

CORROSION MONITORING AND CATHODIC PROTECTION

0100 GENERAL

0101 Description of Work. The work under this section shall consist of furnishing all labor, tools, and equipment required to install or reinstall a corrosion monitoring system and cathodic protection system to 16-inch diameter or larger metallic material pipelines, including corrosion test stations (CTS), sacrificial anodes, wiring, connections, and joint jumper bonds. Where applicable, the CONTRACTOR is responsible for obtaining all permits required to complete the work.

0102 Reference Standards. The current version of the following publication existing at the time of bid advertisement shall form a part of these special specifications to the extent referenced.

- NACE Standard SP0169            Standard Practice- Control of External Corrosion on Underground or Submerged Metallic Piping Systems
- NACE Standard SP0286            Standard Practice- The Electrical Isolation of Cathodically Protected Pipelines
- NACE Standard SP0572            Standard Practice- Design, Installation, Operation and Maintenance of Impressed Current Deep Groundbeds
- NACE Standard SP0285            Standard Practice- Control of External Corrosion on Metallic Buried, Partially Buried, or Submerged Liquid Storage Systems
- NACE Standard SP0388-2007 American Water Works Association Standards (AWWA) D104-11

NACE Standard SP0196-2011 American Water Works Association Standards (AWWA) D106-10

0103 Submittals. The following submittals are required:

(A) Resumes and qualifications of the Corrosion Specialist, Cathodic Protection Specialist, Corrosion Technologists, Corrosion Technicians, and Cathodic Protection Testers, including certification number, whose services are proposed for the work contained in this section.

(B) New material submittals including drawings, catalog cut sheets, and other information regarding products to be furnished and installed on this project. Submittals for materials noted in this section and in the Tucson Water SD-700 Series Standard Water Details are not required.

(C) Proposed joint bonds for CCP, PCCP and steel pipe. See Note on page 4 of 10

(D) The corrosion monitoring system shall be installed in accordance with the plans and specifications section 1408 and Tucson Water SD-700 Series Standard Water Details. Field changes to the corrosion monitoring system, including corrosion test station locations and types, and the location and type of insulating fittings, shall be approved by the ENGINEER and documented in the Final Report and indicated on the redlined drawings.

(E) Three (3) paper copies of the Final Report, including field tests and data, ENGINEER'S comments, and other pertinent information pertaining to the corrosion monitoring and cathodic protection systems. One (1) copy of the Final Report, including tables, shall also be provided on a compact disc (CD) in a format compatible with Microsoft Word and Microsoft Excel. All items shall be submitted to the Construction Section prior to final acceptance.

0104 Personnel. All corrosion-related activities shall be performed under the guidance of a NACE International certified Corrosion Specialist or Cathodic Protection Specialist. All data analysis and final reports shall be reviewed and signed by the same Corrosion Specialist or Cathodic Protection Specialist. All testing shall be performed by or under the direct (in the field) supervision of a NACE International-Certified Corrosion Technologist. All work shall be consistent with sound corrosion engineering practice. The NACE International-Certified Corrosion Technologist shall also certify, in writing, that the work performed under this section was installed in accordance with the plans and specifications.

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0105 Qualifications. The corrosion monitoring and cathodic protection systems shall be installed by a qualified firm. Qualifications should include:

- Minimum of five (5) years' experience designing corrosion monitoring systems for 16-inch diameter or greater pipelines, for the pipe material being installed.
- Minimum of five (5) years for Hydro pneumatic tank, water reservoirs
- Maintain a full time NACE International-Certified Cathodic Protection Specialist on staff.
- Minimum of five (5) years' experience in conducting corrosivity studies on the pipe material being installed for corrosion problems and mitigation of stray current interference.
- Minimum of five (5) years' experience in installation of sacrificial anode or impressed current cathodic protection systems on 16-inch diameter and greater pipelines of the pipe material being installed and tanks, reservoirs, etc.

The CONTRACTOR may be required to submit verification of these qualifications prior to Notice to Proceed.

**0200 PRODUCTS**

**0201 Materials**

(A) Corrosion Test Stations. Corrosion test stations (CTSs) shall be in accordance with Tucson Water Standard Water Details SD-700 Series and these specifications.

Flush mount CTS's will be installed on a case by case basis and require "Prior" approval shall be per Tucson Water Standard Detail SD-705. CTS stranded wire conductors shall be terminated on a linen grade phenolic resin board as per SD-705. The lid for below grade test stations on potable water lines shall be painted using Seymour Precaution Blue, Spray on APWA Blue, or approved equal. The lid for below grade test stations on reclaimed water lines shall be painted using Seymour Safety Purple or approved equal. Concrete utilized in the installation of CTSs shall have a minimum 28-day compressive strength of 2500 psi.

Above grade CTSs shall be per Tucson Water Standard Detail SD-706. CTSs shall be Little FINK, Big FINK, or Fat FINK as manufactured by Cott Manufacturing, or approved equal. Little FINK test stations shall be installed only for Type I test stations per SD-710. Fat FINK test stations shall be installed at locations where 5 or more test leads are terminated in the test station. CTS stranded wire conductors shall be terminated on the test station's terminal board as per SD-705. Above grade test stations on potable water lines shall be constructed of blue polyethylene. Above grade test stations on reclaimed water lines shall be constructed of purple polyethylene. Need to insert a CTS for **Tanks/Reservoirs** – Installed per engineers approved plan.

(B) Wire and Cable. Wire and cable shall be continuous annealed, uncoated, stranded copper with 7/64-inch thick high molecular weight polyethylene (HMWPE) insulation conforming to ASTM D-1248, Type 1, Class A, Category 5, Grades E4 and E5. The insulation shall be surface indented or printed. Corrosion Test Station wires shall be #6 and #10 AWG, joint bond wires shall be minimum #2 AWG, sacrificial anode and zinc ribbon ground mat wires shall be #8 AWG, foreign utility test wires shall be per Owner standards. Reference electrode leads shall be as provided by the manufacturer for the length being installed. Wire sizes other than those listed in this section are not acceptable and as per **SD-708**

Identification of individual test leads shall be made using vinyl electrical tape spaced at three foot intervals, except inside the test station where the tape spacing shall be at six inch intervals. Vinyl electrical tape shall be 3M Super 33+ Scotch Brand, or approved equal. Color coding of the electrical tape shall be in accordance with Table 700-1.

\* All wire splices "must " be Pre-approved through Tucson Water Construction Section

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Stranded copper conductors shall be identified by surface markings indicating conductor size, manufacturer, and insulation material. All new HMW/PE stranded copper conductors shall be continuous (without splices) from the connection at the pipe, anodes, fittings, valves, etc. to the corrosion test station (CTS). Splicing of anode leads is acceptable in sacrificial anode header cable applications only.

Table 700-1: Wire Color Codes

Color	Source
White	New Transmission Main
Blue	Casing Pipe (Jack and Bores)
Black	Foreign Metallic Pipeline
Yellow	Permanent Reference Cell
Orange	Isolated Pipe, Valve, Fitting, or existing pipeline, etc.
Red	Anode
Green	Negative Structure Lead to Rectifier off of Protected Pipe

(C) Exothermic Welding Materials. Exothermic Welding materials shall be manufactured by Erica or Continental or approved equal. Exothermic welding materials consist of wire sleeves, welders, weld cartridges and molds according to the weld manufacturer's recommendations for each wire size and pipe or fitting size material and in accordance with Table 700-2. Weld materials and equipment shall be the product of a single manufacturer. Interchanging materials of different manufacturers is not acceptable.

Table 700-2: Exothermic Welding Materials for DIP

<b>Erico-Cadweld:</b>				
Welder	Weld Metal	Conductor	Sleeve	Pipe Dia.
CAHBA-1G-16	CA25XF-19	#10	B133-1L	16"
CAHBA-1H-16	CA25XF-19	#6	--	16"
CAHBA-1V-16	CA45XF-19	#6	B112	16"
CAHBA-1V-16	CA45XF-19	#2	--	16"
CAHBA-1G-24	CA25XF-19	#10	B133-1L	24"
CAHBA-1H-24	CA25XF-19	#6	--	24"
CAHBA-1V-24	CA45XF-19	#6	B112	24"
CAHBA-1V-24	CA45XF-19	#2	--	24"
CAHBA-1G	CA25XF-19	#10	B133-1L	OVER 24"
CAHBA-1H	CA25XF-19	#6	--	OVER 24"
CAHBA-1V	CA45XF-19	#6	B112	OVER 24"
CAHBA-1V	CA45XF-19	#2	--	OVER 24"
<b>Continental-Thermoweld:</b>				
Welder	Weld Metal	Conductor	Sleeve	Pipe Dia.
M-159-16	45CI	#10	A-201	16"
M-157-16	25CI	#6	--	16"
M-161-16	45CI	#6	A-202	16"
M-161-16	45CI	#2	--	16"
M-159-24	45CI	#10	A-201	24"
M-157-24	25CI	#6	--	24"
M-161-24	45CI	#6	A-202	24"
M-161-24	45CI	#2	--	24"
M-159	45CI	#10	A-201	OVER 24"
M-157	25CI	#6	--	OVER 24"
M-161	45CI	#6	A-202	OVER 24"
M-161	45CI	#2	--	OVER 24"
M-163	65CI	#1	--	30" OR LARGER

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Each exothermic weld, stranded copper conductors, and exposed portions of the pipe shall be covered with an approved exothermic welding cap as per manufacturer recommendations. If not applicable, an approved coating product will be used as per manufacturer's recommendations. Welding caps shall be Calpico Model "T" Cap, Royston Handy Cap, ThermOcaps by Continental Industries or approved equal. Primers shall be Calpico #22 primer, Royston Robond 747 primer, or approved equal. Exothermic weld coating products shall be Royston Roskote R-28, Calpico #10 mastic, or approved equal.

(D) Wire Connector Terminals. A one piece compression connector shall be installed on the end of all stranded wire before connecting to the corrosion test station terminal board in accordance with Tucson Water Standard Water Details SD-705. Compression connectors shall be installed utilizing crimping tools with a die or profile designed for the size of connector being utilized. Installation of terminals using locking pliers, lineman's pliers, or other non-crimping pliers shall not be permitted.

(E) Flange Insulating Kits. Flange Insulating Kits shall be manufactured by Advance Products & Systems (APS) or approved equal. The gasket shall be a Quad Seal Trojan by Advance Products and Systems or approved equal. The gasket shall be full face type "E", constructed of a G10 material, have a minimum dielectric strength of 400 volts per mil, and shall utilize at least two, separate sealing elements per face. The elastomeric sealing element seals shall be constructed of nitrile. The bolts of the FIK shall be electrically isolated from both flanges utilizing either two, one-piece integral sleeves and washers or a continuous sleeve and dual insulating washers. The sleeves and washers shall be constructed of Minion or Mylar. The kit shall include 2, 1/8" thick stainless steel washers to protect the insulating washer from damage by the nut and bolt. Bol ts and washers shall be Type 316 St ainless Steel. Nuts shall be Type 316 St ainless Steel with a Xylan coating.

(F) Joint Bonds. All pipe sections, fittings, mechanically restrained fittings, bolted joint assemblies, gasket joint assemblies, and valves shall be coupled using a minimum of two (2) bonding conductors/joint bonds. Fully welded concrete cylinder pipe and steel pipe joints shall not require joint bonds. Joint bonds shall be installed at all pipe connections except pipe connections called out to be electrically isolated. For ductile iron pipe, the following table outlines the number and size of joint bonds:

Table 700-3: Joint Bonds for Ductile Iron Pipe

Diameter (in)	Class (psi)	Number of Conductors	Size (AWG)	Max. Length (inches)
16	250	2	2	24
16	350	2	2	18
24	200	2	2	16
24	350	3	2	18
30	200	4	2	22
30	350	4	2	18
36	200	5	2	18
36	350	5	2	16
42	200	6	2	16
42	350	7	2	16

\*Need to insert "Bonding Clips" for CCP or PCCP. Three (3 each) welded per joint

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The values in Table 700-3 were determined utilizing Equation 700-1 below for calculating the electrical resistance in a length of pipe and the criteria that the electrical resistance due to bonding conductors per 1000 feet of pipe shall not exceed 250 percent of the electrical resistance of 1000 ft of pipe.

$$I = (1 + R_8/R_p)100 \quad \text{Equation 700-1}$$

where:

I = Percent increase in electrical resistance

R<sub>a</sub> = Resistance, in ohms, of the bonding conductors per 1,000 feet of pipe

R<sub>p</sub> = Resistance, in ohms, of 1,000 feet of pipe calculated as follows:

$$R_p = 0.22/W_p \text{ (Steel) Equation 700-2}$$

$$R_p = 0.86/W_p \text{ (DIP) Equation 700-3}$$

W<sub>p</sub> = Weight of pipe in pounds per linear foot

The CONTRACTOR may submit, to the ENGINEER for approval, alternatives to the joint bonds contained in Table 700-3, provided that they meet the resistance requirements outlined above. The CONTRACTOR is required to submit, to the ENGINEER for approval, proposed joint bonds for CCP, PCCP, or steel pipe prior to construction.

\* \*NOTE: All Joint Bonds shall be installed at Pipe Crown. No exceptions. Including @casing insertion point, through casin to the exiting.

(G) Caution Tape. Caution Tape shall be 6-inches wide and imprinted with 1-inch tall, permanent black lettering which shall read "CAUTION - CORROSION TEST LEAD BURIED BELOW - CONTACT TUCSON WATER. Tape shall be blue for potable water projects and purple for reclaimed water projects. Joining clips shall be manufacturer's standard tin or nickel coated. Tape shall be as manufactured by Terra Tape, or equal.

(H) Sacrificial Anodes. Sacrificial anodes shall be high potential magnesium anodes, as manufactured by Farwest, Mesa Products, or approved equal. The bare anode ingot shall be either 17 pounds or 32 pounds as indicated on the plans or in the special provisions. The anode ingot shall contain that alloy combination contained in Table 700-4.

Table 700-4: Anode Ingot Composition

Component	Fraction by Weight
Aluminum	0.01% Max.
Manganese	0.50% - 1.3%
Copper	0.02% Max.
Silicon	0.05% Max.
Iron	0.03% Max.
Nickel	0.001% Max.
Impurities	0.05% Max. each
Magnesium	Remainder

The normal combined weight of the anode ingot and backfill shall be approximately 45 pounds for the 17 pound bare anode and 70 pounds for the 32 pound bare anode. Sacrificial anodes shall be prepackaged in a cloth bag with 75% gypsum, 20% bentonite, and 5% sodium sulfate. Anode lead wire shall be long enough so that no splices exist between the anode and the CTS, except in header cable applications. Anode lead wire shall be #8 AWG continuous stranded copper wire with HMWPE insulation, black in color. The anode lead wire shall be attached to the galvanized steel anode core by 45% silver solder connection.

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(I) Splice Kits. 3M Scotchcast 82-A, 82-B1, and 90-B1 or Royston SpliceRite splice kits shall be used to insulate and moisture seal the magnesium anode lead to header cable connections. Splice Kit shall be installed per manufacturer's recommendations. Splices in other applications will require the approval of the ENGINEER.

(J) Wire Connectors. Anode wire to header cable connection shall be made with Burndy C crimp YC4C8 connectors, or approved equal. Crimp connector size shall be per manufacturer's recommendation for #8 AWG stranded copper to #6 AWG stranded copper wire connections. Crimp connectors shall be installed with a tool designed and specified for installation of the connector

(K) Rubber Splicing Tape. Rubber-splicing tape shall be installed to cover all exposed copper at the crimp connection. Rubber splicing tape shall be 3M 23 Scotch Brand, or approved equal.

(L) Vinyl Electrical Tape. Vinyl electrical tape shall be 3M Super 33+ Scotch Brand, or approved equal.

0300 EXECUTION

0301 General

(A) The drawings indicate the extent and general arrangement of the Cathodic or corrosion monitoring protection system including corrosion test stations, sacrificial anodes, impressed current systems, and appurtenances. Any changes to the corrosion protection system design or method of installation shall be reviewed by the ENGINEER prior to installation.

(B) The reasons for proposed changes to the Cathodic or corrosion monitoring protection system design or method of installation, and details of proposed changes, shall be submitted to the ENGINEER for review at least ten (10) working days prior to date of proposed installation.

(C) The CONTRACTOR shall inspect the project site and shall review the location of existing utilities, structures, and appurtenances prior to the start of construction. The CONTRACTOR shall promptly notify the ENGINEER if the location, type, or number of existing utilities, structures, and appurtenances, differs substantially from the information provided on the drawings.

(D) The CONTRACTOR shall be responsible for notification and coordination of the corrosion protection system installation with foreign utility company representative's prior start to construction. The CONTRACTOR shall notify El Paso Natural Gas Company, Southwest Gas Corporation, Kinder Morgan, and Central Arizona Project at least five (5) working days prior to construction near any foreign utility pipelines.

(E) The CONTRACTOR shall be responsible for the protection of existing utilities, structures and appurtenances, and the proper routing of buried cable and location of corrosion test stations.

(F) The installation of the corrosion monitoring and cathodic protection system, as described herein and shown on the drawings, shall be in accordance with the following: applicable portions of the latest National, State, County, and City electrical codes and regulations; Pima County and City of Tucson construction permit conditions; manufacturer's recommendations and instructions; and Tucson Water Standard Water SD-700 Series Details. All work shall present a neat and finished appearance.

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- (G) Elements of the cathodic protection or corrosion monitoring system shall be installed within the limits of existing right-of-way and utility easements.
- (H) All stranded copper conductors between the pipe and the CTS shall be brought up from the pipe joint nearest to the CTS indicated on the drawings.
- (I) Corrosion Test Stations (CTS) shall be installed at the locations indicated on the drawings. CTS locations include the beginning and end of the pipeline, at all insulation fittings, at all metallic foreign line crossing, at locations of dissimilar materials, and at intervals of approximately 1,000 linear feet along the pipeline.
- (J) The CONTRACTOR shall salvage any existing above grade corrosion test station and phenolic resin terminal board(s) deemed to be in good condition by the ENGINEER. All salvaged components shall be returned to the Tucson Water Maintenance Division.
- (A) Protection of Materials. All materials shall be stored above the ground, and protected against weather, condensation, and mechanical damage. Equipment or materials damaged during shipment or in the course of installation shall be replaced. All damaged materials shall be promptly removed from the project site. Materials shall be handled with care to avoid damage. All wire shall not be sharply bent or tightly coiled to minimize potential for damage during manufacture, shipment, storage, and installation.
- (B) Corrosion Test Stations. Flush grade CTS's requires "Prior" approval shall be field located for permanency 2 feet behind present or future curb. Flush grade CTS's are not to be located in areas subject to vehicular traffic. If this is unavoidable, location must be approved by the ENGINEER. Above grade CTS's shall be field located 12 feet beyond pavement edges where no curb exists or 2 feet from property line, fences, easements, or as otherwise shown on the plans.
- (C) Foreign Pipelines and Test Leads. The CONTRACTOR is to notify the ENGINEER five (5) working days prior to the installation of foreign line test leads and the CONTRACTOR shall coordinate requirements of the Blue Stake Laws and all construction requirements from Kinder Morgan Energy Partners, El Paso Natural Gas Company, Southwest Gas Corporation, and Central Arizona Project concerning the work in and around gas and water pipelines.

The CONTRACTOR shall notify the following representatives prior to construction activities near their respective pipelines:

Table 700-5: Pipeline Contact Information

Company	Phone Number	Notification Requirements
El Paso natural Gas	(520)574-4929	72 Hours
Southwest Gas Corporation	(520)794-6021	72 Hours
Central Arizona Project	(623)869-2209	72 Hours
Kinder Morgan Energy Partners	(520)514-1065x108	72 Hours

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The CONTRACTOR may be required to uncover the foreign line so that others can attach the HWM/PE stranded copper conductors to the foreign line. The CONTRACTOR shall furnish materials and may be required to install all HWM/PE stranded copper conductors from the foreign line to the CTS.

(D) Trenches. Direct burial cables, underground conduit, and wires shall be installed in a clean trench, free of debris, rocks, or other material, which may damage the insulation or conduit. All cables shall be placed in the trench with sufficient slack to prevent strain. All cables shall be installed a minimum of 36-inches below final grade. Blue caution tape shall be installed over wires and 24 inches below grade. Caution tape shall be installed along the centerline of the wires in accordance with Section 0201, Paragraph (G).

Trenches shall be carefully backfilled with clean excavated soil and compacted as required by local code, or to 90% relative compaction as determined by ASTM D698. Care shall be taken to prevent damage to the cable during backfill and compaction of trenches.

(E) Splicing. If splicing of stranded copper conductors is required, the new conductor shall be spliced to the old conductor of the same size by "butting" stripped conductor ends inside an appropriately-sized aluminum compression connector. The connector shall be crimped utilizing a tool specified by the connector manufacturer. The new connection shall be sealed with a hot shrink splice for non-shielded conductors. The shrink splice shall be of the appropriate size to completely cover the aluminum compression connector and any exposed wire, and shrunk to form a water tight seal. If existing conductors are not of the #10, #8, or #6 size, the Tucson Water Inspector shall be contacted for **instruction. Splices in underground cable shall be made only where specified or approved by the ENGINEER. \* All Wire splices "must" be preapproved!**

(F) Sacrificial Anodes. Sacrificial Magnesium Anodes shall be installed at the locations indicated on the drawings. The sacrificial anode shall be soaked thoroughly with water just prior to installation. Anodes shall be laid horizontally in the trench, at an equal distance between the water line and the foreign utility, if applicable. Clean fill, free of rocks and debris, shall be used to backfill the anode to a height of 1 foot above the anode. Water shall be used to saturate the soil backfill around the anodes immediately after installation. The soil backfill shall be saturated immediately after the sacrificial anodes are installed. Care shall be taken to prevent stressing or damaging the anode lead wire during installation and backfill procedures. The anodes shall not be suspended by the lead wire at any time, prior to or during installation. 24 hours prior to burial, the CONTRACTOR shall test each anode and verify that the anodes are properly installed. Direct connection anodes to pipelines are not permitted. All anode connections to pipelines must be through a CTS.

(G) Exothermic Welding. All exothermic welding and coating shall be performed in accordance with Tucson Water Standard Water Detail SD-703.

(H) Wire to Zinc Ribbon Connections. Wire to zinc ribbon connections shall be made by removing 2 inches of the zinc material from the galvanized core. The ribbon core and wire shall be spliced using a C Type crimp connector of appropriate size per manufacturer's recommendation. All exposed ribbon core and copper wire shall be thoroughly covered with two each layers of 50 percent overlap spiral wrapped rubber splicing tape. Rubber splicing tape shall than be covered with two layers of vinyl electrical tape extending 1 inch minimum beyond the rubber tape on both ends of the spliced area.

**0303 Warranty**

(A) All workmanship, materials, and equipment provided and installed by the CONTRACTOR shall be guaranteed for a period of two (2) years from the date of substantial completion.

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(B) Requirements. The Contractor shall perform the following tests on the Cathodic Protection and Corrosion Monitoring System, if applicable:

- (1) Station integrity test. This shall be performed by applying current to the pipeline and recording I(on) and I(off) potentials at each CTS.
- (2) Pipeline native (static pipe-to soil) potentials and each CTS.
- (3) Pipeline electrical continuity (current test).
- (4) Effectiveness of flange insulating kits (insulating joints) both before and after burial.
- (5) Verification of casing isolation.
- (6) Measurement of soil transitivity at each test station at 5-, 10-, and 15-foot depths using the Wenner 4-pin method
- (7) Stray current tests. The Contractor shall coordinate with the foreign utility Owner for joint test procedure.
- (8) Potentials of foreign structures before and after correction of stray current interference.
- (9) Evaluation of interference effects from or to adjacent utility systems and structures. A description of all corrections made for interference effects shall be documented. These test and corrections shall be coordinated with respective utility operators.
- (10) Pipeline span resistance between adjacent test stations.
- (11) Rectifier location and outputs in volts and amperes from impressed current systems on foreign pipelines from locations used to perform the current test.
- (12) Pipe-to-soil potentials before and after connection of sacrificial anodes.
- (13) Current output of each anode or anode header cable as measured across a 0.01-ohm shunt.
- (14) Location, size, and drainage current of each resistance bond installed for mitigation of stray current effects (if necessary).

The Contractor shall provide the Engineer with 3-day advance notice before beginning test. All testing shall be performed under the direct supervision of a NACE International Certified Corrosion Technologist, and then reviewed and verified by a NACE International Certified Cathodic Protection Specialist. If any tests reveal that the installation does not meet the project specifications, the Contractor shall perform all repairs and retests at no cost to the Owner.

The Contractor shall submit for the Engineer's approval a final report, including all test results, within 30calendar days of completion of testing.

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(C) Final Report. Within 60 calendar days of completing all corrosion monitoring and cathodic protection system installation, the Contractor shall submit 3 hard copies of the Final Report to the Engineer for approval. The report shall include the following:

- (1) Field tests and data outlined in Subsection 1408.0105(B), above.
- (2) Engineer's comments.
- (3) Verification that each new or related corrosion component is installed per the standard specifications and working as designed.
- (4) Identification of any existing or potential "hot spots" where corrosion is a concern.
- (5) Comparison of the theoretical resistivity to the actual resistivity of the transmission main.
- (6) List of all equipment and labor required to perform the testing outlined above.
- (7) Photographs with descriptive captions of all corrosion monitoring and cathodic protection system components installed by the Contractor.
- (8) Other pertinent information regarding the corrosion monitoring and cathodic protection systems

One copy of the Final Report, including tables, shall also be provided in a digital format compatible with Microsoft Word and Microsoft Excel. The Engineer will review the report for compliance with the plans and specifications and will notify the Contractor of final acceptance or the need for revisions. Acceptance of the Final Report will be required prior to substantial completion of the project.

1408.0306 Record Drawings. The Contractor shall redline the project drawings at each CTS, foreign line crossing, and sacrificial anode installation. The redlined drawings shall be performed per acceptable standards and Owner approval.

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