**SP-151090**
**(New)**

**SPECIAL PROVISIONS**
**FOR**
**WATER MAIN**

**Polk County**
**STBG-SWAP-CO77(229)--FG-77**

**Effective Date**
**February 16, 2020**

**THE STANDARD SPECIFICATIONS, SERIES 2015, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.**

## I. GENERAL INFORMATION

### A. Submittals

Existing hydrants will be replaced as part of Polk County's pavement widening project due to grade changes. Cathodic protection on the 24 inch ductile iron feeder main requires the splicing of wiring to allow adjustment of test station to new grade. 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 shop drawings electronically to:

Carla Schumacher
Des Moines Water Works
Email: cschumacher@dmww.com
Phone: 515-323-6227

Subject Line:
HMA PAVEMENT WIDENING/HMA RESURFACING NW 26th STREET FROM NW 66th AVENUE TO HWY 415

### B. Preparation

Notify DMWW Engineering Technician 48 hours prior to the start of any water main related construction. DMWW Engineering Technician shall be on site for work involving cathodic protection test stations and fire hydrants installation.

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

**C. Protection of Existing Facilities**

Contractor to protect water main and feeder main within the construction zone. The Polk City Booster Station has a critical electrical line that shall be protected as noted on plan sheets.

## II. BASIS OF PAYMENT

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

## SECTION 02 22 00 - EXCAVATING, BACKFILLING, AND COMPACTING OF WATER MAINS

## PART 1GENERAL

### 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 02 61 00 – Ductile Iron and Polyvinyl Chloride Pipe for Water Mains.

B. Section 02 64 00 – Valves and Hydrants.

C. Section 02 66 00 – Water Service Transfers.

### 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).

### 1.4 MEASUREMENT AND PAYMENT

A. Stabilization Materials: per ton, based on quantities shown on material delivery tickets provided to Engineer.
   1. Include cost for all material, equipment, labor, and associated work necessary to complete work associated with stabilization materials in the unit bid price for Foundation Rock on the Proposal.
   2. Estimated quantity shown on Proposal for Foundation Rock is not to be used as an indication of site conditions that will be encountered during the course of the Work.

## PART 2 PRODUCTS

### 2.1 EXCAVATED MATERIALS

A. Strip, grub, and stockpile topsoil for finished grading.

B. Backfill material to be:
   1. Approved for use by 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 chloride 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% points above optimum moisture content.
   5. Material that is not frozen.

## 2.3 STABILIZATION MATERIAL

A. When required by field conditions, use stabilization material of 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 Engineer.

## 2.4 BORROW MATERIALS

A. If sufficient quantity of suitable material is not available from excavations, obtain material 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. Conform borrow materials, including topsoil and backfill material, to specifications for excavated materials in Part 2.1.

C. Topsoil borrow material to 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, 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 Standard Specifications.

## 2.6 MANUFACTURED SAND MATERIAL

A. When directed by Engineer, install manufactured sand.
   1. Stone sand complying with the following gradation:

| Sieve | Percent Passing |
|---|---|
| 3/8 inch | 100 |
| No. 4 | 90-100 |
| No. 8 | 60-75 |
| No. 30 | 15-30 |
| No. 200 | 0-4 |

## PART 3 EXECUTION

### 3.1 GENERAL

A. General Description
1. Complete trenching, backfilling, and compacting for water main in accordance with the Standard Specifications. These specifications are intended to highlight or modify basic requirements; see Standard Specifications for more detailed information.

B. Quality Assurance
1. Give Engineer the opportunity to review excavated or borrowed soils prior to placement as backfill.
2. 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. Use Proctor curves and soil analysis information in determining proper compaction of soils placed.

C. General Safety
1. Blasting not permitted.
2. Safety and protection:
   a. Provide shoring, sheeting, and bracing, as required, to protect Work, adjacent property, private or public utilities, and workers.
   b. Strictly observe laws and ordinances regulating health and safety measures.

D. Soil Testing
1. Field tests for density and moisture content to be performed by the soils engineer, defined in Part 3.1.B above, to ensure that specified density is being obtained. Perform testing using ASTM D2922 nuclear methods or another method approved by Engineer.
2. Take density tests at finished grade, at 3 feet below finished grade, and as directed by Engineer under special conditions. Test locations to be selected by Engineer immediately prior to performing tests. Excavate, as directed by Engineer, for tests at intermediate depths. As a minimum, take density tests at approximately 200 foot intervals along the trench. The following locations require additional testing:
   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. Remove, replace, and recompact all material between the satisfactory tests in lifts to meet specifications. Compaction corrections are made at no expense to Contracting Authority.
   c. Provide density tests to recompacted areas at the same frequency as the original tests. Testing of recompacted areas performed at the Contractor’s expense.
4. Notify Engineer if petroleum-based materials are detected in soils.
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.

E. Protection of Utility Lines

1. Conduct trenching operations to avoid damaging underground utilities.
2. Protect all underground utilities. Damage resulting from trenching or backfilling to be repaired by Contractor or utility company at Contractor's expense.
3. Underground utilities discovered by Contractor are to be protected.

## 3.2 DISPOSAL OF EXCAVATED MATERIAL

A. Remove excess material excavated for water main trench from 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. Excavate trenches so as to:
   1. Follow lines and grades as indicated on plans.
   2. Provide uniform bearing on undisturbed soil and continuous support along the entire length of 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. Correct unstable trench bottoms, as determined by Engineer, as follows:
   1. Over-excavate the trench to stable soil or to a maximum of 2 feet below the bottom of the pipe.
   2. If stable soil is reached, bring trench 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, place 1 foot of the specified trench stabilization material in the trench bottom and compact. Bring trench back to grade using suitable backfill material or bedding material compacted to 90% Standard Proctor Density.
   4. Place pipe only after trench bottom has been fully stabilized.

D. Remove stones encountered during excavation. When large rocks are encountered, remove to an elevation 6 inches below the bottom of the proposed improvement. Fill voids created through removal of stones with approved backfill material and thoroughly compact to 90% Standard Proctor Density.

E. Excavate trench bottoms deeper at location of bell joints to permit body of pipe to rest uniformly supported upon trench bottom. Use bell holes no longer than is necessary for practical installation of pipe.

F. The length of trench to be opened at one time is as follows:
   1. In extended runs, open trench length is not to exceed 100 feet.
   2. In street crossings, do not open trench 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. Place excavated material:
   1. As approved by Engineer when these specifications do 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 pipe to an elevation above 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. Perform backfilling of trenches only after pipe installation, jointing, and bedding are complete, inspected, and approved.

B. Use backfill material complying with Part 2 above.

C. Mechanically tamp backfill with impact or vibrating compaction equipment.

D. Place backfill in layers and compact to required density.

E. Backfill to be:
   1. Compacted to 90% Standard Proctor Density to a level 1 foot above the pipe.
   2. For the remainder of the trench:
      a. Compact public rights-of-way to 95% Standard Proctor Density.
      b. Compact easement areas 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 pipe trenches is not 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 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 pipe or rising around pipe.

C. Do not allow water pumped or diverted from excavation site to be:
   1. Pooled anywhere on site.
   2. Removed in such a manner as to disperse silt.
   3. Placed on surfaces heavily traveled by pedestrian traffic.

D. Do not use installed pipe as a conduit for trench dewatering.

E. Control surface water as follows:
   1. Divert surface water to prevent entry into pipe trenches.
   2. Remove surface water accumulated in pipe trenches and other excavations prior to continuation of excavation work.
   3. Remove surface water saturated soil from excavation.

F. Control groundwater as follows:
   1. Where groundwater is encountered, dewater trenches and other excavations, as necessary, to permit proper execution of the Project.
   2. When large quantities of groundwater are encountered, stabilize trenches with the specified stabilization material, and bed pipe as specified.

## 3.8 DISPOSAL OF UNSUITABLE OR EXCESS MATERIAL

A. Dispose of surplus material and material not suitable for backfill 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. Contractor to provide transportation of such material.

## 3.9 CLEANUP AND RESTORATION

A. Clear the site in and around the excavation 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 site.

C. Repair damage to adjacent property suffered during installation work to a condition equal to, or better than, that condition existing prior to trenching Work.

**** END OF SECTION ****

# SECTION 02 60 00 - PROTECTION OF WATER SUPPLY

## PART 1 GENERAL

### 1.1 SUMMARY OF WORK

A. This Section describes Iowa Department of Natural Resources (IDNR) requirements for protection of water supply systems from the Standard Specifications on file with IDNR dated October 10, 2014.

### 1.2 RELATED SECTIONS

A. Section 02 61 00 – Ductile Iron and Polyvinyl Chloride Pipe for Water Mains.

B. Section 02 64 00 – Valves and Hydrants.

C. Section 02 67 40 – Pressure Testing Water Mains.

D. Section 02 67 50 – Disinfection of Water Distribution Systems.

### 1.3 REFERENCES

A. Iowa Wastewater Facilities Design Standards.

## 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 water main and pump 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. Bottom of water main is at least 18 inches above top of sewer.
      b. 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 requirements of Section 02 61 00. In no case shall 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. Force main is constructed of water main quality materials having a minimum pressure rating of 150 psi and meeting requirements of Section 02 61 00.
   b. Water main is laid at least 4 linear feet from sewer force main.

C. Vertical separation of water mains from sanitary sewer crossovers:
1. Provide a vertical separation of at least 18 inches from bottom of water main to top of 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 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 bottom of sanitary sewer to top of water main in cases where water mains cross under the sanitary sewer. Place 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 bottom of water main to top of 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 with one of the following methods:
   a. Verify storm sewer has gasketed joints.
   b. Install water main of 20 feet of ductile iron pipe material with nitrile gaskets.
   c. Encase storm sewer.
   d. Encase water main.
2. Provide a minimum vertical separation of at least 18 inches from bottom of storm sewer to top of water main in cases where water mains cross under storm sewer mains and construct with one of the following methods:
   a. Verify storm sewer has gasketed joints.
   b. Install water main of 20 feet of ductile iron pipe material with nitrile gaskets.
   c. Encase storm sewer.
   d. Encase 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 that are 15 feet in width or larger.
   a. Place top of water main a minimum of 5 feet below natural bottom of streambed.
   b. Securely anchor water main to prevent movement of pipe and provide easily

accessible shutoff valves located outside the floodway at each end of the water crossing.
   c. Backfill trench with crushed rock or gravel.
   d. Seed, sod, or otherwise protect 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.
4. DMWW will electronically pinpoint leaks in lieu of inserting a small meter to determine leakage and obtain water samples on each side of shutoff valve.

## 3.4 DEPTH OF COVER AND WIDTH OF TRENCH

A. Provide 5 feet minimum depth of cover from top of pipe to ground surface.

B. Where possible, provide an additional 6 inches 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.

**** END OF SECTION ****

## SECTION 02 61 00 - DUCTILE IRON AND POLYVINYL CHLORIDE PIPE FOR WATER MAINS

### PART 1 GENERAL

### 1.1 SUMMARY OF WORK

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

### 1.2 RELATED SECTIONS

A. Section 02 22 00 – Excavating, Backfilling, and Compacting for Water Mains.

B. Section 02 60 00 – Protection of Water Supply.

C. Section 02 64 00 – Valves and Hydrants.

D. Section 02 67 40 – Pressure Testing Water Mains.

E. Section 02 67 50 – 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 60 In.

## 1.4 SUBMITTALS

A. Submit the following items for materials provided by the Contractor:
   1. Manufacturer's certification that materials furnished are in compliance with applicable requirements of referenced standards and this Section.
   2. Shop Drawings and manufacturer's data showing details of pipe and fittings to comply with this Section.
   3. Class of pipe and fittings.
   4. Restrained joint details for Engineer's approval.
   5. List of at least ten projects similar to this Project. Include project name, scope, duration of project, and references with phone numbers.

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. Measure water main in linear feet, along centerline of pipe.

B. Maximum quantity is plan quantity, unless lengths are extended by Engineer.

C. Include costs for material, equipment, and labor necessary to comply with this Section in the appropriate unit price bid on the Proposal for:
   1. Ductile Iron Pipe, 4-inch
   2. Ductile Iron Pipe, 6-inch
   3. Ductile Iron Pipe, 8-inch
   4. Ductile Iron Pipe, 12-inch
   5. Ductile Iron Pipe, 16-inch
   6. Polyvinyl Chloride Pipe, 8-inch
   7. Polyvinyl Chloride Pipe, 12-inch
   8. Polyvinyl Chloride Pipe, 16-inch

# PART 2 PRODUCTS

## 2.1 DUCTILE IRON PIPE

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

A. Use Class 235 (DR 18) pipe with ductile iron pipe equivalent outside diameters.

B. Manufacture pipe in accordance with AWWA C900.

C. Use restrained-joint PVC pipe for pipe installed utilizing horizontal directional drilling.

D. Use blue pipe.

## 2.3 FITTINGS FOR DUCTILE IRON AND POLYVINYL CHLORIDE PIPE

A. Use compact fittings in accordance with AWWA C153, or full size in accordance with AWWA C110.

B. Use ductile iron material for construction in accordance with AWWA C110.

C. Joints
   1. Mechanical in accordance with AWWA C111 with restraint.
      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.
         (4) Approved Manufacturers:
            (a) Birmingham Fastener Manufacturing Fluorocarbon Coated T-Head Bolt.
            (b) Or approved equal.
   2. Flanged in accordance with AWWA C115, as indicated on plans, with ANSI Class 125 full-faced flange.
      a. Gaskets: SBR Rubber of thickness compatible with machining tolerance of flange faces. Minimum thickness: 1/8 inch.
      b. Nuts and bolts: stainless steel in accordance with ASTM A230, 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.

## 2.4 JOINTS FOR DUCTILE IRON AND POLYVINYL CHLORIDE PIPE

A. Use push-on joints 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. Use ductile iron follower glands for mechanical joints.

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.
   4. Approved Manufacturers:

a. Birmingham Fastener Manufacturing Fluorocarbon Coated T-Head Bolt.
b. Or approved equal.

E. Solvent cement joints are strictly prohibited.

F. Provide flanged joints for connections to flanged valves, hydrant valves, and other flanged fittings where shown on plans. Conform to AWWA C115 with ANSI Class 125 full-faced flange.
1. Gaskets: SBR Rubber of thickness compatible with machining tolerances of flange faces. Minimum thickness: 1/8 inch.
2. Nuts and bolts: Conform to ASTM A320, Type 304.

G. Joint bonds: No. 2 AWG-HMWPE stranded copper cable per Section 13 11 00.

## 2.5 RESTRAINED JOINTS

A. Mechanical Joint
1. Incorporate restraint for all mechanical joints into the design of the follower gland.
2. Use retainer gland designed to 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. Conform dimensions 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) EZ Shield by SIP Industries.
         (f) Or approved equal.
8. Minimum safety factor of 2.
9. Use ductile iron retainer wedge segments heat treated to a minimum Brinell hardness number of 370.
10. Incorporate twist-off nuts, the same size as hex-head nuts for T-bolts, 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. EZ Grip by SIP Industries Series EZP.
    f. 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. EZ Grip by SIP Industries Series EZD.
f. Or approved equal.

B. PVC Pipe Joint
1. Provide restraint for in-line PVC pipe 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 North American Specialty Products.
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.

## 2.6 POLYETHYLENE PIPE ENCASEMENT MATERIAL (DUCTILE IRON PIPE AND FITTINGS)

A. Polyethylene encasement manufactured in accordance with AWWA C105.

B. Linear low-density polyethylene film.

C. Minimum thickness of 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. Use flat-width tubing of the following sizes:

| 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 |

A. Provide markings containing the following information spaced every 2 feet apart:
1. Name of manufacturer.
2. Year of manufacture.
3. ANSI/AWWA C105-A21.5.
4. 8 mil linear low-density polyethylene (LLDPE).

5. Applicable range of nominal pipe diameter.
6. Warning – Corrosion Protection – Repair Any Damage.

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

C. Use 2 inch wide, 10 mil thick pressure-sensitive polyethylene tape to close seams and hold overlaps.

## 2.7 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 locating 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 locating 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. Install tracer wire on pipe installations with a combination of open cut and directional drilling to meet directional drilling requirements.

B. Anode Ground Rod:
   1. 1-pound magnesium drive-in anode, 1.315 inch diameter by 18.5 inch length, 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 cap to aid in hammering into 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 locating 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 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. Use blocking and hold-downs during shipment to prevent movement or shifting.

C. Pipe with damage to cement mortar lining will be rejected with field-patching not permitted.

D. Do not telescope small pipe inside larger pipe for shipment and storage.

E. Handle pipe materials by use of nylon straps, wide canvas or padded slings, wide-padded forks and skids, or other approved means designed to prevent damage to the polyethylene encasement. Unpadded chains, sharp edges or buckets, wire ropes, narrow forks, hooks, and metal bars are unacceptable.

F. Dropping or rolling of pipe material is not permitted.

G. Do not store PVC pipe in direct sunlight for prolonged periods of time.

H. Protect pipe 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 02 22 00.

D. Install ductile iron pipe in accordance with AWWA C600.

E. Install PVC pipe in accordance with AWWA C605.

F. Prepare trench bottom with sufficient exactness before pipe is installed so that only minor movement of the pipe will be necessary after installation.

G. Clean pipe interior prior to placement in trench.

H. Install pipe to line and grade shown on plans with an allowable tolerance of 6 inches, plus or minus.

I. Maintain uniform bearing along full length of pipe barrel at all times. Blocking the pipe up will not be acceptable. Excavate trench bottoms deeper at location of bell joints to permit body of pipe to rest uniformly supported upon trench bottom. Use bell holes 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. Furnish vegetable-soap lubricant meeting manufacturer's recommendations. Use lubricant approved for use with potable water.

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

M. Deflect joints within manufacturer's specifications for maximum deflections.

N. Tighten bolts on mechanical joints evenly around pipe by alternating from one side of the pipe to the other.

O. Cut pipe in a neat manner, without damage to pipe or cement mortar lining, if any. Leave a smooth end at right angles to axis of pipe. Bevel cut pipe ends for push-on-type joints in accordance with manufacturer's recommendations.

P. Do no install pipe in water, nor allow water to rise in trench above bottom of pipe.

Q. Place watertight bulkheads on exposed ends of pipe at all times when pipe installation is not actually in progress.

R. Backfill and compact around pipe as outlined in Section 02 22 00.

## 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. Use polyethylene encasement to prevent contact between the pipe and bedding material. The polyethylene encasement is not intended to be a completely airtight and watertight enclosure.

G. Repair damaged polyethylene encasement material using polyethylene tape or replace damaged section(s).

H. Pick and move polyethylene-encased pipe with nylon slings; wire rope is not permitted.

## 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, to be as shown on the plans. Minimum thickness for any thrust block to 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 pipe every 5 feet in the 5 or 7 o'clock position to prevent damage to 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 splice 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 02 67 40.

B. Disinfect all water mains in accordance with Section 02 67 50.

C. A tracer wire test will be conducted by Engineer or Contracting Authority prior to any pavement or surface restoration. The tracer wire system including terminations at all TriViews, anode ground rods, and splice kits are to be completely installed prior to tracer wire test. Any deficiency found in tracer wire system to be corrected by Contractor at Contractor's expense.

**** END OF SECTION ****

# SECTION 02 64 00 - VALVES AND HYDRANTS

## 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 02 22 00 – Excavating, Backfilling, and Compacting for Water Mains.

B. Section 02 60 00 – Protection of Water Supply.

C. Section 02 61 00 – Ductile Iron and Polyvinyl Chloride Pipe for Water Mains.

D. Section 02 67 40 – Pressure Testing Water Mains.

E. Section 02 67 50 – Disinfection of Water Distribution System.

### 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 are in compliance with applicable requirements of 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 Contract Documents.

## 1.5 MEASUREMENT AND PAYMENT

A. Valves.
   1. Measure valves by number of each individual valve installed.
   2. Maximum quantity is plan quantity, unless quantity is increased by DMWW Engineer.
   3. Payment for valves includes the material, equipment and labor necessary to install the valve, valve joints, retainer glands, valve boxes, valve box adapter and polyethylene encasement material in compliance with this specification for the size of pipe specified on the plans.

B. Hydrants
   1. Measure hydrants by number of hydrants installed.
   2. Maximum quantity is plan quantity, unless quantity is increased by DMWW Engineer.
   3. Payment for hydrants includes the material, equipment and labor necessary to install the fire hydrant on the water main, including new fire hydrant, tee, 6 inch ductile iron pipe, fittings, valve box, valve box adapter, tracer wire system and post, including excavation, polyethylene encasement, thrust restraint, backfill and compaction.

# 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. Provide valves with non-rising stem.
   4. Provide 2 inch by 2 inch wrench operating nut that opens valves when turned in counterclockwise direction (open to the left), unless noted otherwise on 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 Plans.
      c. Use the following gear ratios for the corresponding sizes:

| Valve Size (inches) | 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) Design input shaft 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 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 are required to have a cleaning system on both sides of the gate consisting of materials that are non-corrosive.

E. Interior and exterior valve coating minimum of 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 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. EJ Flowmaster.
6. 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. EJ Flowmaster.
5. Approved equal.

## 2.2 SWING CHECK VALVE (When Needed)

A. Provide swing check valves manufactured in accordance with AWWA C508.
   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.

B. Materials of Construction:
   1. Body and cover: ductile iron per ASTM A536.
   2. Disc: molded Buna-N (NBR) per ASTM D2000-BG.
   3. Disc accelerator: Type 302 stainless steel.
   4. Exposed hex bolts and nuts: stainless steel.
   5. Joints:
      a. 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: Conform to ASTM A320, Type 304.

C. Provide full-size top access port to allow removal of the disc without removing the valve from the line.

D. Provide one-piece disc with alloy steel and nylon reinforcement.

E. Provide one-piece disc accelerator, enclosed within the valve, field adjustable, and replaceable without removing the valve from the line.

F. Interior and exterior valve coating shall be ANSI/NSF approved fusion-bonded epoxy.

G. Manufacturers:
   1. Val-Matic Series #7200 Surgebuster Swing Check Valve.
   2. Approved equal.

## 2.3 HYDRANTS (DES MOINES)

A. Hydrants manufactured in accordance with AWWA C502.

B. Use dry-barrel, breakaway type hydrants designed to break near ground line on impact. The breaking ring consists of a full circumference one piece or split contact retaining ring.

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 having 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 to 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 (Alternative 1)
a. Coat interior surfaces, other than machined surfaces, with asphaltic coating.
b. Coat exterior surfaces below grade with two coats of asphaltic coating.
c. Prime exterior surfaces above grade using an aromatic urethane, zinc-rich system with 2.5 to
3.5 mils dry film thickness. Tnemec Series 90-97.
d. Paint exterior surfaces above grade using an aliphatic acrylic polyurethane system at 2.5 to
3.5 mils dry film thickness. Tnemec Series 73.
e. Apply a 2 to 3 mils dry film thickness of high gloss clear coat to exterior surfaces above grade after paint has been allowed to dry thoroughly. Tnemec Series 1079.
f. Color:
(1) Asphaltic coating: Black.
(2) Primer: Reddish-gray.
(3) Body: Bright Yellow (03SF).
(4) Bonnet: Safety Green (09SF).
(5) Caps: Bright Yellow (03SF).
4. Tnemec epoxy paint system (Alternative 2)
a. Coat interior surfaces, other than machined surfaces, with asphaltic coating.
b. Coat exterior surfaces below grade with two coats of asphaltic coating.
c. Prime exterior surfaces above grade using a polyamide epoxy system, Tnemec Series 20, FC20 or 66, and paint using an aliphatic acrylic polyurethane system, Tnemec Series 75, or approved equal. Provide total dry mil thickness of 5 to 7 mils.
d. Apply a 2 to 4 mils dry thickness of clear coat to exterior surfaces above grade 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).
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. Metal components in contact with water to comply with requirements of ASTM B584 copper alloy UNS No. C89520 or UNS No. C89833. Residual lead levels of the metal not to exceed 0.25% by weight as cast or extruded.

M. Manufacturers:
   1. Clow Medallion.
   2. Mueller Centurion.
   3. Approved equal.

## 2.4 JOINTS FOR VALVES AND HYDRANTS

A. Use mechanical joints in accordance with AWWA C111 or restrained as indicated on plans.

B. Use ductile iron follower glands for mechanical joints.

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 of 304 stainless steel.

D. Use flange joints having 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. Use elastomeric or nitrile gaskets in accordance with AWWA C111.

## 2.5 RETAINER GLANDS

A. Incorporate restraint for all mechanical joints into design of follower gland.

B. Use a retainer gland design imparting 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 conforming 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) EZ Shield by SIP Industries.
         (6) Or approved equal.

H. Minimum factor of safety of 2.

I. Use ductile iron retainer wedge segments heat-treated to a minimum Brinell hardness number of 370.

J. Incorporate twist-off nuts, the same size as hex-head nuts for T-bolts, 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. EZ Grip by SIP Industries Series EZP.
   6. 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. EZ Grip by SIP Industries Series EZD.
   6. Or approved equal.

## 2.6 VALVE BOXES

A. Provide cast iron screw-type adjustable heavy-duty valve box with cast iron stay-put cover marked "WATER" for each buried valve.

B. Minimum inside diameter of valve boxes of 5 1/8 inches.

C. Weight of valve box assembled, top and bottom sections, without valve box lid as follows:

| Extension Height (inches) | Weight (pounds) |
|---|---|
| 27-37 | 71 |
| 33-43 | 78 |
| 39-50 | 85 |
| 36-52 | 93 |
| 39-60 | 100 |

D. Tyler No. 6850 29-U Domestic, or approved equal.

E. For an approved equal, provide proof that all parts of proposed valve box can be interchangeable with Tyler No. 6850 29-U Domestic.

F. Install valve boxes upon valve with use of a rubber Valve Box Adapter II as manufactured by Adaptor Inc or approved equal.

### 2.7 POLYETHYLENE ENCASEMENT MATERIAL

A. Polyethylene encasement manufactured in accordance with AWWA C105.

B. Linear low-density polyethylene film.

C. Minimum thickness of 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. Use 2 inch wide, 10 mil thick pressure-sensitive polyethylene tape 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 02 22 00.

D. Install valves and hydrants in accordance with AWWA C600.

E. Clean interior of valve or hydrant prior to placement in trench.

F. Install valves and hydrants to line and grade as shown on 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. Provide vegetable-soap lubricant meeting manufacturer's recommendations. Use lubricant approved for use with potable water.

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

K. Evenly tighten bolts on mechanical joints or flanged joints around pipe by alternating from one side of 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 02 22 00.

## 3.3 VALVE INSTALLATION

A. Do not support valves off of piping.

B. Ensure valve box is centered over operating nut.

C. Install Rubber Valve Box Adapter II as manufactured by Adapter Inc., or approved equal, inside of valve box centered on valve.

## 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 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 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. Use polyethylene encasement material on buried valves and 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 preventing contact with bedding material is not intended to be an airtight and watertight enclosure.

E. Repair damaged polyethylene encasement material using polyethylene tape or replace damaged section.

## 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, as shown on the plans. Minimum thickness for thrust block of 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 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 incidental to Contract.

C. Remove abandoned fire hydrants by disconnecting pipe from fire hydrant at the shoe.

D. Return abandoned fire hydrants to Des Moines Water Works at 408 Fleur Drive, unless Engineer approves their disposal.

E. Backfill and restore all excavations for fire hydrant removals according to Section 02 22 00 of these Specifications.

F. Remove abandoned valve box and entire top section, backfill the lower section and excavation, and restore according to Section 02 22 00 of these Specifications.

**** END OF SECTION ****

# SECTION 02 66 00 - WATER SERVICE TRANSFERS

## PART 1 GENERAL

### 1.1 SUMMARY OF WORK

A. 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 02 22 00 – Excavating, Backfilling, and Compacting for Water Mains.

B. Section 02 60 00 – Protection of Water Supply.

C. Section 02 61 00 – Ductile Iron and Polyvinyl Chloride Pipe for Water Mains.

D. Section 02 64 00 – Valves and Hydrants.

E. Section 02 67 40 – Pressure Testing Water Mains.

F. Section 02 67 50 – Disinfection of Water Distribution Systems.

### 1.3 REFERENCES

A. American Society for Testing and Materials (ASTM) B62 – Composition Bronze or Ounce Metal Castings.

B. American Society for Testing and Materials (ASTM) B88 – Seamless Copper Water Tube.

C. American Society for Testing and Materials (ASTM) B584 – Copper Alloy Sand Castings for General Applications.

D. American Water Works Association (AWWA) C800 – Underground Service Line Valves and Fittings.

E. Federal Register – Occupational Safety and Health Administration (OSHA), Occupational Safety and Health Standards – Excavations.

### 1.4 SUBMITTALS

A. Submit the following items for materials provided by the Contractor:
   1. Manufacturer’s certification that materials furnished are in compliance with the applicable requirements of the referenced standards and this Section.
   2. Shop drawings and manufacturer’s data showing details of pipe and fittings to comply with this Section.

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

### 1.5 MEASUREMENT AND PAYMENT

A. Payment for installation of 1 inch to 2 inch water service transfer is 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. Payment for installation of 3 inch and larger water service transfer is made as a unit, including the tee, valve, DI pipe, valve box, valve box adapter, needed fittings, poly wrap, bonded joints, and thrust restraint.

C. All work related to water service transfer is included in the unit price for the bid item.

## 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: flared copper connection.

D. Provide corporations to be used on iron pipe with a dielectric insulator that prevents the passage of electric current.

E. Metal components in contact with water to comply with the requirements of ASTM B584 copper alloy UNS No. C89520 or UNS No. C89833. Residual lead levels of the metal not to exceed 0.25% by weight as cast or extruded.

F. Metal components not in contact with water to comply with the requirements of ASTM B62 copper alloy UNS No. C38600 or the material as described in Part 2.1.E.

G. Meet Des Moines Water Works Rules and Regulations for Water Services.

H. Approved Manufacturers for Corporation Valves on Non-iron Pipe:
   1. A.Y. McDonald Mfg. Co., Model No. 74701B.
   2. The Ford Meter Box Company, Inc., Catalog No. FB600-NL.
   3. Mueller Co., Model No. 300 Catalog No. B-25000N.

I. Approved Manufacturers for Corporation Valves on Iron Pipe:
   1. A.Y. McDonald Mfg. Co., Model No. 74701BDB.
   2. The Ford Meter Box Company, Inc., Catalog No. SI-FB600-NL.
   3. Mueller Co., Model No. 300 Catalog No. N-35000N.

### 2.2 COPPER PIPE

A. Copper Tubing: ASTM B88, Type K, annealed.

B. Joints: flared.

C. Meet Des Moines Water Works Rules and Regulations for Water Services.

### 2.3 FITTINGS (2 INCH AND SMALLER)

A. Joints: flared.

B. Metal components in contact with water to comply with the requirements of ASTM B584 copper alloy UNS No. C89520 or UNS No. C89833. Residual lead levels of the metal not to exceed 0.25% by weight as cast or extruded.

C. Metal components not in contact with water to comply with the requirements of ASTM B62 copper alloy UNS No. C38600 or the material as described in Part 2.3.B.

D. Meet Des Moines Water Works Rules and Regulations for Water Services.

## 2.4 CURB STOP

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

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

C. Provide valve head checks that limit rotation to 90 degrees. Valve head to be parallel to valve body when open; valve head to be perpendicular to valve body when closed (Operate right to shutoff).

D. Metal components in contact with water to comply with the requirements of ASTM B584 copper alloy UNS No. C89520 or UNS No. C89833. Residual lead levels of the metal not to exceed 0.25% by weight as cast or extruded.

E. Metal components not in contact with water to comply with the requirements of ASTM B62 copper alloy UNS No. C38600 or the material as described in Part 2.4.D.

F. Meet Des Moines Water Works Rules and Regulations for Water Services.

G. Approved Manufacturers:
   1. A.Y. McDonald Mfg. Co., Model No. 76100.
   2. A.Y. McDonald Mfg. Co., Model No. 76104.
   3. The Ford Meter Box Company, Inc., Catalog No. B22-444M-NL or B22-777M-NL.
   4. The Ford Meter Box Company, Inc., Catalog No. B22-444-NL or B22-777-NL.
   5. Mueller Co., Model No. 300 Catalog No. B-25204N.
   6. Mueller Co., Model No. 300 Catalog No. B-25154N.

## 2.5 CURB BOX

A. Body:
   1. Upper section: 1 inch inside-diameter steel pipe.
   2. Base section: arch base pattern, with telescoping 1 inch upper section, stainless steel rod and pin, and lid.
   3. Adjust to accommodate:
      a. 5 foot minimum service depth.
      b. 7 foot maximum service depth.
   4. Provide a positive means of preventing rotation of upper section during removal of lid.

B. Lid:
   1. Material: cast iron.
   2. Style: two-hole Erie pattern, to fit spanner wrench.
   3. Provide 1 inch NPT female-threaded brass bushing to screw onto curb box with 1 inch diameter upper section. Bushing shall be secure and rotate integrally with lid.
   4. Acceptable lids:
      a. A.Y. McDonald Mfg. Co., Model No. 5601L.
      b. The Ford Meter Box Company, Inc., Type HS.
      c. Mueller Co., Model Part No. 89982.
      d. Or approved equal.

C. Stationary Shutoff Rod

1. Material: 304 stainless steel, single-piece construction.
2. Diameter: approximately 1/2 inch.
3. Rod:
   a. Self-centered in curb box.
   b. Extending above curb box joint. Distance between top of rod and top of box to 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.

D. Meet Des Moines Water Works Rules and Regulations for Water Services.

E. Approved Manufacturers:
1. A.Y. McDonald Mfg. Co., Model No. 5601.
2. The Ford Meter Box Company, Inc., Catalog No. EA1- #1 -40- #2 R, with #1 being extended length of stop box housing and #2 being rod length.
3. Or approved equal.

## 2.6 LARGE WATER SERVICE TRANSFERS (3 INCH AND LARGER)

A. Use products listed in Sections 02 61 00 and 02 64 00.

B. Use ductile iron for all pipe.

# PART 3 EXECUTION

## 3.1 GENERAL

A. Qualifications:
1. Plumbing work covered by this Section to 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:
1. Install services only after the new water main passes pressure test per Section 02 67 40 and disinfection per Section 02 67 50.
2. The Contractor is to notify residential customers 24 hours in advance when their water service will be interrupted for service transfer.
3. The Contractor is to notify commercial and industrial customers a minimum of 24 hours in advance when water service will be interrupted for service transfer and to coordinate the interruption completely with the customer. Commercial and industrial service transfers may need to be completed outside normal working hours to minimize impact on the affected customers. No additional compensation will be paid for work outside normal working hours.

## 3.2 EXAMINATION

A. Confirm location, elevation, and orientation of existing utilities and modify elevation of new water services to omit conflicts with utilities while maintaining 5 foot minimum cover.

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

## 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.
   2. Complete 1 1/2 inch and 2 inch service transfers with 2 inch taps and pipe same size as existing.

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 02 22 00.

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 Contracting Authority 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 Contracting Authority's normal workdays.

B. Shore excavations for taps to be made by Contracting Authority according to OSHA Trench Shoring Standards.

C. Provide 12 inch clear area behind and below main and 48 inch clear area in front of main to be tapped.

D. Install service lines in accordance with local plumbing codes.

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

F. Corporation:
   1. Install corporations no closer than 18 inches from a pipe joint, another corporation, or side of excavation.
   2. One inch corporations will be installed at a 45 degree angle above horizontal; 2 inch corporations will be installed horizontal.
   3. Corporation to face the property to be served.
   4. Corporation taps will not be allowed on dry mains.

G. Pipe:
   1. Maintain minimum separation between water piping and sewer piping in accordance with IDNR requirements as described in Section 02 60 00.
   2. Maintain 5-foot-minimum cover below final grade. Do not exceed 7 foot cover without Contracting Authority's authorization.

3. Install 4 inch SDR 26 PVC encasement for all 1 inch water services installed under storm sewers as indicated on Plans.

H. 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 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.

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

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

K. Install large service transfers in accordance with Section 02 61 00.

## 3.6 RETIREMENT OF EXISTING SERVICE LINES

A. Effectively cap existing service stub after service is transferred to new main.

B. Repair of leaks that develop in existing service lines or mains due to service transfer operations are the responsibility of the Contractor and costs are incidental to service line transfer.

## 3.7 BACKFILL, COMPACTION, AND RESTORATION

A. Backfill and compact excavations as specified in Section 02 22 00 for trenches.

B. Restore affected areas as specified elsewhere and as shown on Plans.

**** END OF SECTION ****

## SECTION 02 67 40 - PRESSURE TESTING WATER MAINS

### PART 1 GENERAL

### 1.1 SUMMARY OF WORK

A. Pressure test water mains in accordance with this Section.

### 1.2 RELATED SECTIONS

A. Section 02 61 00 – Ductile Iron and Polyvinyl Chloride Pipe for Water Mains.

B. Section 02 64 00 – Valves and Hydrants

### 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. Include cost for all material, equipment, labor, and associated work necessary to complete pressure testing in the unit bid price for Water Main of specified size and material.

### 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 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 in-line gate valves. Relieve pressure on non-test side of gate valve.

F. Pressurize new piping to test pressure at lowest point in the isolated system. Do not pressurize to more than 5 psi over test pressure at lowest point in the isolated system.

G. Monitor pressure in 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 test pressure, re-pressurize by pumping water into the line in sufficient quantity to bring pressure back to between test pressure and 5 psi above test pressure. Accurately measure the quantity 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 test pressure, re-pressurize to test pressure. Accurately measure the quantity of water required to re-pressurize the main.

J. Allowable leakage, in gallons, per hour of testing shall equal

$(LD(P)^{1/2}) / 148{,}000.$

L = length of pipe section being tested in feet
D = nominal diameter of pipe in inches
P = average test pressure in psig

K. Leakage equals total quantity of water required to keep line pressurized during the 2 hour test period and re-pressurize line at the end of the test period.

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

M. If average leakage per hour is more than allowable leakage, the pressure test is not acceptable. Locate and make approved repairs as necessary until leakage is within specific allowance.

N. If pressure in the isolated line never drops to test pressure, having started no more than 5 psi above test pressure, the pressure test is acceptable.

O. Repair visible leaks regardless of the quantity of leakage.

**** END OF SECTION ****

# SECTION 02 67 50 - DISINFECTION OF WATER DISTRIBUTION SYTEMS

## 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 02 22 00 – Excavating, Backfilling, and Compacting for Water Mains.

B. Section 02 61 00 – Ductile Iron and Polyvinyl Chloride Pipe for Water Mains.

C. Section 02 64 00 – Valves and Hydrants

D. Section 02 66 00 – 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 MEASUREMENT AND PAYMENT

A. Include cost for all material, equipment, labor, and work associated with disinfection requirements in the unit price for Disinfection of Water Services.

## 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 Contracting Authority 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. Perform disinfection of piping and appurtenances only after satisfactory pressure testing.

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

D. Review procedures and coordinate disinfection with Contracting Authority.

E. Perform Work in accordance with AWWA C651.

F. Bacteriological samples are to be taken and tested by Contracting Authority to ensure satisfactory disinfection.

**3.2 CHLORINATION OF PIPING**

A. Provide equipment and materials necessary to complete chlorination.

B. Use 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 3.0 fps in piping to be disinfected. When flushing velocities of 3.0 fps cannot be obtained, swab pipe until pipe is free of debris. Type of swab and procedures for use shall be approved by Contracting Authority prior to its use.

D. Induce flow of potable water through new piping at required flushing velocity. Make provisions for diverting and disposing of flushing water that does not damage surroundings. Repair damage caused by flushing activities.

E. At a point within five pipe diameters of connection to 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 temporary chlorination taps and cap the main once the main passes.

F. Introduce highly chlorinated water continuously until entire section of new piping contains a minimum of 25 mg/L free chlorine. Do not exceed 100 mg/L free chlorine.

G. Isolate 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 existing potable water system.

H. After the contact period, water in new piping must have a residual-free chlorine content of not less than 10 mg/L. If residual is less than 10 mg/L, rechlorinate as outlined above.

**3.3 FLUSHING CHLORINATED PIPING**

A. After the contact period, flush recently chlorinated piping with potable water.

B. Continue flushing until chlorine residual in new piping is equal to chlorine residual in existing distribution system.

C. Isolate new piping from existing distribution system for a period of not less than 24 hours.

D. Chlorinated water, flushed from new piping, to 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 Contracting Authority 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 Contracting Authority.

B. The Contracting Authority 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 Contracting Authority.

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 Contracting Authority.

**** END OF SECTION ****

# SECTION 03 11 00 - CATHODIC PROTECTION FOR FEEDER MAINS

## PART 1 GENERAL

### 1.1 SUMMARY OF WORK

A. This Section includes all materials, equipment, and labor necessary to raise existing cathodic protection test stations to proposed grade for Polk County's HMA Pavement Widening project. Submittal requirements are limited to materials required to splice existing wire to raise the existing test station. It is assumed that the existing test station will be reset at the proposed elevation shown on plans without the need to replace the test station.

### 1.2 RELATED SECTIONS

A. Section 02 22 00 – Excavating, Backfilling, and Compacting for Water Mains.

B. Section 02 61 00 – Ductile Iron Pipe for Water Mains.

C. Section 02 64 00 – Valves and Hydrants.

### 1.3 REFERENCES

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

B. NACE International Standard Practice SP0169 (latest edition) – Control of External Corrosion on Underground or Submerged Metallic Piping Systems.

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

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

E. 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 product categories and all applicable product subheadings specified in this Section:
      a. Electrical Continuity Provisions – Ferrous Pipe
      b. Corrosion Monitoring Test Stations, Buried Reference Electrodes and Calibrated Wire Shunts
      c. Electrical Isolation Devices
      d. Galvanic Anodes
      e. Wire, Cable, and Splices
      f. Exothermic Welds and Connection Devices
   2. Manufacturer's product submittals shall be incorporated into a single document to demonstrate that the items have been properly coordinated by the Contractor as a unit.
      a. A notation shall be made on each shop drawing submitted as to the item's specific use by the appropriate Article-Paragraph referenced in this Specification.
      b. Multiple or incomplete submittals furnished by the Contractor may be rejected.

### 1.5 DELIVERY, STORAGE, AND HANDLING

A. Manufacturers shall provide adequate care to protect cathodic protection materials from

damage during handling, storage, hauling, and installation.

### 1.6 MEASUREMENT AND PAYMENT

A. Include lump sum cost to furnish all materials, equipment and labor necessary to raise the cathodic test stations to proposed elevations shown on plans and per DMWW standard details and the cathodic protection system described in this Section in the unit price bid for Raise the Cathodic Test Station on the Proposal.

## PART 2 PRODUCTS

### 2.1 APPROVED MATERIAL SUPPLIERS

A. The following list of suppliers is provided for the Contractor's convenience in procuring the material required by these specifications. It shall remain the Contractor's responsibility to ensure that the materials furnished meet the physical descriptions and performance characteristics listed herein.

B. Subject to meeting the requirements of this specification, CP materials are available from the following manufacturers-suppliers:
   1. Mesa Products, Inc., (918-627-3188).
   2. Brance-Krachy, Inc., 4411 Navigation Blvd., Houston, TX 77011 (713-225-0349).
   3. Champion Corrosion Products, (830-303-8505).

### 2.2 WARRANTY ON CONTRACTOR-PROVIDED MATERIALS

A. All Contractor-provided materials shall be guaranteed for a period of 2 years.

B. The warranty 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.

### 2.3 ELECTRICAL CONTINUITY PROVISIONS – FERROUS PIPE

A. Insulated Stranded Copper Cable
   1. The quantity and gauge of continuity bond cables required for each pipe joint shall be as shown on the CP Installation Details included hereinafter in this Section.
      a. The Contractor, at his option, may install the largest gauge of continuity bond cable for all pipe sizes provided that the weld shots do not damage the pipe wall or its interior lining.
   2. Bond cables shall be factory-made with formed copper sleeves installed at both ends of the bond cable using the manufacturer's proper-sized hammer dies.
   3. Cable shall be constructed of stranded copper equipped with a high molecular weight polyethylene insulation. Insulation shall conform to ASTM D1248 – Specification for Plastic Molding and Extrusion Materials, Type 1, Class C, Grade 5 and be configured as follows:
      a. No. of Strands: 7
      b. Outer Jacket Thickness: 0.110 inches
      c. Length: 18 inches (minimum)
   4. Subject to meeting the requirements of this specification, acceptable manufacturer's products which may be incorporated into the work include the following or an approved equal:
      a. Continental Industries (918-627-5210), Model Therm-O-Weld Jumper Bonds.

### 2.4 CORROSION MONITORING TEST STATIONS

A. Non-Metallic Post-Type Test Stations
   1. Monitoring stations shall be a non-metallic post-type station mounted on a non-metallic conduit post. Test station shall be furnished with a capped terminal board equipped with wire/cable binding posts to permit ready access and shall be constructed as follows:
      a. Terminal Board: Polycarbonate plastic (clear).
      b. Test Station Cap: Polycarbonate plastic (color coded by test station type).
      c. Conduit Post: UV stabilized polyethylene (white).
      d. Shorting Bar: Nickel-plated copper 1.25 inch by 0.5 inch by 1/16 inch thickness.
      e. Binding Posts: Nickel-plated marine brass (six minimum).
   2. Subject to meeting the requirements of this specification, acceptable manufacturer's products which may be incorporated into the work include the following or an approved equal:
      a. Tinker & Rasor Company (909-890-0700), Model T-3.

B. Prepackaged Cu-CuSO4 Reference Electrodes
   1. Description: Cu-CuSO4 electrodes shall be used for soil environments to provide a stable electrical benchmark from which to measure the cathodic protection system's effectiveness. Electrodes shall be constructed as follows:
      a. Element: Copper rod encapsulated in a proprietary backfill electrolyte containing high purity copper sulfate crystals and a chloride ion trap to prevent contamination of the electrolyte.
      b. Service life of the reference electrode shall be no less than 20 years.
      c. Lead Wire: No. 14 RHH-RHW (yellow) stranded copper wire. Lead wire shall be sufficiently long to reach its termination point without splicing.
   2. Subject to meeting the requirements of this specification, acceptable manufacturer's products which may be incorporated into the work include the following or an approved equal:
      a. Borin Manufacturing, Inc. (310-822-1000) Model SRE-007-CUY.
      b. GMC Electrical, Inc. (909-947-6016) Model CU-1-UGPC.

C. Calibrated Wire Shunts
   1. Description: Color-coded calibrated wire shunts shall be used to connect the cathodic protection system's anode header cable and structure return connection circuits.
   2. Subject to meeting the requirements of this specification, acceptable manufacturer's products which may be incorporated into the work include the following or an approved equal:
      a. Tinker & Rasor Company (909-890-0700), 0.01-ohm wire shunt with yellow mounting plate rated at 8 amps.

## 2.5 ELECTRICAL ISOLATION DEVICES

A. Flange Isolation Kit (FIK) Assemblies
   1. FIK assemblies shall be certified by an independent certification agency to meet the requirements of the NSF-61 Standard and shall consist of the following components:
      a. Flange Gasket Retainer: Full-faced (Type E) G-10 Epoxy Glass.
      b. Sealing Elements: Ethylene propylene diene monomer (EPDM) quad O-Rings.
      c. Isolation Sleeves: 1/32 inch thick G-10 Epoxy Glass.
      d. Isolation Washers: Double 1/8 inch thick G-10 Epoxy Glass.
      e. Backup Washers: Double 1/8 inch thick Type 304 Stainless Steel.
   2. Subject to meeting the requirements of this specification, acceptable manufacturer's products which may be incorporated into the work include the following or an approved equal:
      a. GPT, Inc. Model LineBacker® (303-988-1242).
      b. Lamons® Model IsoGuard™ (713-222-0284)

B. Petrolatum Tape-Wrap Encapsulation of Buried Flange Isolation Kits

1. All buried FIK shall be encapsulated in a three-part cold-applied petrolatum tape coating consisting of a primer, profiling mastic, and a low-temperature petrolatum tape.
   a. Primer:
      (1) Solids Content: 100%
      (2) Specific Gravity: 1.08
      (3) Specific Volume: 26 cubic inches per pound
      (4) Flash Point: > 356ºF
      (5) Coverage: 10 to 22 square feet per pound
   b. Profiling Mastic:
      (1) Solids Content: 100%
      (2) Specific Gravity: 0.605
      (3) Specific Volume: 46 cubic inches perpound
      (4) Flash Point: 356ºF
      (5) Coverage: Varies by application
   c. Low-Temperature Petrolatum Tape:
      (1) Thickness: 46 mils
      (2) Maximum Service Temperature: 122ºF
      (3) Roll Width: 2 inches to 12 inches
      (4) Roll Length: 33 feet
      (5) Coverage with 55% Overlap: 87 square feet of tape per 100 square feet of pipe
2. Subject to meeting the requirements of this specification, acceptable manufacturer's products which may be incorporated into the work include the following or an approved equal:
   a. Denso NA, Inc. (281-821-3355) Denso Paste S105/Profiling Mastic/LT Tape.

## 2.6 GALVANIC ANODES

A. Magnesium Anodes
   1. Description: Anodes shall be capable of delivering a minimum efficiency of 500 amp-hours per pound of magnesium demonstrated in accordance with ASTM G97 (2013).
   2. Anodes shall have the following metallurgical analysis in accordance with ASTM B843 Grade M1C:
      a. Aluminum: 0.01% (max.)
      b. Manganese: 0.50% to 1.3%
      c. Copper: 0.02% (max.)
      d. Nickel: 0.001% (max.)
      e. Iron: 0.03% (max.)
      f. Other (each): 0.05% (max.)
      g. Other (total): 0.30% (max.)
      h. Magnesium: Balance
   3. Packaged Magnesium Anode Backfill
      a. Magnesium anodes shall be packaged within a cotton sack in a special chemical backfill having the following proportions:
      b. Ground Hydrated Gypsum:75%
      c. Powdered Bentonite: 20%
      d. Anhydrous Sodium Sulfate: 5%
      e. Backfill shall have a grain size such that 100% is capable of passing a No. 20 mesh screen and a No. 100 mesh screen shall retain 50%.
      f. Backfill shall completely surround the anode ingot without voids.

   4. Anode Lead Wire
      a. Lead Wire: No. 12 Type TW (red) solid copper wire of sufficient length to reach its connection point without splicing.
      b. Lead Wire Connection to Anode Core
         (1) Magnesium anodes shall be cast with a minimum 20 gauge galvanized steel core.

(2) One end of the anode shall be recessed to expose the core for silver-soldering the lead wire.
(3) The silver-soldered lead wire connection and anode recess shall be filled with an electrical potting compound before packaging.

5. Magnesium Anode Physical Parameters

| Anode Weight (#) | | Nominal Package Dimensions | |
|---|---|---|---|
| **Bare Anode** | **Pkg'd Anode** | **Length (in.)** | **Dia. (in.)** |
| 48 | 98 | 38 | 8.0 |

6. Subject to meeting the requirements of this specification, acceptable manufacturer's products which may be incorporated into the work include the following or an approved equal:
   a. Mesa Products, Inc.: 4445 S. 74th E. Avenue, Tulsa, OK 74145 (918-627-3188).
   b. BK Corrosion, LLC: 4411 Navigation Blvd., Houston, TX 77011 (713-225-6661).
   c. Champion Corrosion Products, Inc.: 7050 S. State Highway 123, Seguin, TX 78155 (830-303- 8505).

## 2.7 WIRE, CABLE, AND SPLICES

A. Test Wires for CP System Monitoring (Direct Burial)
   1. Cross-linked polyethylene (XLPE) Type RHW-2 and USE-2 for use at 600 volts or less shall be used for all underground structure connections as part of the CP system's monitoring circuit. Wire insulation shall conform to NEC for direct burial, general-purpose applications at a maximum continuous operating temperature of 90 degrees C in either wet or dry locations.
   2. The test wires shall be configured as follows:
      a. Conductors: The single copper conductor shall be solid or stranded annealed or hard, coated or uncoated copper per UL83 and ASTM requirements.
      b. Primary Insulation: 0.045 inch thickness
      c. Gauge and Structure Color Code: No. 12 AWG (colors as shown on contract documents)
   3. Subject to meeting the requirements of this specification, acceptable manufacturer's products which may be incorporated into the work include the following or an approved equal:
      a. Graybar Electric Company (800-472-9227)
      b. Omni Cable Corp. (800-292-6664)
      c. Kris-Tech Wire (315-339-5268)

B. Anode Header Direct Burial Cable
   1. High molecular weight polyethylene (HMWPE) insulated copper cable shall be used for all underground portions of the CP system's anode header cable. Insulation shall conform to ASTM D1248 – Specification for Plastic Molding and Extrusion Materials, Type 1, Class C, Grade 5.
   2. The CP cables shall be configured as follows:
      a. Conductors: The single copper conductor shall be stranded annealed or hard, coated or uncoated copper per UL83 and ASTM requirements.
      b. Outer Jacket: 0.110 inch thickness
      c. Anode Header Cable: No. 8 AWG (red)

C. Compression Crimp Splice Connectors
   1. Field splices shall be made through the use of copper compression crimp connectors. The proper size connectors shall be used in accordance with the manufacturer's recommendations. Connectors shall be crimped with a hand tool capable of delivering a minimum of 12 tons of compressive force.

2. Subject to meeting the requirements of this specification, acceptable manufacturer's products which may be incorporated into the work include the following or an approved equal:
   a. Burndy LLC (800-346-4175) - Type YC-C Copper Crimpit.

D. Splice Encapsulation
   1. All underground spliced connections shall be sealed with rubber and plastic tape contained within a waterproof coating.
   2. Subject to meeting the requirements of this specification, acceptable manufacturer's products which may be incorporated into the work include the following or an approved equal:
      a. 3M Electrical Products (888-364-3577) - Scotch Brand 23 Rubber Splicing Tape.
      b. 3M Electrical Products (888-364-3577) - Scotch Brand 33+ Vinyl Electrical Tape.
      c. 3M Electrical Products (888-364-3577) - Scotchkote Electrical Coating.

## 2.8 EXOTHERMIC WELDS AND CONNECTION DEVICES

A. All connections used within the DC cathodic protection system circuit shall be by exothermic welds.
   1. The proper size welders, metal charges, and wire sleeves shall be used in accordance with the manufacturer's recommendations. Do not mix different manufacturers' products.
      a. When connecting to horizontal ductile iron or cast-iron structures, use a maximum of 32 gram weld metal charge and furnaces designated specifically for cast iron.
      b. When connecting to horizontal carbon steel structures, use a maximum of 25 gram weld metal charge and furnaces designated specifically for carbon steel.
   2. Subject to meeting the requirements of this specification, acceptable manufacturer's products which may be incorporated into the work include the following or an approved equal:
      a. Continental Industries (918-627-5210), Model thermOweld®.
      b. ERICO International Corporation (440-248-0100), Model CADWELD®.

B. Coating of Wire and Cable Connections to Structures
   1. A pre-fabricated plastic sheet with an igloo-shaped dome and entry tunnel filled with an oil- and gas-resistant elastomeric rubber and a primer-less elastomeric tape for bonding directly to the structure.
   2. Subject to meeting the requirements of this specification, acceptable manufacturer's products which may be incorporated into the work include the following or an approved equal:
      a. Continental Industries (918-627-5210), Model Therm-O-Cap PC.
      b. Chase Corporation (781-332-0700), Model Royston Handy Cap IP.

# PART 3 EXECUTION

## 3.1 GENERAL

A. Examine the areas and conditions under which CP 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.

B. Install all CP components and equipment according to the following CP Installation Details included hereinafter in this Section.
   1. Detail No. CP-01: Pipe Continuity Bonding for Push-On or MJ Ductile Iron Pipe
   2. Detail No. CP-02: Exothermic Weld Procedure for Ferrous Pipe Material (Horiz. Only)
   3. Detail No. CP-03.A: Insulating Rubber & Tape Wye Splice for Sacrificial Anode Cable Connections
   4. Detail No. CP-03.B: Insulating Rubber & Tape Butt Splice for Sacrificial Anode Cable

Connections
5. Detail No. CP-05.A: Casing Test Station (CTS)
6. Detail No. CP-05.B: CTS Terminal Board Installation Details
7. Detail No. CP-06.A: Isolation Test Station (ITS)
8. Detail No. CP-06.B: ITS Terminal Board Installation Details
9. Detail No. CP-08.A: Anode Test Station (ATS)
10. Detail No. CP-08.B: ATS Terminal Board Installation Details
11. Detail No. CP-09.p: Post Type Test Station Terminal Board & Wires
12. Detail No. CP-10: Flange Isolation Kit (FIK)

## 3.2 FIELD QUALITY CONTROL

A. Contractor's Quality Control System
   1. The Contractor shall implement a quality control system to ensure the CP system components conform to 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.
   4. The Contractor shall provide the services of a representative from the CP system material supplier(s) to provide technical consultation during the installation of the CP system. The Contractor may, at his own expense, furnish the services of a NACE-certified corrosion engineer to monitor field compliance with these Specifications.

## 3.3 INSTALLATION OF ELECTRICAL CONTINUITY PROVISIONS – FERROUS PIPE

A. General: Factory-made cable bonds shall be installed across all non-welded ferrous pipe joints except those pipe joints that are specifically required to be electrically isolated.

B. Method:
   1. Inspect each bond cable to ensure a continuous electrical conductor with no cuts or tears in the cable insulation.
   2. Attach bond cable to water main by the exothermic welding process in accordance with the manufacturer's instructions.
   3. Do not use any exothermic weld equipment that is either damp or wet.
   4. Cover all exothermic welds with a pre-fabricated, igloo-shaped, domed-plastic elastomeric rubber cover as described in this specification.

C. Post-Installation Visual Inspection: Inspect all electrical continuity bond cable connections by visually examining each exothermic weld connection for strength and suitable coating prior to backfilling.

D. Post-Installation Continuity Testing: Contractor shall use one (or more) of the following procedures to verify all bonded pipe joints are electrically continuous prior to backfilling. All data shall be documented for the job record and submitted each day to the Engineer and also summarized and submitted to the Engineer at the completion of the Project.
   1. Static: Measure the electrical potential at each side of selected bonded connections with a copper/copper-sulfate reference electrode (CSE). Leave the CSE in a stable location. Potentials must be identical on both sides of the subject bonded joint.
   2. Resistance: Measure the resistance through the selected bonded joint with a suitable volt-ohm measurement device. Resistances of 0.001 ohms or less are acceptable.
   3. Current-Applied: Position a CSE at a stable location adjacent to the bonded structure. Impress a temporary 12 VDC current on the structure. Record current-applied pipe-to-soil potential readings along the structure relative to the stable CSE. Current-applied potential measurements referenced to the stable CSE must be nearly identical (less than ±5 mV)

along the structure to indicate electrical continuity. Voltage drops through the structure shall be considered in determining electrical continuity by this method.

E. Acceptance Criterion: If, in the opinion of the Engineer, any exothermic weld is deficient, the Contractor shall remove and replace the deficient welded connection at no expense to the Des Moines Water Works.

F. 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 Des Moines Water Works.

## 3.4 INSTALLATION OF CORROSION MONITORING TEST STATIONS

A. General: Raise the required number of test stations at the locations shown on the contract documents or as directed by the Engineer.

B. Reference Electrode
   1. Keep permanent reference electrodes dry and protect from freezing before installation.
   2. Remove plastic or paper shipping bags from around the reference electrode prior to installation.
   3. Place reference electrode in native soil within 12 to 36 inches of the water main.

C. Test Wires
   1. Provide test station lead wires that are continuous with no cuts or tears in the insulation covering the conductor.
   2. Attach test leads to the water main by the exothermic welding process.
   3. Connect all test station wires to one side of the terminal board using the test station manufacturer’s standard binding posts at the locations shown on the Plans.
   4. Install wire shunt plate and shorting bars to the opposite side of terminal board from the incoming wires.
   5. Install wire shunt plate last to permit easy removal from terminal board without having to disassemble other test station wire and cable connections.

D. Terminal Board and Test Stations on Mounting Post:
   1. Route all test station wires through the mounting pipe and run to an area along the water main that will not accumulate standing water.
   2. Install the test station terminal board on top of the mounting pipe and extend the pipe vertically to a height of at least 36 inches to 42 inches above final grade.
   3. Install the top of test station head and color-coded cap. Permanently mark as-built pipeline stationing number on test station cap or mounting post.
   4. Thoroughly backfill and compact the soil surrounding the mounting post to prevent settling and voids.

E. Post-Installation Backfilling
   1. Protect test leads during the backfilling operation to avoid damage to the wire insulation and integrity of the conductor.
   2. Protect permanent reference electrode during backfilling to avoid damage to the electrode and its lead wire.
   3. If, in the opinion of the Engineer, the installation of the test station wires or the reference electrode is deficient, the Contractor shall remove and replace these components at no expense to the Des Moines Water Works.

## 3.5 INSTALLATION OF ELECTRICAL ISOLATION DEVICES

A. General: Install the required number of electrical isolation devices at the locations shown on the contract documents and the CP Installation Schedule provided hereinafter in this Section or as directed by the Engineer. The water main intended for cathodic protection shall be electrically isolated at all connections to existing metallic water mains or at connections to new water mains that are not intended for cathodic protection.

B. Flange Isolation Kit (FIK) Procedure:
   1. Inspect the gasket kit and verify that the material is as specified and that the material is not damaged.
   2. Clean the bolting materials. Apply lubricant or anti-seizing compound to all threads required for alignment with nuts and nut facings.
   3. Align flange faces so that they are parallel and concentric with each other and within 0.010 inch without external loading or springing.
   4. Line up bolt holes by driving two tapered drift pins in opposite directions to each other into two diametrically opposite bolt holes.
   5. Insert insulating sleeves into bolt holes. Sleeves must slide in easily; if not, flanges must be realigned. Do not force sleeves into bolt holes.
   6. Assemble studs/bolts as follows:
      a. Run one nut on each stud so that two full threads are showing beyond the nut.
      b. Slide steel backup washer onto stud and insert into bolt hole. If flange requires two-sided insulation, add an insulating washer after the steel washer.
      c. From the opposite end of the stud, place an insulating washer, steel backup washer, and a nut; tighten by hand.
      d. Torque the first two studs at diametrically opposite locations to a maximum of 30% of the final torque value in a star pattern.
      e. Repeat star-torqueing pattern at each bolt by increasing torque to 50% to 60% of final value.
      f. Continue torqueing all studs in a star pattern using the specified torque setting (100%) until there is no further rotation of the nuts.

C. Acceptance
   1. Immediately after a FIK has been installed in accordance with the manufacturer's specifications, an electrical isolation test will be conducted by the Contractor using a radio frequency isolating test meter.
   2. If, in the opinion of the Engineer, the installation of the FIK is deficient, the Contractor shall remove and replace these components at the Contractor's expense.

D. Sealing Buried Isolation Flanges
   1. After any buried FIK has been tested and found to be 100% effective, the entire isolator shall be encapsulated in a three-part non-toxic, petrolatum tape wrap before burial.
   2. Encapsulation shall completely cover both flange sides and shall extend a minimum of six inches beyond the ends of all flange bolt heads and nuts.

## 3.6 INSTALLATION OF GALVANIC ANODES

A. General: Install the required number of anodes at the locations shown on the contract documents and CP Installation Schedule 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 to insulated header cable or route lead wire directly to pipe or test station as required.
5. Splices are not permitted within the length of a factory-fabricated anode lead wire.
6. Install prepackaged anodes with compacted backfill material, such that no voids exist between the anode material and the backfill.
7. In soils that do not exhibit any signs of moisture content or granular soils that have no cohesive strength, 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

A. Install underground wires, cables, and connections at a minimum 36 inches below final grade with a minimum separation of 6 inches from other underground structures.

B. Crimp Connectors:
   1. All spliced connections will be made by the use of copper compression crimp connectors.
   2. Contractor must furnish a hand tool capable of generating a minimum of 12 tons of compressive force to install crimp connectors. Use only hand tools compatible with the manufacturer's copper compression taps.

C. Seal splices against water penetration as follows:
   1. Clean and then wrap with a minimum of two half-lapped layers of rubber electrical tape.
   2. Apply two half-lapped layers of plastic electrical tape.
   3. Cover with a fast-drying electrical sealant.

## 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 structure. Do not use exothermic weld equipment if the graphite mold is wet.

B. Structure Surface Preparation
   1. All bare metal shall be free of dust, dirt, grease, oil and other foreign matter.
   2. Practical removal shall be by either power or hand wire brushing.
   3. Grinding or filing shall remove sharp edges or burrs.

C. Installation of Elastomeric Cover over Exothermic Welds
   1. Clean the pipe surface which is to be covered by removing all moisture, dirt, grease and other contaminants.
   2. The weld areas shall be no more than warm to the touch before applying the elastomeric cover.
   3. Remove the release paper from the back of the mastic pad. Avoid touching the exposed elastomeric tape.
   4. Apply the mastic pad to the structure by firmly pressing on all edges making sure that the tunnel area of the plastic dome completely covers the lead wire entering the exposed copper of the connection.
   5. Push the dome of the plastic weld cap firmly over the exothermic weld area and the wire entering the weld cap.

## 3.9 POST-INSTALLATION TESTING OF CATHODIC PROTECTION SYSTEMS

A. General: Des Moines Water Works will provide services of a NACE-certified Cathodic Protection Specialist for periodic field inspections and final commissioning services of the CP system installed for all pipe materials in accordance with NACE International standard

practices and test methods:

1. NACE International Standard Practice SP0169 (latest edition).
2. NACE International Standard Test Method TM0497 (latest edition).

B. Energizing: Assist Des Moines Water Works and Des Moines Water Work's Cathodic Protection Specialist during initial energizing of the cathodic protection systems.

**** END OF SECTION ****

## SECTION 13 21 00 - CATHODIC PROTECTION FOR SMALL DIAMETER. (4”-16”) WATER MAINS

### PART 1 GENERAL

### 1.1 SUMMARY OF WORK

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

### 1.2 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 (not applicable to this project).
      d. Galvanic Anodes and Accessories.
      e. Wire, Cable, and Splices.
      f. Exothermic Welds and Repair Coatings.

### 1.3 MEASUREMENT AND PAYMENT

A. Install bonding cables across all pipe joints. Include costs for material, equipment, and labor in Cathodic Protection Test Station unit bid item.

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 unit bid item.

C. Install electric isolators in all corporation stops. Include cost for isolators in Water Service unit bid item.

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

### PART 2 PRODUCTS

### 2.1 WARRANTY ON CONTRACTOR-PROVIDED MATERIALS

A. All Contractor-provided materials shall be guaranteed for a period of 2 years.

B. The 2 year period commences at the time of final installation of all components by Contractor and after system has been tested and properly adjusted for operation by Contracting Authority.

### 2.2 ELECTRICAL CONTINUITY BOND CABLES

A. Install factory-prefabricated high molecular weight polyethylene insulated stranded copper continuity bond cables across all pipe joints of mechanically-coupled pipe. Conform insulation to ASTM D1248
   – Specification for Plastic Molding and Extrusion Materials, Type 1, Class C, Grade 5.
   1. Size pipe joint continuity bond cables as follows:
      a. Wire gauge: No. 4.
      b. Number of strands: Seven.
      c. Outer jacket: 0.110 inch thickness.

d. Length: 18 inch (minimum.).
e. Number of bonds: One across each pipe joint.

## 2.3 CORROSION MONITORING TEST STATIONS

A. Monitoring stations shall be as follows:
1. Tube of the test station of Acrylonitrile Butadiene Styrene.
2. Test station minimum of 24 inches in height and 6 1/8 inches in diameter.
3. Cast iron collar and lid.
4. Stainless steel lid with hold-down bolt with stainless steel nut.
5. Minimum weight of 22.0 pounds.
6. Minimum load test of 35,000 pounds.
7. A terminal board equipped with terminal posts to permit ready access and testing constructed as follows:
   a. Terminal Board: polycarbonate plastic.
   b. Binding/Terminal Posts: nickel-plated marine brass (five minimum).
   c. Two shunts between posts.
   d. Terminal Board shall sit in the top of test station.
8. Prepackaged Cu-CuSO4 Reference Electrodes
   a. Description: Use Cu-CuSO4 electrodes for soil environments to provide a stable electrical benchmark from which to measure the cathodic protection system's effectiveness. Construct electrodes as follows:
      (1) Element: copper rod encapsulated in a proprietary backfill electrolyte containing high purity copper sulfate crystals and a chloride ion trap to prevent contamination of the electrolyte.
      (2) Service life of reference electrode no less than 20 years.
      (3) Lead Wire: No. 1 RH-RHW (Yellow) stranded copper wire. Lead wire sufficiently long to reach its termination point without splicing.
      (4) Approved manufacturers:
         (a) Borin Manufacturing, Inc., Model SRE-007-CUY.
         (b) GMC Electrical, Inc., Model CU-1-UGPC.

B. Subject to meeting the requirements of this Section, acceptable manufacturer's products that may be incorporated into work include the following, or an approved equal:
1. Cathodic Protection 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. Construct electrically isolating pipe couplings 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 A513, ASTM A635, or ASME SA675 GR60.
3. Use stainless-steel bolts and nuts.
4. Gaskets shall be Nitrile Grade 27 Buna-S compounded to resist aliphatic hydrocarbons within a temperature range of minus 20°F to 180°F.
5. Use fusion-bonded epoxy coating.
6. Subject to meeting the requirements of this Section, acceptable manufacturer's products that may be incorporated into work include the following, or an approved equal:
   a. Dresser Industries, Style 39 Pipe Isolation Coupling.
   b. Smith Blair, Style 416 Insulating Coupling.

B. Use electrically isolating corporation stops for all 2 inch and smaller service connections; see Section 02 66 00.
1. Subject to meeting the requirements of this Section, acceptable manufacturer's products

that may be incorporated into work include the following, or an approved equal:
a. Ford Meter Box Company, Model Service Insulator Corporation Stops.
b. Approved equal.

## 2.5 SACRIFICIAL ANODES AND ACCESSORIES

A. Magnesium Anodes
1. Use magnesium anodes capable of delivering a minimum efficiency of 500 amp-hours per pound of magnesium and having the following metallurgical analysis and physical properties:
a. Bare Ingot Weight: 32 pounds.
b. Metallurgy:
(1) Aluminum: 0.01% (maximum).
(2) (2) Manganese: 0.50% to 1.3%.
(3) Copper: 0.02% (maximum).
(4) Nickel: 0.001% (maximum).
(5) Iron: 0.03% (maximum).
(6) Other (each): 0.05% (maximum).
(7) Other (total): 0.30% (maximum).
(8) Magnesium: balance.

B. Packaged Magnesium Anode Backfill
1. Package magnesium anodes 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. Use backfill having a grain size such that 100% is capable of passing a No. 20 mesh screen and a No. 100 mesh screen retaining 50%.
a. Backfill completely surrounding 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. 10-foot length of No. 12 AWG solid copper wire with Type TW (red) thermoplastic insulation is to be used as the standard lead wire for a magnesium anode.
2. Lead Wire Connection to Anode Core
a. Use magnesium anodes cast with a minimum 20 gauge galvanized steel core.
b. Recess one end of the anode to expose core for silver-soldering the lead wire.
c. Fill the silver-soldered lead wire connection and anode recess with an electrical potting compound before packaging.

## 2.6 TEST WIRES FOR CATHODIC PROTECTION SYSTEM MONITORING

A. Use oil- and gas-resistant insulated/jacketed stranded copper wire for structure connections as part of the system's monitoring circuits. Insulation conforms to ASTM Standard UL-83 for Thermoplastic Insulated Wires.
1. Size test wires as follows:
a. Number 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. Exothermic weld all connections used within the DC cathodic protection system circuit.

Use the proper size welders, metal charges, and wire sleeves in accordance with manufacturer's recommendations.

2. Subject to meeting the requirements of this Section, acceptable manufacturer's products that may be incorporated into work include the following, or an approved equal:
   a. Continental Industries, Model Therm-O-Weld.
   b. Erico Products, Model Cadweld.

B. Repair Coatings:
   1. Apply an oil- and gas-resistant, cold-applied, coal tar mastic compound to exothermic weld connections.
   2. Subject to meeting the requirements of this Section, acceptable manufacturer's products that may be incorporated into work include the following, or an approved equal:
      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

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

### 3.2 DESCRIPTION OF WORK

A. Refer to additional notes and Cathodic Protection Details included in Plans to install all cathodic protection components and equipment.

B. Examine areas and conditions under which cathodic protection materials are to be installed and notify Engineer in writing of conditions detrimental to proper and timely completion of work. Do not proceed with 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 bonding cables across points of connection to existing structures or across electrical isolation devices.
   3. Continuity bonding cables will not be required across joints with retainer glands.

B. Method:
   1. Attach cable to water main by exothermic welding process.
   2. Perform exothermic welding of bond cables in accordance with 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, Contractor shall remove and replace the weld at no expense to Contracting Authority.

D. Backfilling of Bond Cables:
   1. Perform backfilling that will prevent damage to bond cables and connections to the water main.

2. If construction activity damages a bond cable, Contractor shall remove and replace the bond cable at no expense to Contracting Authority.

## 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 water main by 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 area immediately surrounding test station to prevent settling or tipping.

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

## 3.5 INSTALLATION OF ELECTRICAL ISOLATION DEVICES

A. General: Follow manufacturer's written instructions for 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 Engineer.
   2. If, in the opinion of the Engineer, the installation of the isolation device is deficient, Contractor shall remove and replace these components at Contractor's expense.

## 3.6 INSTALLATION OF GALVANIC ANODES

A. General: Install required number of anodes at locations shown on plans or as directed by 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 Cathodic Protection Details on Plans. Make field modifications only with approval of Engineer.
   3. Handle galvanic anodes to avoid damaging anode materials and wire connections.
   4. Attach anode lead wire directly to 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 anode material and backfill.
   6. In very dry or coarse soils, pour 5 gallons of water over anode after backfilling and tamping have been completed to a point about 6 inches above anode. After water has been absorbed by the earth, complete backfilling to ground surface level.

## 3.7 INSTALLATION OF WIRE, CABLE, AND SPLICES

A. 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. Perform all exothermic welding in accordance with 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 graphite mold is wet. Follow manufacturer's MSDS for storage and handling.
   1. Structure Surface Preparation
      a. Remove all dust, dirt, grease, oil, and other foreign matter by either power or hand-wire brushing to expose bright shiny metal free of coating, soil residue, or oxidation.
      b. Grind or file to remove sharp edges or burrs.
   2. Installation of Elastomeric Cover over Exothermic Welds
      a. After cooling, remove all slag from exothermic weld connection.
      b. Clean pipe surface that is to be covered by removing all moisture, dirt, grease, and other contaminants.
      c. Coat welded connection to completely cover all exposed copper or damaged pipe coating.

## 3.9 FIELD QUALITY CONTROL

A. Contractor's Quality Control System
   1. Cathodic protection system components conform to applicable Plans and Specifications established by Contract Documents.
   2. Standards for materials, workmanship, construction, and functional performance are adhered to throughout the course of the Work.
   3. Contractor's superintendent to monitor the Contractor's quality control system.

**** END OF SECTION ****