

SECTION 26 42 40
CORROSION CONTROL

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Contractor shall furnish and install gaskets, dielectric isolating gaskets, isolating sleeves and washers, bolts and nuts, bolt and nut caps, corrosion test stations, and mounting hardware as indicated on the Drawings or as specified in these Specifications.
- B. All gaskets, either isolating or non-isolating flanges for this Contract, shall be in conformance to the Specifications in Section 2.02.
- C. The requirements for bolts and nuts, either isolated or non-isolated flanges, shall be in conformance to the Specifications Section 2.03.
- D. The location of all isolated flange joints shown on the Corrosion Control Site plan drawings, unless specifically noted on the drawings, are shown in an approximate location and shall be determined in the field and approved by the City Representative. All isolated flange joints shall be tested and signed off by a qualified corrosion engineer as provided by the Contractor.
- E. The location of the cathodic protection test stations (CPTS) and isolated flange joint test stations shown on the Corrosion Control Site plan drawings are approximate. Exact locations of the test stations shall be determined in the field and approved by the City Representative.
- F. Contractor shall touch up the paint as damaged during the transportation and during the installation. The touch up shall be performed by the professional painting crew, with the same coating system as supplied by the equipment, pipe/valve manufacturers. Take extra care to minimize the coating damage on bolts and nuts. Bolts and nuts shall not be painted in the field.
- G. The system shall be complete and in a satisfactory operating condition at the time of acceptance of the work.
- H. If there are conflicts between Contract Specifications, the materials as specified in this Section will prevail.
- I. Contractor shall furnish and install bond cables on the buried mechanical joints in the field, except at the isolated flange joints (IFJ).
- J. Contractor shall coordinate with the manufacturers of bolts and nuts, washers, insulating washers, and nut caps to ensure the perfect fit of these items.

1.02 RELATED WORK

- A. Section 26 42 60 - Cathodic Protection

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- B. Section 33 11 41 - V-Bio Polyethylene Encasement of Ductile Iron Pipe

1.03 REFERENCED SPECIFICATIONS, CODES AND STANDARDS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. Where a date is given for reference standards, that edition shall be used. Where no date is given for reference standards, the latest edition available on the date of Notice Inviting Bids shall be used.
- B. American Society for Testing and Material
1. ASTM A193 / A193M, Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
 2. ASTM A194 / A194M, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
- C. American National Standards Institute
1. ANSI B18.2.1, Square and Hex Bolts and Screws (Inch Series)
 2. ANSI B18.2.2, Square and Hex Nuts (Inch Series)
- D. National Electrical Manufacturers Association
- E. Institute of Electrical and Electronic Engineers
- F. Insulated Power Cable Engineers Association
- G. Occupational Safety and Health Administration
- H. National Association of Corrosion Engineers
- I. All electrical equipment and materials and the design, construction and installation thereof shall comply with all applicable provisions of the National Electric Code (NEC) and applicable local codes and regulations.
- J. Where the Drawings or these Specifications require a higher degree of workmanship or better quality of material than implied by the above codes and standards, these Drawings and Specifications shall prevail.

1.04 CONTRACTOR SUBMITTALS

- A. Equipment and materials list shall be as specified in these Technical Specifications. After approval of the submittals by the City Representative, Contractor shall order equipment and materials necessary to complete the facilities so that any long delivery times shall not delay the completion of the work in the specified time.
- B. Brands or trade names are mentioned to set standards of quality: Use no substitute materials unless approved in writing by the City Representative. Approval of substitute materials does not relieve the Contractor of responsibility for providing a workable and functional system as designed.

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- C. Catalog cuts, bulletins, brochures or data sheets shall be submitted for items of material or equipment for which shop drawings are not designated to be submitted. This data shall be submitted marked with a clear indication of the Contractor's intent. A list of items indicated "as specified" will not suffice. A manufacturer's name alone will not suffice. The foregoing described catalog data are not required to be submitted for miscellaneous items of hardware which are needed to accomplish this work but which are not covered specifically in these specifications.
- D. Items to be submitted:
 - 1. Gasket
 - 2. Isolation washer/Steel back-up washer
 - 3. Isolation sleeve
 - 4. Test station
 - 5. Wire and Cables
 - 6. Pin brazing
 - 7. Bolts and Nuts
 - 8. ID tags
 - 9. Bolt and Nut Caps with Gel
 - 10. Test Reports
 - 11. Isolating Union

1.05 QUALITY CONTROL

- A. It is the intent of these Specifications and Drawings to establish quality standards for all equipment and materials and to require first class workmanship.
- B. All equipment and materials shall be new and of the highest quality and shall be supplied by a manufacturer regularly engaged in the production of such equipment.
- C. All work shall be accomplished by qualified, experienced personnel working under competent supervision.
- D. All exothermic welds/pin brazing shall be performed by personnel who have done this type of welding as their normal line of work.
- E. Equipment installed without prior review by the City Representative shall be subject to removal at the Contractor's expense.
- F. Contractor shall provide a corrosion engineer to perform all testing as outlined in Section 3.06.

1.06 INTERFERENCE AND ERRONEOUS LOCATIONS

- A. The locations of corrosion monitoring equipment as indicated on the Drawings are approximate only.
- B. Exact locations shall be determined by the Contractor subject to the approval of the City Representative.

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PART 2 - PRODUCTS

2.01 GENERAL

- A. All materials to be installed shall be new and of a quality generally accepted by the industry and must comply with the regulations and codes specified in Section 1.03. Nothing in the drawings or specifications is to be construed as permitting work not conforming to these regulations and codes.
- B. Where larger size or better grade materials than required by the above-mentioned regulations and codes are specified or shown, these Drawings and Specifications shall have precedence.

2.02 GASKETS: ISOLATED AND NON-ISOLATED FLANGE JOINTS

A. General:

- 1. All gasket materials shall be NSF-61 compliant.
- 2. The gaskets shall be Type "E" and occupy the surface of the flanges between outside diameter of the flange and the inside diameter of the flange.
- 3. The gasket manufacturer shall be certified to ISO 9001 Standards.
- 4. The gasket manufacturer shall have full time engineering staff for engineering support and AMTEC test rig for Gasket Validation.
- 5. Before installation, all gaskets shall require inspection for adherence to the specifications by the City Representative. City Representative reserves the right to reject any isolating material within the isolated flange kit due to the signs of defects and/or the poor workmanship.

B. ISOLATED FLANGE JOINTS

- 1. Each flange isolation kit shall consist of a sealing/isolation gasket of one piece construction, a full-length isolating sleeve for each flange bolt, two oversized isolating washers and two oversized Fluoropolymer coated steel back-up washers, see 2.03 Bolts and Nuts, below.
 - a. Isolation sleeve, isolation washers and one-piece sleeve-washer shall be fabricated from G-10 material.
 - b. Isolation sleeves and the sleeve of one piece sleeve-washer shall have 1/32 inch minimum wall thickness.
 - c. Isolation washer and the washer of one piece sleeve-washer shall have 1/8 inch minimum thickness.
 - d. The outside/inside diameter of the Zylon coated back-up washers shall be equal to the outside/inside diameter of the isolating washer.

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- e. The complete assembly shall have an ANSI pressure rating equal to or greater than the pressure rating of the flanges between which is installed.
- 2. All flange gaskets shall be new 1/8 inch thick G-10 with EPDM sealing elements.
 - a. The isolated flange sealing/isolation gasket shall have a 550 volts/mil dielectric strength.
 - b. EPDM sealing element placement shall accommodate flat faced flanges
 - c. The gasket shall be Incline Plane Groove/Rectangular Seal Element Type.
- 3. Manufacturer:
 - a. The manufacturer shall be capable of making dual seals or Tandem Seals.
 - b. Manufacturer shall be:
 - 1. Advance Products & System, Inc.;
 - 2. Lamons, Isoguard;
 - 3. PSI, Linebacker;
 - 4. Or Approved Equal.

C. NON-ISOLATED FLANGE JOINTS

- 1. Non-Insulating gaskets shall comply with requirements of Insulated Flange Joints Gaskets, as listed above, or:
- 2. Gasket shall be compressible. Gasket shall be fabricated from synthetic fiber with rubber binder. Gasket shall not “weep” sealed fluid through the fibers. Gasket shall swell in the presence of water to improve seal. Gaskets shall be 1/16 inch or 1/8 inch thickness, per manufacturer's recommendation for flange size and operating pressure.
- 3. Gasket shall be Garlock Multi-Swell 3760U, or approved equal.

2.03 BOLTS AND NUTS

A. General

Failure to comply with the length dimension specified herewith will result in material rejection.

- 1. General Dimensions:

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- a. Bolt dimensions shall conform to ANSI B18.2.1; Nut dimensions shall conform to ANSI B18.2.2.
 - b. For shoulder bolts, the shoulder diameter shall not exceed the threaded major diameter.
 - c. Threads shall conform to ANSI B1.1, Unified National Course (UNC).
2. Bolt Lengths:
- a. The length of all bolts for use with nuts shall be such that after joints are made up, each bolt shall extend through the entire nut by two complete threads, but in no case more than one-half inch beyond the nut.
 - b. The length of bolts and/or stud bolts for insertion into threaded blind holes shall be such that after joints are made up, each bolt shall extend into the threaded hole a length equal to a maximum of two times (2X) the threaded major diameter of the bolt or stud bolt, or a length equal to a minimum of one and one half times (1-1/2) the threaded major diameter of the bolt or stud bolt; or in accordance with the equipment manufacturer's written instruction.
 - 1) At no time shall the inserted threaded length of bolt and/or stud bolt be longer than 80% of the threaded depth of the threaded blind hole.
 - 2) In the case of a stud bolt installed in a threaded blind hole, the length of the nut-side of the stud bolt shall not exceed the limitations of 2.b above.
3. Bolts and Stud Bolts shall be cut flat with chamfered or rounded ends.
- B. Fasteners for AWWA Class "B" and "D" Flanges shall be:
1. Bolts and Stud Bolts— ASTM A307 Grade B;
 2. Nuts – ASTM A563A Hex for bolts 1-1/2 inch and smaller; ASTM A563A Heavy Hex for bolts larger than 1-1/2 inch;
 3. Washers – ASTM F436 Type 1 Round SAE Pattern.
- C. Fasteners for AWWA Class "E" and "F" Flanges shall be:
1. Bolts and Stud Bolts – ASTM A193 Grade B7;
 2. Nuts – ASTM A194 Grade 2H;
 3. Washers – ASTM F436 Type 1 Round SAE Pattern.
- D. Protective Coatings:
1. All Surfaces of bolts, nuts and washers shall be Chemically Cleaned.

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2. All bolts, nuts and washers shall be coated with multiple coats of fluoropolymer coating to provide chemical and corrosion resistance, a low coefficient of friction, and permanent lubrication to eliminate need for anti-seize compounds.
3. All steel washers, bolts and nuts shall have multiple coats of Fluoropolymer (Xylan) Coating. All bolts and nuts shall be coated with TRIPAC 2000 Blue Coat System, or approved equal.

E. Manufacturer:

1. All Bolts, Stud Bolts, Nuts, and Washers shall be supplied by TRIPAC;
2. Or Approved Equal.

2.04 MISALIGNED FLANGES

- A. In situations where misaligned flange bolt holes are encountered and will not accommodate the size of the bolt with the isolating sleeve, Contractor shall ream the holes as necessary to accommodate the bolt, nut and sleeve installation.

2.05 INSTALLATION NON-CONDUCTIVE LUBRICATION

- A. Suitable bolt installation dielectric non-conductive lubrication shall be provided by the Contractor. Grease shall be Lube-O-Seal, product code (NM-91), or Di-Electric grease by CRC Industries, Inc., product number (02085); or approved equal.

2.06 ISOLATING UNIONS

- A. Isolating unions, whether shown or not shown on drawings, shall be installed to isolate the two dissimilar metals. Isolating unions shall be installed at threaded or sweated fittings and shall have compatible ANSI pressure ratings.
- B. The isolating union shall be "O-ring" Flat Faced Type 150 Class 300 CWP, as manufactured by Central Plastics Company, or approved equal.

2.07 PIN BRAZING

- A. Pin Brazing as manufactured by BAC or approved equal, shall be provided for cable to structure connections. Connections shall be made at locations shown on Drawings, or as specified herein.
- B. The pin brazing shall be installed strictly in compliance of the instruction from the manufacturer. Machined lugs shall be used for all welds. Direct welding of wire is not allowed.
- C. The testing of the pin brazing shall be as specified in Section 3.03.C.

2.08 FLUSH MOUNTED (AT GRADE) TEST STATIONS

- A. The test station box shall be of cast iron, with a total weight including the lid not to exceed 60 pounds. The test station box shall be Mark V, I10BHVICT Cathodic Test as manufactured by Bingham and Taylor, or approved equal.

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- B. The cast iron lid for the test station box shall be marked "SFWD/CP".
- C. The terminal box shall be Big Fink, or approved equal. The color for the Big Fink cover shall be blue.

2.09 IDENTIFICATION TAGS

- A. All wires and cables shall be properly identified. The identification tag shall be typed on a heat shrinkable tube applied to each end of the wire.
- B. The marking shall be a permanent, nonsmearing, solvent resistant type, similar to Bradey, Raychem TMS, or approved equal.
- C. An identification tag shall be installed in front of each test station to identify the structure being tested. Nameplates shall be black phenolic with white lettering. The labels shall be as shown on the drawings.

2.10 NUT AND BOLT CAPS

- A. Nut and Bolt Caps shall be installed onto each flange bolt and nut that is inside the vault and above ground.
- B. Caps shall be sized to completely secured onto the head of the bolt and nut fitting flush with the surface of the flange or substrate.
- C. Nut and Bolt Caps shall consist of VCI (Volatile Corrosion Inhibitor). VCI ingredients shall have sufficient vapor pressure to release molecules from the resin compound into the air and block corrosive effects of electrolytes. VCI molecules condense in a microscopic layer on all metal surfaces they can reach.
- D. Nut and Bolt Caps shall be Advance Products Radolid® low density polyethylene caps molded with sealing lip mechanism and VCI (Volatile Corrosion Inhibitors) compound. Type II shall be used to cover a nut or bolt with washers under it.
- E. The KleerGel® Corrosion Inhibitor gel shall be applied inside each bolt and nut cap to provide extra protection. Contractor shall remove and totally wipe off all excessive gel around the caps.

2.11 WIRE AND CABLE

- A. The buried non-insulated mechanical joints shall be made continuous by providing a minimum of one bond cable per joint.
- B. Underground cables shall be stranded copper #8 AWG, type CP, USE-2, RHW-2, or HMWPE.
- C. Aboveground cables can be stranded copper wire, sizes as called for on the Drawings. The insulation can be type THHN or THWN.
- D. Cable to pipe connections shall be made with pin brazing as specified hereinbefore.

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PART 3 - EXECUTION

3.01 WIRES AND CABLES

- A. Each wire run shall be continuous in length and free of joints or splices, unless otherwise specified or shown on the Drawings. Care shall be taken during installation to avoid punctures, cuts or other damage to the wire insulation. Damage to insulation will require replacement of the entire length of wire.

3.02 ISOLATED FLANGE JOINTS (IFJ)

- A. The IFJ shall meet the dimension requirement as specified in Section 2.02. The flanges which do not meet the required dimensions, or pass the tests as specified in Section 3.02.D below, will be rejected.
- B. The length of the isolation sleeve is very critical. The isolating sleeve shall be precisely cut to the length in the factory as required to completely isolate the bolts from touching the flange, and to prevent cracking of the isolating sleeves when the bolts and nuts around the isolating flange are tightened.
- C. All isolation flange components shall be cleaned of all dirt, grease, oil, and other foreign materials immediately prior to assembly. After flanged bolts have been tightened, each isolation washer shall be inspected for cracks or other damage. All damaged washers or sleeves shall be replaced.
- D. Flange isolation kits shall be installed to effectively isolate adjoining metallic piping. Contractor shall test the performance of these flange isolation kits. The test shall be performed by a competent person or by a corrosion engineer and witnessed by the City's Inspector. All isolated flange joints shall satisfy both tests, using the Isolation Checker and using voltmeter with reference cell.

Isolation Checker: Testing shall be performed using a Gas Electronics Model No. 601 Insulation Checker or approved equal. The meter shall indicate 100% isolation. Any leaky joints shall be considered deficient and shall be repaired and retested at Contractor's expense.

Voltmeter with Reference Cell: A high impedance voltmeter and a copper/copper sulfate reference cell shall be used to verify the isolation of the IFJ. A minimum of 100-mV difference on both sides of the flange will be used as a criterion. If the 100-mV is not achievable, additional equipment such as a temporary ground-bed and a portable rectifier may be needed to accommodate the measurement.

The corrosion engineer who performed the tests shall sign the test results for both tests. Submit the signed document to the City Representative construction records.

- E. Contractor shall apply the touch up paint to the exposed steel after the test of the insulated flanges.

3.03 PIN BRAZING CONNECTIONS

- A. Pin Brazing connections shall be installed in the manner and at the locations shown on the Drawings. Coating materials shall be removed from the surface over an area just sufficient to make the connection. The steel surface shall be cleaned to white metal by grinding or filing prior to the Pin Brazing.

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- B. After the weld has cooled, all slag shall be removed and the metallurgical bond shall be tested for adherence to the pipe. All defective welds shall be removed and replaced.
- C. All wire connections, including bond cables shall be tested by Contractor, in the presence of the City Representative, for adherence to the metal surface. A 22-ounce hammer shall be used for adherence testing by striking three blows to each side of the weld. Care shall be taken to avoid hitting the wires. If there is any evidence of a defect, the Contractor shall remove and reinstall the weld connection by cleaning the surface and rewelding the wire to the pipe.
- D. All exposed surfaces of the copper wires and steel surfaces shall be covered with coating as shown in the Drawings.

3.04 COATING OF THE PIN BRAZING

- A. Contractor shall furnish all materials, clean surfaces and repair any damage to protective coatings and linings damaged as a result of the exothermic welding.
- B. The welds shall be coated with the material as specified on the Drawing. Assure that the area to be coated is thoroughly wire brushed, clean and completely dry.
- C. Buried exothermic weld: Cover the copper wires and steel surfaces with the Viscotaq Coating Patch, or approved equal. The coating material shall be applied per the manufacturer's instructions. This coating shall overlap the structure coating a minimum of 3 inches. Allow sufficient time to dry prior to backfilling.
- D. Exposed Pin Brazing: Remove dirt and other contaminations from the surfaces, hand-apply 2 coats of epoxy coating material on to the surfaces. The color shall match existing color or as approved by the City Representative.

3.05 TEST STATIONS

- A. The cables at each test Station shall be installed as shown on the drawings. Care shall be taken during installation of the cables to avoid punctures, cuts or similar damage to insulation. Any damage to insulation of the wire will require replacement of the entire length of cable.
- B. Locations of the test stations shall be as approved by the City Representative.
- C. All cables shall be terminated on the Big-Fink test station as shown on the Drawing. All cables shall be properly identified.

3.06 ACCEPTANCE TESTS

- A. All testing shall be performed by a corrosion technician under the supervision by a corrosion engineer, registered in State of California, or by NACE certified Cathodic Protection Specialist or a NACE certified Corrosion Specialist. The report shall be reviewed and signed off by the corrosion engineer or by the Cathodic Protection Specialist.
- B. Notify the City Representative at least 5 working days prior to the testing. All testing shall be witnessed by the City Representative.

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- C. All isolated flange joints shall be properly tested. All test reports shall be submitted to City Representative for record.
- D. Any deficiencies shall be repaired and retested by the Contractor at no additional expense to the City.
- E. Upon completion of the installation, the Contractor shall provide testing of the completed system by a qualified corrosion technician and the data shall be reviewed by a registered Corrosion Engineer to ensure conformance with the Contract Documents, NACE SP0169, and NACE SP0286.
- F. The Contractor shall provide a written report, prepared by the Corrosion Engineer documenting the results of the testing and recommending corrective work, as required to comply with the contract documents. A schematic diagram showing the location of all the corrosion facilities and GPS coordinates for all test stations shall be clearly identified in the report. Any deficiencies of systems tested shall be repaired and re-tested by the Contractor at no additional cost to the City.

END OF SECTION

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