D. American Water Works Association (AWWA) C104 – Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
E. American Water Works Association (AWWA) C105 – Polyethylene Encasement for Ductile-Iron Pipe Systems.
F. American Water Works Association (AWWA) C110 – Ductile-Iron and Gray-Iron Fittings.

G. American Water Works Association (AWWA) C111 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
H. American Water Works Association (AWWA) C115 – Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
I. American Water Works Association (AWWA) C150 – Thickness Design of Ductile Iron Pipe.
J. American Water Works Association (AWWA) C151 – Ductile Iron Pipe, Centrifugally Cast.
K. American Water Works Association (AWWA) C153 – Ductile-Iron Compact Fittings.
L. American Water Works Association (AWWA) C600 – Installation of Ductile-Iron Water Mains and Their Appurtenances.
M. American Water Works Association (AWWA) C605 – Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.
N. American Water Works Association (AWWA) C900 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In., for Water Transmission and Distribution.
O. American Water Works Association (AWWA) C905 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In, for Water Transmission and Distribution.

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. Class of pipe and fittings.
4. 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
A. Water main shall be measured in linear feet, along centerline of the pipe.
B. Install regular joint pipe items by open trench. Include costs for material, equipment, and labor for Work included in this Section.
C. Install lock joint pipe items by horizontal directional drilling. Include costs for material, equipment, and labor for Work included in this Section.

Part 2 Products

2.1 Ductile Iron Pipe (12 Inches and Smaller)
A. Special Thickness Class 52 per AWWA C150.
B. Manufacture pipe in accordance with AWWA C151.
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 C-900
A. Manufacture 12 inch and smaller pipe in accordance with AWWA C900.
B. Pipe shall be Class 235 (DR 18) with ductile 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 Polyvinyl Chloride Pipe C-905
A. Manufacture 16 inch pipe in accordance with AWWA C905.
B. Pipe shall be Class 235 (DR 18) with ductile iron pipe equivalent outside diameters.
C. Pipe installed utilizing horizontal directional drilling shall be restrained joint PVC.

D. Pipe shall be blue in color.

2.4 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
   1. Mechanical in accordance with AWWA C111 and shall be restrained.
      a. T-bolts and hex-head nuts for mechanical joints in accordance with AWWA C111.
         (1) Material: low carbon alloy weathering Cor-Ten steel.
         (2) Coating: Cor-Blue fluorocarbon resin.
         (3) Color: blue.
   2. Flanged in accordance with AWWA C115, as indicated on the plans, with ANSI Class 125 full-faced flange.
      a. Gaskets: of thickness compatible with machining tolerances of flange faces. Minimum thickness: 1/8 inch.
      b. Nuts and bolts: stainless steel in accordance with ASTM A320, Type 304.
D. Pressure rating:

Size (Inches)	Pressure Rating (psi)
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.

2.5 Joints for Ductile Iron and Polyvinyl Chloride Pipe

A. Joints shall be push-on using an integral bell with an elastomeric or nitrile gasket in accordance with AWWA C111, mechanical in accordance with AWWA C111, or restrained as needed for thrust restraint.
B. Follower glands for mechanical joints shall be ductile iron.
C. Solvent cement joints are strictly prohibited.
D. T-bolts and hex-head nuts for mechanical joints in accordance with AWWA C111.
   1. Material: low carbon alloy weathering Cor-Ten steel.
   2. Coating: Cor-Blue fluorocarbon resin.
   3. Color: blue.

2.6 Restrained Joints

A. Mechanical Joint
   1. Incorporate restraint for all mechanical joints into the design of the follower gland.
   2. Retainer gland design shall impart multiple wedging actions against the pipe, increasing its resistance as pressure increases.
   3. Restrained joints to consist of a mechanical joint with retainer gland or manufacturer's proprietary-restrained joint.
   4. Dimensions shall conform to the requirements of AWWA C111 and AWWA C153.
   5. Pressure rating:
      a. Minimum of 235 psi for PVC pipe.
      b. Minimum of 350 psi for ductile iron pipe for sizes 16-inch and smaller.
      c. Minimum of 250 psi for ductile iron pipe for sizes 18-inch and larger.
   6. Color:
      a. Red for PVC pipe.
      b. Black for ductile iron pipe.
   7. Materials for construction:

a. Body, wedge segments, and break-off bolt assemblies: Grade 65-45-12 ductile iron as specified by ASTM A536.
b. Coating to be electrostatically applied and heat cured.
(1) Approved manufacturers:
(a) MEGA-BOND by Ebaa Iron, Inc.
(b) CORRSAFE by Sigma.
(c) Starbond by Star Products.
(d) Resicoat R2-ES by Tyler Union.
(e) Or approved equal.

8. Minimum factor of safety of 2.
9. Ductile iron retainer wedge segments shall be heat treated to a minimum Brinell Hardness Number of 370.
10. Twist-off nuts, the same size as hex-head nuts for T-bolts, shall be incorporated into the design to ensure proper actuating torque is applied during installation.
11. Approved manufacturers for PVC pipe:
a. Megalug by EBAA Iron Inc. Series 2000PV.
b. One-Lok by Sigma Series SLCE.
c. Stargrip by Star Products Series 4000.
d. TUFGrip by Tyler Union Series 2000.
e. Or approved equal.
12. Approved manufacturers for ductile iron pipe:
a. Megalug by EBAA Iron Inc. Series 1000.
b. One-Lok by Sigma Series SLDE.
c. Stargrip by Star Products Series 3000.
d. TUFGrip by Tyler Union Series 1000.
e. Or approved equal.

B. PVC Pipe Joints:
1. Restraint for in-line PVC pipe shall be provided through the use of groove and spline or grip ring located in the bell that provides full-circumferential restrained joint.
2. Restraint joints to have a minimum pressure rating of 150 psi.
3. Manufacturers:
a. Certa-Lok by Certainteed.
b. Diamond Lok-21 by Diamond Plastics.
c. Eagle Loc 900 by JM Eagle.
d. Or approved equal.

C. Ductile Iron Pipe Joint
1. Restraint for in-line ductile iron pipe shall consist of the manufacturer's proprietary-restrained joint.
2. Restraint joints to have a minimum pressure rating of 250 psi.

2.7 Polyethylene Pipe Encasement Material (Ductile Iron Pipe and Fittings)
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.

2.8 Tracer System

A. Tracer Wire:
   1. Open Cut:
      a. No. 14 AWG high-strength copper clad steel (HS-CCS) manufactured by Copperhead Industries, or pre-approved equal.
         (1) Insulation: 30 mil, high-density, high molecular weight polyethylene (HDPE) and rated for direct burial at 30 volts.
         (2) HW-CCS Conductor: 21% conductivity for locates purposes with a minimum 282 pounds break load.
         (3) Origin of copper clad steel manufacture is required and steel core must be manufactured in the United States.
         (4) Color: Blue.
   2. Directional Drilling/Boring:
      a. No. 12 AWG extra-high-strength copper clad steel conductor (EHS-CCS) manufactured by Copperhead Industries for directional drilling and boring applications, or pre-approved equal.
         (1) Insulation: 45 mil, high-density, high molecular weight polyethylene (HDPE) and rated for direct burial at 30 volts.
         (2) EHS-CCS Conductor: 21% conductivity for locates purposes with a minimum 1150 pounds break load.
         (3) Origin of copper clad steel manufacture is required and steel core must be manufactured in the United States.
         (4) Color: Blue.
      b. Tracer wire on pipe installations with a combination of open cut and directional drilling shall be installed to meet directional drilling requirements.

B. Anode Ground Rod:
   1. 1# by 1.315 inch D by 18.5 inch L, magnesium drive in anode manufactured by Copperhead Industries, or pre-approved equal.
   2. Cap installed on one end of anode ground rod to be HDPE.
   3. Provide a beveled pointed end on anode ground rod opposite of the cap to aid in hammering into the ground.
   4. Wire from cap for anode ground rod to tracer wire connection:
      a. No. 14 AWG copper clad steel (HS-CCS) manufactured by Copperhead Industries or approved equal.
      b. Insulation: 30 mil, high-density, high molecular weight polyethylene (HDPE) and rated for direct burial at 30 volts.

c. Length: 10 feet.
(1) HS-CCS Conductor: 21% conductivity for locates purposes with a minimum 250 pounds break load.
d. Color: Red.

C. Wire Splice Connector:
1. Tracer wire splices shall only be used to connect the anode ground rod to the tracer wire.
2. Tracer wire splices will not be allowed between anode ground rods and connection terminal.
3. Splices used for tracer wire repair must be approved by the Engineer.
a. Splice Kit: 3M Scotchcase 3832 Buried Service Wire Splice Kit with Burndy KS15 8-14 AWG Splice Bolt.
b. Or approved equal.

D. Tracer Wire Connection:
1. Rhino TriView TracerPed, or approved equal.
a. Three internal terminals with two shunts.
b. 5 foot white plastic triangular post.
c. Removable top cap with lock.
d. Three 2 7/8 inch by 14 inch custom vinyl decals No. SD-5594K.
e. Tri-grip anchor.

Part 3 Execution

3.1 Handling, Storage, and Shipping

A. Handle pipe 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. Handle pipe materials 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. 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. Duct tape tracer wire to the pipe every 5 feet in the 3 or 9 o’clock position opposite of the anode beds to prevent damage to the wire during backfill and future construction exposure.
C. Install anode ground rods adjacent to connections to existing piping and at each fire hydrant.
D. Terminate tracer wire in tracer wire connection next to each fire hydrant or other locations directed by Engineer.
E. Wire splice connectors can only be used to connect ground rods to tracer wire. Wire splice connectors are not allowed at any other locations unless approved by Engineer. Provide long enough roll of tracer wire to not need the use of wire splices connectors
F. Allow Engineer to inspect underground splices prior to backfilling.
G. Tracer wire installation is considered incidental to water main installation.

3.6 Testing and Chlorination
A. Perform hydrostatic and leakage tests in accordance with Section 02674.
B. Disinfect all water mains in accordance with Section 02675.
C. A tracer wire test will be conducted by the Des Moines Water Works prior to acceptance of the Project. Discontinuities found in the tracer system shall be corrected by the Contractor at the Contractor’s expense.

SECTION 02640 VALVES AND HYDRANTS

INDEX

****

Part 1 General

1.1 Summary of Work

A. This Section includes valves and hydrants as shown on the plans, 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.
B. American Society for Testing and Materials (ASTM) A320 – Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service.
C. American Society for Testing and Materials (ASTM) B584 – Copper Alloy Sand Castings for General Applications.
D. American Water Works Association (AWWA) C105 – Polyethylene Encasement for Ductile-Iron Pipe Systems.
E. American Water Works Association (AWWA) C111 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
F. American Water Works Association (AWWA) C115 – Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
G. American Water Works Association (AWWA) C153 – Ductile Iron Compact Fittings.
H. American Water Works Association (AWWA) C502 – Dry-Barrel Fire Hydrants.

I. American Water Works Association (AWWA) C509 – Resilient-Seated Gate Valves for Water Supply Service.
J. American Water Works Association (AWWA) C515 – Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service.
K. American Water Works Association (AWWA) C550 – Protective Interior Coatings for Valves and Hydrants.
L. 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 Section.
B. Provide dimensional drawings, fabrication details, functional description, and properly identified catalog data on all items to prove complete compliance with Plans and specifications.

1.5 Measurement and Payment
A. All material, equipment, and labor necessary to comply with this Section shall be incidental to the unit price bids on the Proposal.

Part 2 Products

2.1 Gate Valves
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 plans.
5. Valve gearing for 20 inch to 48 inch valves:
a. Provide valve with gear box.
b. Provide vertical valve unless otherwise specified on the Plans.
c. The following gear ratios shall be used for the corresponding sizes:

Valve Size	Gear Ratio
20"	3 to 1
24"	3 to 1
30"	6 to 1
36"	6 to 1
42"	8 to 1
48"	8 to 1

d. Totally enclosed type, oil-filled, and designed for buried and submerged service.
e. Materials of construction:
(1) Gear housing: ductile iron.
(2) Gears: carbon steel.
(3) Pinion shaft: 304 stainless steel.
(4) Input shaft shall be designed with a ball bearing and sealed with o-rings.
(5) Exposed hex nuts and bolts: 304 stainless steel.
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: 304 stainless steel.
6. Joints:

a. Mechanical in accordance with AWWA C111.
   (1) Gaskets: Buna-N or nitrile.
   (2) Nuts and bolts:
      (a) All T-bolts and hex-head nuts for mechanical joints in accordance with AWWA C111.
      (b) Material: low carbon alloy weathering Cor-Ten steel.
      (c) Coating: Cor-Blue fluorocarbon resin.
      (d) Color: blue.
      (e) Approved Manufacturers:
         1) Birmingham Fastener Manufacturing Fluorocarbon Coated T-Head Bolt.
         2) Or approved equal.

b. Flanged in accordance with AWWA C115, as indicated on the plans, with ANSI Class 125 full-faced flange.
   (1) Gaskets: Buna-N or nitrile, of thickness compatible with machining tolerances of flange faces. Minimum thickness: 1/8 inch.
   (2) Nuts and bolts: 304 stainless steel.

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. Horizontal valves shall consist of a cleaning system on both sides of the gate. The cleaning system shall consist of materials that will not cause corrosion.

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

F. 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.

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

H. Manufacturers' Models for 4 inch to 16 inch valves:
   1. Clow Model 2638.
   2. American Flow Control Series 2500.
   3. Mueller 2300 Series.
   4. M & H Style 4067.
   5. Approved equal.

I. Manufacturers' Models for 20 inch to 48 -inch valves:
   1. Clow Model 2638.
   2. American Flow Control Series 2500.
   3. Mueller 2300 Series.
   4. 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 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

H. Provide markings cast-in-bonnet that indicate 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. 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. Tnemec epoxy paint system
      a. Interior surfaces, other than machined surfaces, shall be coated with asphaltic coating.
      b. Exterior surfaces below grade shall be coated with two coats of asphaltic coating.
      c. 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.
      d. Exterior surfaces above grade shall have 2 to 4 mils dry thickness of clear coat applied after paint has been allowed to dry thoroughly.
      e. Color:
         (1) Asphaltic coating: Black.
         (2) Primer: White (AA83).
         (3) Paint: Bright Yellow (SC02).
         (4) Bonnet: Safety Green (SC07).
         (5) Caps: Bright Yellow (SC02).
   4. TGIC Protective Coating only with prior approval from Des Moines Water Works.
      a. Color:
         (1) Asphaltic coating: Black.
         (2) Base coat: Red Oxide Epoxy IF1947T.
         (3) Paint: Dandelion Yellow TGIC.
         (4) Bonnet: Des Moines Water Works Green TGIC.
         (5) Caps: Dandelion Yellow TGIC.
   5. 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. Any metal component in contact with water shall comply with the requirements of ASTM B584 copper alloy UNS No. C89520 or UNS No. C89833. Residual lead levels of the metal shall not exceed 0.25% by weight as cast or extruded.

M. 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. Bolts:
    1. All T-bolts and hex-head nuts for mechanical joints in accordance with AWWA C111.
        a. Material: low carbon alloy weathering Cor-Ten steel.
        b. Coating: Cor-Blue fluorocarbon resin.
        c. Color: blue.
        d. Approved Manufacturers:
            (1) Birmingham Fastener Manufacturing Fluorocarbon Coated T-Head Bolt.
            (2) Or approved equal.
    2. All bolts and hex nuts for flanged joints shall be 304 stainless steel.
D. 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.
E. Gaskets shall be elastomeric or nitrile in accordance with AWWA C111.

2.4 Retainer Glands

A. Incorporate restraint for all mechanical joints into the design of the follower gland.
B. Retainer gland design shall impart multiple wedging actions against the pipe, increasing its resistance as pressure increases.
C. Restrained joints to consist of a mechanical joint with retainer gland or manufacturer's proprietary-restrained joint.
D. Dimensions shall conform to the requirements of AWWA C111 and AWWA C153.
E. Pressure rating:
    1. Minimum of 235 psi for PVC pipe.
    2. Minimum of 350 psi for ductile iron pipe for sizes 16-inch and smaller.
    3. Minimum of 250 psi for ductile iron pipe for sizes 18-inch and larger.
F. Color:
    1. Red for PVC pipe.
    2. Black for ductile iron pipe.
G. Materials for construction:
    1. Body, wedge segments, and break-off bolt assemblies: Grade 65-45-12 ductile iron as specified by ASTM A536.
    2. Coating to be electrostatically applied and heat cured.
        a. Approved manufacturers:
            (1) MEGA-BOND by Ebaa Iron, Inc.
            (2) CORRSAFE by Sigma.
            (3) Starbond by Star Products.
            (4) Resicoat R2-ES by Tyler Union.
            (5) Or approved equal.
H. Minimum factor of safety of 2.
I. Ductile iron retainer wedge segments shall be heat treated to a minimum Brinell Hardness Number of 370.
J. Twist-off nuts, the same size as hex-head nuts for T-bolts, shall be incorporated into the design to ensure proper actuating torque is applied during installation.
K. Approved manufacturers for PVC pipe:
    1. Megalug by EBAA Iron Inc. Series 2000PV.
    2. One-Lok by Sigma Series SLCE.
    3. Stargrip by Star Products Series 4000.
    4. TUFGrip by Tyler Union Series 2000.
    5. Or approved equal.
L. Approved manufacturers for ductile iron pipe:
    1. Megalug by EBAA Iron Inc. Series 1000.
    2. One-Lok by Sigma Series SLDE.
    3. Stargrip by Star Products Series 3000.

4. TUFGrip by Tyler Union Series 1000.
5. Or approved equal.

2.5 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. Tyler No. 6850, or approved equal.
- D. Valve boxes shall be installed upon the valve with the use of a rubber Valve Box Adapter II as manufactured by Adaptor Inc., or approved equal.

2.6 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 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. 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 or flanged joints shall be tightened evenly around the pipe by alternating from one side of the pipe to the other. Follow manufacturer’s installation specifications for electrical isolation flanges to prevent damage during bolt torquing.
- 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. The use of hydrant extensions will not be allowed to set hydrant to the appropriate height unless approved by Engineer. Hydrant extensions, if approved, must be from same manufacture as the fire hydrant.
D. Use restrained joints in hydrant branch.
E. Set hydrant on a solid concrete cinder block not smaller than 8 inches by 16 inches by 4 inches.
F. Provide poured concrete thrust blocks behind hydrant and hydrant tee.
G. Ensure hydrant drain is free-flowing and unobstructed in areas where normal groundwater level is below the drain opening.
H. Provide not less than 1 cubic yard of open-graded granular fill around base of hydrant for drainage.

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 an 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. 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. 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 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.

3.7 Removal of Abandoned Fire Hydrants and Valve Boxes

A. Surface restoration items including pavement removal and replacement, seeding, or sodding, needed to remove abandoned fire hydrants or valve boxes shall be paid in accordance with appropriate bid item in contract.
B. All other items related to removal of abandoned fire hydrants and valve boxes including repairs to traffic loops and lawn irrigations systems shall be incidental to contract.
C. Abandoned fire hydrants shall be removed by disconnecting the pipe from the fire hydrant at the shoe.
D. Abandoned fire hydrants shall be returned to Des Moines Water Works at 408 Fleur Drive unless Engineer approves their disposal.
E. All excavations for fire hydrant removals shall be backfilled and restored according to Sections 02220 of these specifications.
F. Abandoned valve boxes shall have the entire top section of the valve box removed and the lower section and excavation backfilled and restored according to Sections 02220 of these specifications.

SECTION 02674 PRESSURE TESTING WATER MAINS

INDEX

****

Part 1 General

1.1 Summary of Work
A. Pressure-test water mains 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.
B. American Water Works Association (AWWA) C605 – Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.

1.4 Submittals (Not used)

1.5 Measurement and Payment
A. Work under this Section incidental to Contract.

Part 2 Products
Not used.

Part 3 Execution

3.1 Pressure Testing
A. Perform Work in accordance with AWWA C600 and AWWA C605.
B. Test piping at 150 psi or as indicated on the plans for 2 hours.
C. Fill and flush new piping with potable water, ensuring that all trapped air is removed.
D. Isolate new piping from the existing system.
E. Pressure test new piping in sections by isolating each section using the in-line gate valves. Relieve pressure on non-test side of the gate valve.
F. Pressurize the new piping to the test pressure at the lowest point in the isolated system. Do not pressurize to more than 5 psi over the test pressure at the lowest point in the isolated system.
G. Monitor pressure in the line being tested for a period of not less than 2 hours.

H. 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.
I. 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.
J. Allowable leakage in gallons, per hour of testing shall equal $(ND(P)^{½}) / 7,400$.
    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
K. 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.
L. If the average leakage per hour is less than the allowable leakage, the pressure test is acceptable.
M. If the average leakage per hour is more than the allowable leakage, the pressure test is not acceptable. Locate and make approved repairs as necessary until leakage is within the specific allowance.
N. 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.
O. 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.
P. Repair visible leaks regardless of the amount of leakage.

SECTION 02675 DISINFECTION OF WATER DISTRIBUTION SYSTEMS

INDEX

****

Part 1 General

1.1 Summary of Work
A. Disinfect water mains and 2 inch and larger water services 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.
C. Section 02660 – Water Service Transfers.

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

1.4 Submittals (Not used)

1.5 Measurement and Payment
A. Work under this Section incidental to Contract.

Part 2 Products

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

2.2 De-chlorination Chemicals
A. Vita-D-Chlor (Ascorbic Acid) by Integra Chemical Company.
B. Vita-D-Chlor, Neutral (Sodium Ascorbate) by Integra Chemical Company.
C. No-Chlor (Ascorbic Acid) by Measurement Technologies.
D. Approved equal.

Part 3 Execution

3.1 Examination

A. 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.
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 DMWW.
E. Perform Work in accordance with AWWA C651.
F. Bacteriological samples shall be taken and tested by the DMWW to ensure satisfactory disinfection.

3.2 Chlorination of Piping

A. Provide equipment and materials necessary to complete chlorination.
B. Use the continuous feed method as outlined in AWWA C651.
C. 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 fps in piping to be disinfected. When flushing velocities of 2.5 fps cannot be obtained, the pipe shall be swabbed until the pipe is free of debris. Type of swab and procedures for use shall be approved by DMWW prior to its use.
D. 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.
E. 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.
F. 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.
G. 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.
H. 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 above.

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, stream, or storm sewers. Method to be approved by the DMWW prior to any flushing activities.

3.4 Bacteriological Testing

A. Immediately following flushing of pipelines and again at least 24 hours after flushing pipelines, samples will be taken and tested by DMWW.
B. The DMWW reserves the right to take and test additional samples 48 hours after flushing.
C. Approximately one sample will be taken for each 1200 feet of new water main.
D. Additional samples may be taken at the discretion of the DMWW.

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 DMWW.