SPECIAL PROVISIONS
FOR
CATHODIC PROTECTION SYSTEM

Johnson County
HDP-3715(652)--71-52

Effective Date
April 19, 2016

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.

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Part 1 - General

1.1 Summary of Work

A. Cathodic protection for 16 inch, 12 inch, 8 inch and 6 inch diameter ductile iron pipe with field-applied polyethylene encasement using sacrificial anode system for new water mains as described below:
   1. 3,880 lineal feet of 16 inch main along Dubuque Street including new 6 inch hydrant laterals.
   2. 175 lineal feet of 16 inch main along Brown Street.
   3. 105 lineal feet of 12 inch main along Park Road
   4. 165 lineal feet of 8 inch main cross Dubuque Street.
   5. 450 lineal feet of 8 inch main along Kimball Road.
   6. 110 lineal feet of 8 inch main along North Gilbert Street.
   7. 345 lineal feet of 12 inch main along Taft Speedway.

1.2 Related Specification Sections

A. SP-156042 – Special Provisions for Water Mains and Appurtenances.

1.3 References

A. American Society for Testing and Materials (ASTM) – Applicable testing methods and materials.
B. National Association of Corrosion Engineers (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 Bond Cables – Ductile Iron Pipe
      b. Corrosion Monitoring Test Stations, Buried Reference Electrodes and Calibrated Shunts
      c. Electrical Isolation Devices and Petrolatum Tape Overwrap
      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 and will function properly as a unit.
   3. A notation shall be made on each shop drawing submitted as to the item's specific use either by a particular type number referenced in the Contract Documents, or by a description of the item's specific location.

1.5 Measurement and Payment

A. Include cost to furnish all materials, equipment and labor necessary to install the cathodic protection system described in this Specification in the unit price bid for "Furnish and Install Cathodic Protection System" in the contract documents.

Part 2 - Products

2.1 Warranty on Contractor-Provided Materials

A. All Contractor-provided materials shall be guaranteed for a period of 1 year.

B. The 1 year period shall commence at the time of the final installation of all components by the Contractor and after the system has been tested and properly adjusted for operation by the Contracting Authority's Corrosion Engineer.

2.2 Electrical Continuity Bond Cables – Ferrous Pipe

A. High molecular weight polyethylene insulated stranded copper cable shall be used for continuity bond cables installed across all non-welded ferrous pipe joints.

B. The quantity and size of continuity bond cables required for each pipe joint shall be as shown on the CP Installation Detail Drawings included hereinafter in this Section.

C. Insulation shall conform to ASTM D1248 – Specification for Plastic Molding and Extrusion Materials, Type 1, Class C, Grade 5 and be configured as follows:

1. No. of Strands: 7
2. Outer Jacket Thickness: 0.110 inches
3. Length: 18 inches (min.)
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 Jumper Bonds.

2.3 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 covered terminal board equipped with terminal posts to permit ready access and testing and shall be constructed as follows:
    a. Terminal Board: Polycarbonate plastic (clear).
    b. Binding/Terminal Posts: Nickel-plated marine brass (six minimum).
    c. Conduit Post: UV stabilized polyethylene (white).
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. Flush-Mounted Test Station Enclosures

1. Test station shall be contained in a heavy-duty, polymer concrete, flush-to-grade utility enclosure able to withstand incidental traffic and constructed as follows:
    a. The open bottom body shall be constructed of polymer concrete having a minimum compressive strength of 87 MPa.
    b. The cover shall be constructed of polymer concrete having a non-skid surface and shall cover the body of the enclosure. Cover shall be capable of withstanding a minimum of 20,000 pounds without failure in accordance with the requirements ANSI/SCTE 77/T15 applications.
    c. Cover shall have a minimum of two hex-capped stainless steel hold-down bolts placed at opposite corners and shall be labeled "CP TEST" in minimum 1 inch high letters.
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. Duravault LLC. (909-267-9657) Model PC132412STB.
    b. New Basis, Inc. (951-787-0600) Model PCA132412S.

C. Prepackaged Cu-$CuSO_4$ Reference Electrodes

1. Description: Cu-$CuSO_4$ 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.

D. Calibrated Shunts
1. Description: Color-coded calibrated 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), Yellow 0.01 ohm shunt plate rated at 8 amps.

2.4 Electrical Isolation Devices

A. Flange Isolation Kit (FIK) Assemblies
1. Isolation flange gaskets shall be constructed of a full-faced (type E) and constructed as one of the following:
   a. Synthetic fiber with proprietary rubber binder (Multi-Swell™ Style 3760U), or
   b. G-10 Epoxy Glass w/ ethylene propylene diene monomer (EPDM) O-Ring.
2. Isolation Washers: Double 1/8 inch thick G-10 Epoxy Glass.
3. Backup Washers: Double 1/8 inch thick Type 304 stainless steel.
4. FIK materials shall be certified by an independent certification agency to meet the requirements of the NSF-61 Standard.
5. 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. Garlock Pipeline Technologies, Inc. (303-988-1242).

B. Petrolatum Tape-Wrap Encapsulation of Buried Flange Isolation Kits
1. All buried flange isolation kits 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: > 356 ºF
      (5) Coverage: 10-22 square feet per pound
   b. Profiling Mastic:
      (1) Solids Content: 100%
      (2) Specific Gravity: 0.605
      (3) Specific Volume: 46 cubic inches per pound
      (4) Flash Point: 356 ºF
      (5) Coverage: Varies by application
   c. Low-Temperature Petrolatum Tape:
      (1) Thickness: 46 mils

(2) Maximum Service Temperature: 122 ºF
(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.

C. Electrically Isolating Corporation Stops
1. Electrically isolating corporation stops shall be constructed as follows:
   a. All brass construction conforming to AWWA Standard C800 (ASTM B-62 and ASTM B-584).
   b. Solid one-piece tee-head and stem with Ethylene Propylene Diene Monomer (EPDM) O-ring in stem.
   c. Molded EPDM seat to support fluorocarbon-coated brass ball.
   d. Threaded nylon insulator factory inserted between the body assembly and flared copper/nut service line.
   e. Entire assembly threads secured with adhesive to prevent unintentional disassembly and to render unit leak resistant to 300 psi working pressure.
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. Ford Meter Box Co., Inc. (260-563-3171), Service Insulator Corporation Stops.
   b. Mueller Company (770-206-4200), Model Insulated Water Service Products.

D. Casing Spacers
1. Carrier pipe shall be contained within steel casing sleeves by the use of casing isolation spacers.
   a. Band Sections:
      (1) Spacers shall be bolt-on style constructed of two-piece carbon steel band sections each having a 14-gauge minimum thickness and a bandwidth of not less than 12 inches for carrier pipe sizes up to 36 inches.
      (2) Sections shall be equipped with a 0.09 inch minimum thickness flexible (Durometer "A" 85-90 hardness), ribbed PVC liner that overlaps the edges.
      (3) Band sections shall be bolted together using cadmium-plated carbon steel studs, hex nuts, and washers set in embossed shell flanges.
   b. Risers:
      (1) Constructed of 10-gauge thick carbon steel and MIG welded to the shell section in accordance with AWS Standards.
      (2) Fasteners: Furnish cadmium-plated carbon steel studs, hex nuts, and washers and set in embossed shell flanges.
      (3) Finish: Synthetic enamel with rust-inhibiting pigment.
   c. Runners:
      (1) Method: Attached to the end of each riser by 3/8 inch welded steel studs and lock nuts recessed in the runner at appropriate positions to properly locate the carrier pipe within the casing.
      (2) Material: Glass reinforced polyester with a minimum compressive strength of 18,000 psi having a length of at least 11 inches and a minimum width of not less than 2 inches.
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. Garlock Pipeline Technologies, Inc. (303-988-1242), Model C Casing Isolators.

E. Casing End Seals
1. Synthetic rubber, pull-on end seals shall be installed to eliminate the possibility of foreign material entering the opening between the carrier pipe and the casing sleeve.

a. Material: Synthetic rubber (Ethylene Propylene Diene Monomer).
b. Thickness: 1/8 inch (minimum).
c. Color: Black.
d. Temperature Rating: 250 ºF

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. Garlock Pipeline Technologies, Inc. (303-988-1242), Model Type S.

2.5 Galvanic Anodes

A. Magnesium Anodes

1. Description: Magnesium anodes shall be capable of delivering a minimum efficiency of 500 amp-hours per pound of magnesium and shall have the following metallurgical analysis:
2. Metallurgy:
   a. Aluminum: 0.01% (max.)
   b. Manganese: 0.50% - 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 20-mesh screen and a 100-mesh screen shall retain 50 %.
   f. Backfill shall completely surround the anode ingot without voids.
4. Anode Lead Wire
   a. The standard lead wire for a magnesium anode shall be at least 10 foot length of No. 12 AWG solid copper wire with Type TW (red) thermoplastic insulation
   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. Brance-Krachy, Inc.: 4411 Navigation Blvd., Houston, TX 77011 (713-225-0349).
   c. Champion Corrosion Products, Inc.: 7050 S. State Highway 123, Seguin, TX 78155 (830-303-8505).

2.6 Wire, Cable, and Splices

A. Anode Header Cable and Structure Return Connection (Direct Burial)
   1. High molecular weight polyethylene insulated stranded copper cable shall be used for all underground portions of the cathodic protection system's anode header cable and structure return connection circuits. Insulation shall conform to ASTM D1248 – Specification for Plastic Molding and Extrusion Materials, Type 1, Class C, Grade 5.
   2. The cables shall be sized as follows:
      a. No. of Strands: 7
      b. Outer Jacket: 0.110 inch thickness
      c. Anode Header Cable: No. 8 AWG (red)
      d. Structure Return Connection: No. 8 AWG (blue)

B. Test Wires for Cathodic Protection 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 cathodic protection system's monitoring circuit. Wire insulation shall conform to NEC for direct burial, general-purpose applications at a maximum continuous operating temperature of 90° C in either wet or dry locations.
   2. The test wires shall be configured as follows:
      a. Conductors shall Class B stranded annealed uncoated copper per UL Standard 854 and 44.
      b. Primary Insulation: 0.045 inch thickness
      c. Gauge and Structure Color Code: No. 12 AWG (colors as shown on drawings)
   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)

C. Compression Crimp Splice Connectors
   1. All underground spliced connections used within the cathodic protection circuit shall be made through the use of copper compression crimp connectors.
      a. The proper size connectors shall be used in accordance with the manufacturer's recommendations.
      b. Connectors shall be crimped with a hand tool capable of delivering a minimum of 12 tons of compressive force.

D. Splice Encapsulation
   1. All underground spliced connections used within the cathodic protection circuit 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 (1-888-364-3577) - Scotch Brand 23 Rubber Splicing Tape.
      b. 3M Electrical Products (1-888-364-3577) - Scotch Brand 33+ Vinyl Electrical Tape.
      c. 3M Electrical Products (1-888-364-3577) - Scotchkote Electrical Coating.

2.7 Exothermic Welds and Connection Devices

A. All connections used within the 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 Therm-O-Weld.
   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. The Tapecoat Company (800-758–6041), Model Royston Handy Cap IP.

Part 3 - Execution

3.1 General

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

B. Drawings: Install all cathodic protection components and equipment according to the following cathodic protection Installation Detail Drawing Sheets U.74 through U.82
1. Drawing No. CP-01: Pipe Continuity Bonding for Push-On or MJ Ductile Iron Pipe
2. Drawing No. CP-02: Exothermic Weld Procedure for Ferrous Pipe Material (Horizontal Only)
3. Drawing No. CP-03A: Insulating Rubber & Tape Wye Splice for Sac Anode Cable Connections
4. Drawing No. CP-03B: Insulating Rubber & Tape Butt Splice for Sac Anode Cable Connections
5. Drawing No. CP-04.A: Potential Test Station (PTS)
6. Drawing No. CP-04.B: PTS Terminal Board Installation Details
7. Drawing No. CP-05.A: Casing Test Station (CTS)
8. Drawing No. CP-05.B: CTS Terminal Board Installation Details
9. Drawing No. CP-06.A: Isolation Test Station (ITS) w/o Tapping Tee
10. Drawing No. CP-06.B: ITS Terminal Board Installation Details
11. Drawing No. CP-08.A: Anode Test Station (ATS)
12. Drawing No. CP-08.B: ATS Terminal Board Installation Details
13. Drawing No. CP-09.f: Flush-Mounted Enclosure for Test Station Terminal Board & Wires
14. Drawing No. CP-09.p: Post-Type Enclosure for Test Station Terminal Board & Wires
15. Drawing No. CP-10: Flange Isolation Kit (FIK)
16. Drawing No. CP-11: Isolation Corporation Stop (ICS)
17. Drawing No. CP-12: Not Used
18. Drawing No. CP-13: Electrical Isolation Devices for Metallic Casing Sleeves

3.2 Field Quality Control

A. Contractor's Quality Control System
1. The Contractor shall implement a quality control system to ensure the cathodic protection system components conform to the applicable plans and specifications established by the Contract Documents.

2. The quality control system shall ensure that standards for materials, workmanship, construction, and functional performance are adhered to throughout the course of the Work.
3. The Contractor's superintendent shall be used to monitor the Contractor's quality control system.
4. Contractor may, at his own expense, furnish the services of a NACE-certified corrosion engineer to monitor compliance with these Specifications.

3.3 Installation of Electrical Continuity Bond Cables – Ferrous Pipe

A. General
   1. Inspect each cable to ensure a continuous electrical conductor with no cuts or tears in the cable insulation.
   2. Attach cable to water main by the exothermic welding process.
   3. Cover all exothermic welds with a pre-fabricated igloo-shaped domed plastic elastomeric rubber cover as described in this specification.

B. Method:
   1. Perform exothermic welding of bond cables in accordance with the manufacturer's instructions.
   2. Do not use any exothermic weld equipment that is damp or wet.

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 City of Iowa City.

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 City of Iowa City.

3.4 Installation of Corrosion Monitoring Test Stations

A. General: Install the required number of test stations at the locations shown on the CP Installation Schedule 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 shunt plate last to permit easy removal from terminal board without having to disassemble other test station wire and cable connections.

D. Test Station Terminal Board and Flush-Mounted Enclosure
1. Install test station terminal board within color-coded cap and mount vertically to white polyethylene (PE) pipe.
2. Set the PE pipe within enclosure and support with a minimum 6 inch gravel base to support and drain the inside of the enclosure.
3. Extend bottom of PE pipe to a minimum of 24 inch below bottom of enclosure and install top of test station head with a minimum separation of 1inch from bottom of enclosure cover
4. Backfill and compact the area immediately surrounding the enclosure to prevent settling
5. Locate enclosure behind curb lines and do not locate enclosure in trafficked areas.
6. Set the top of the enclosure flush to final grade and at highest grade points possible.

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 City of Iowa City.

F. Provisions for Future Locating of Flush Test Stations Enclosures
1. Drive a vertical 12 inch long No. 5 steel rebar flush into the ground and immediately alongside the enclosure to facilitate locating with a magnetic sensing device.
2. Permanently mark as-built pipeline stationing number on test station cap or mounting post.

3.5 Installation of Electrical Isolation Devices

A. General: Install the required number of electrical isolation devices at the locations shown on the Installation Schedule provided hereinafter in this Section or as directed by the Engineer.

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.
7. Torque the first two studs at diametrically opposite locations to a maximum of 30% of the final torque value in a star pattern.
8. Repeat star-torquing pattern at each bolt by increasing torque to 50-60% of final value.

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

D. Sealing Buried Isolation Flanges
   1. After any buried flange isolation kit 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.

E. Electrically Isolating Corporation Stop
   1. Procedure: Follow manufacturer's written instructions for the specific device to be installed.

F. Casing Spacers
   1. One spacer shall be placed not more than 12 inches from each end of the casing.
   2. Install 3 casing isolators per pipe section spaced at no less than 6 to 7 feet on center.

G. Casing End Seals
   1. Prepare outside surfaces by removing dirt from casing and carrier pipes.
   2. After carrier pipe is completely inserted into casing and end seal is correctly positioned relative to both the casing and the carrier pipe, secure large end (casing end) with stainless steel hose/banding clamp. Hose/banding clamp should be positioned at least 1inch from the end of the casing pipe. Tighten screw with a standard screwdriver to secure end seal to casing pipe.
   3. Fold end seal into an "S" shape so it will protrude into the casing. This is done to relieve stress during backfilling and allow for expansion and contraction both during and after installation is complete. The small end of the end seal will slide toward the casing as the "S" is constructed.
   4. Position banding clamp approximately one inch from the small end of the end seal (on the carrier pipe) and tighten with a standard screwdriver to secure end seal to carrier pipe.

3.6 Installation of Galvanic Anodes

A. General: Install the required number of anodes at the locations shown on the Installation Schedule provided hereinafter in this Section 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 Cathodic Protection 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. Field splices of a factory-fabricated anode lead wire are permitted only when performed in accordance with these Specifications.
   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 tools compatible with Burndy 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 any 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: City of Iowa City will provide services of a NACE-certified Cathodic Protection Specialist for periodic field inspections and final commissioning services of cathodic protection systems installed for all pipe materials in accordance with the following NACE International reference standard and test method:
   1. NACE International Standard Practice SP0169 (latest edition).
   2. NACE International Standard Test Method TM0497 (latest edition).
B. Energizing: Assist City of Iowa City's Cathodic Protection Specialist during initial energizing of the cathodic protection systems.