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CorrStop

网状阳极、阴极保护、腐蚀检测、PVC 粉末涂料、FBE 粉末涂料

## SPECIFICATION

### AUTOMATICALLY CONTROLLED IMPRESSED CURRENT

### CATHODIC PROTECTION FOR INTERIOR OF STEEL

### WATER TANKS

#### A. SCOPE

The cathodic protection design/install constructor shall provide all engineering services, materials, equipment, labor, and supervision for the installation of an automatically controlled impressed current cathodic protection system for corrosion control for the interior submerged surface of the specified tank. All work furnished shall be in accordance with A.W.W.A. Standard D104-97 and features included in this specification. The cathodic protection constructor shall be Corrpro Waterworks.

All engineering services shall be provided by a Corrosion Specialist who is accredited by the National Association of Corrosion Engineers International as a Senior Corrosion Technologist, Corrosion Specialist, or Cathodic Protection Specialist.

The Corrosion Specialist shall provide services for:

- Design of system
- Supervision of installation
- Supervision of start-up testing
- Review of reports

#### B. DESIGN

The system shall be designed by a Corrosion Specialist with experience in cathodic protection for water storage tanks. The Corrosion Specialist shall design the system to provide effective corrosion control in accordance with criteria for protection. The criteria for protection shall be based on a tank-to-water potential, IR drop free, within a range of -0.850 volts to -1.250 volts relative to a stationary copper-copper sulfate reference electrode. This potential shall be measured free of the effect of voltage gradients (IR drops).

The Corrosion Specialist shall also base system capacity and performance on:

1. Total submerged surface area of the tank. Total surface area includes HWL in bowl and wet risers in elevated tanks, which are 10" diameter or larger.
2. Type of coating and condition of coating.
3. Total bare surface area to be protected will be a minimum of 50% of total surface area.
4. Minimum current density of 10 MA/ft.2 bare surface area.
5. Chemical analysis of water including resistivity expressed in ohm-cm.
6. Tank is, or is not, susceptible to icing.
7. Minimum anode design life of twenty (40) years.

~~8. Selection, dimensions, and layout of system components specified in Section C.~~

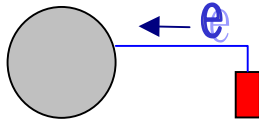
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## C. SYSTEM COMPONENTS

### C.1 RECTIFIER

The rectifier unit shall perform in accordance with ANSI/AWWA Standard D104-97 Section 4: 4.1.1.1.1., Type A, IR drop free system, and include:

1. Transformer
2. Selenium or silicon rectifying elements
3. Circuit breaker(s)
4. Lightning, surge, and overload protection
5. Provision for air-cooling operation
6. Voltmeter(s) and ammeter(s)
7. Weatherproof cabinet in accordance with NEMA 3R requirements
8. Provision to vary current output from 0% to 100% of rated capacity
9. Provisions for mounting, grounding, and locking
10. Provision for 110-120 volt, 60 Hz, single phase A.C. power
11. D.C. output capacity in volts and amperes in accordance with Design (Section B)
12. Number of circuits or separate rectifiers in accordance with Design (Section B)
13. Automatic controller shall be AWWA D104-97, Type A and shall adjust current output to compensate for changes in water level, temperature of water, water chemistry, and cathodic polarization, and shall include the following provisions:
  - Utilize long-life reference electrode(s) mounted in tank
  - Monitor the tank-to-water potential, free of IR drop
  - Automatically adjust the tank-to-water potential, free of IR drop, to a preset value (Section B)
  - Operate within 25MV of preset value
  - Limit current to a preset value
  - Utilize potential meter(s) to display tank-to-water potential, free of IR drop

### **C2. LONG LIFE REFERENCE ELECTRODE(S)**

The permanent reference electrode shall consist of a copper-copper sulfate electrode which is manufactured to remain stable (plus or minus 10MV) for a minimum of ten (10) years. The reference electrode to lead wire connection shall be encapsulated to prevent water migration.

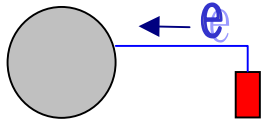
The stationary reference electrode shall be positioned in the tank water to provide the most representative measurements for the submerged surface area(s).

### **C3. ANODE SUSPENSION SYSTEM**

#### **FOR ICING TANKS**

The anode suspension system shall be designed to be resistant to ice damage and in accordance with ANSI/AWWA Standard D104-97, Section 4.2.4.1.1 Type A, Horizontal System.

The anode suspension system shall consist of a minimum 5/16" polyester cord. The cord shall be secured to steel anchors welded to the side wall of the tank bowl or to the exterior of the dry access column of spheroidal type tanks and the side wall of wet risers which are 30" diameter or larger. All cord to cord connections shall be tied and taped.



#### ***FOR NON-ICING TANKS***

The anode suspension system shall be in accordance with ANSI/AWWA Standard D104-97, Section 4.2.4.2, 1. Type A, Horizontal System or 4.2.4.2.2 Type C, Vertical System. The anode lead wire shall be a minimum #10 HMWPE or U.S.E. The anode lead wire for vertical suspension shall be attached to a porcelain insulator bracket bolted or welded to the interior of the tank roof.

Handhole assemblies used for the installation of vertical anode suspension systems from the roof of the tank shall consist of a 6" diameter steel cover, rubber gasket, and a steel bar and bolt assembly for each 5" diameter access opening..

#### ***C4. ANODE MATERIALS***

The anode materials shall be selected in accordance with Design (Section B) and shall consist of one of the following:

1. Minimum .062" diameter platinized niobium with 25 micro inches of platinum. The wire anode shall be continuous with a maximum of two (2) anode to header connections.
2. Minimum .062" diameter titanium with a precious metal oxide coating. The wire Anode shall be continuous with a maximum of two (2) anode to header connections.

All anode to header cable connections shall be sealed to prevent water migration.

#### ***C5. PRESSURE ENTRANCE FITTING***

For icing tanks the pressure entrance fitting shall accommodate anode and reference electrode lead wires at the base of the tank or at the base of wet risers for elevated tanks, which are 30" diameter or larger. The fitting shall be manufactured to prevent leakage through the fitting and to prevent water migration through the wire insulation.

The entrance fitting shall be sized for a maximum 1.5 inch Schedule 80 steel coupling.

#### ***C6. WIRING***

All wiring within the tank shall be insulated to prevent copper conductor to water contact.

All wiring on the exterior of the tank shall be insulated and run in rigid conduit.

#### ***C7. HARDWARE***

All hardware used in conjunction with the system shall be protected against corrosion.

#### ***C8. ANSI/NSF 61***

All materials in contact with the water, or exposed to the interior of the tank, shall be classified in accordance with ANSI/NSF 61 "Drinking Water System Components."

#### **D. SUBMITTALS**

The cathodic protection constructor shall submit the following information to the purchaser for approval by the Owner or his representative.

1. Drawings showing system design/configuration.
2. Description of system components.
3. Copy of ANSI/NSF 61 classification for all system components located within the tank.

#### **E. WORKMANSHIP AND INSTALLATION**

##### ***E1. QUALIFICATIONS***

The cathodic protection constructor shall have a minimum of five (5) years experience installing and

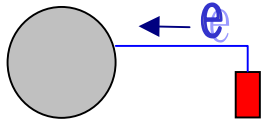
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servicing the types of system described in this specification. The system shall be installed by personnel specifically trained by the constructor to provide all workmanship required for corrosion control performance. All personnel shall be subject to Federal Substance Abuse and Testing Regulations.

## **E2. PERFORMANCE**

All work shall be in accordance with the following requirements:

1. Components of the cathodic protection system shall be installed in the manner and at the locations as shown on the design drawings prepared by the Corrosion Specialist.
2. Pressure entrance fitting shall be installed in accordance with AWWA D100-96, Section 3.13.
3. Welding, cutting, and coating shall be in accordance with AWWA Standards D100, D102, and D105.
4. Welding of steel coupling and anchors for horizontal anode suspension and rectifier mounting bracket shall be furnished by the prime contractor prior to coating the tank. Cutting of 5" diameter access openings for vertical anode suspension shall be furnished by the prime contractor. The cathodic protection constructor shall furnish drawings and materials to the prime contractor prior to coating.
5. Electrical continuity of all sections of bolted or riveted tanks shall be furnished by the prime contractor.
6. Materials and equipment shall be inspected prior to installation. Any defective component shall be repaired or replaced.
7. Electrical work shall be in accordance with the National Electrical Code.
8. Lead wires shall be installed to prevent damage from abrasion.
9. Electrical connections within the tank shall be sealed to prevent water migration.
10. The rectifier shall be mounted at a convenient height (eye level) above grade for monitoring and service purposes.
11. A.C. power to the rectifier shall be furnished by the purchaser.
12. Disinfection shall be the responsibility of the purchaser.
13. Work provided by the cathodic protection constructor shall be completed in a clean and safe manner.

## **F. ENERGIZING SYSTEM**

After the system is installed and the tank is filled, the cathodic protection constructor shall provide startup service which includes energizing, testing, and adjusting the system for optimum performance of the cathodic protection system. This startup service shall be in accordance with ANSI/AWWA D104-97 Section 5.2 Testing, 5.2.1 Field Test for Type A, IR Drop-Free System. This startup service shall be coordinated with the Owner or his representative.

All tank-to-water potential measurements shall be conducted with a calibrated portable copper-copper sulfate reference electrode and a portable high impedance voltmeter. A minimum of five (5) locations shall be measured. All test data shall be reviewed and evaluated by the Corrosion Specialist.

The final test and adjustment of the system shall be conducted approximately twelve (12) months after the startup service.

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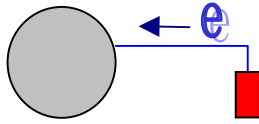
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In addition to the startup service, "as-built" drawings and an Owners Maintenance Manual shall be submitted to the purchaser.

## **G. MONITORING**

### **GI. PERFORMANCE**

The cathodic protection constructor shall furnish self-addressed report cards to be completed by the owner. Report cards received by the cathodic protection constructor during the guarantee and service period(s) shall be evaluated for system performance.

## **H. GUARANTEE**

All workmanship, equipment, and materials furnished by the cathodic protection constructor shall be guaranteed for one (1) year.

## **I. SERVICE AGREEMENT**

The cathodic protection constructor shall furnish a service agreement for the type of system installed. The agreement shall include the annual service rate and a complete description of the scope of work proposed.

The agreement for annual inspection and potential testing shall be in accordance with AWWA D104-97 Appendix C and include as a minimum:

1. One (1) annual job site visit.
2. Tank-to-water potential measurements conducted at representative locations within the tank. A minimum of five (5) locations shall be measured.
3. Measurements shall be conducted with a portable high impedance voltmeter and a calibrated copper-copper sulfate reference cell.
4. Adjustments for optimum corrosion control shall be in accordance with criteria for protection.
5. Data recorded shall provide sufficient information to evaluate the performance of the system relating to criteria for protection.
6. In the event additional work is required, the constructor shall submit a report with recommendations for optimizing corrosion control.