# Cathodic Protection Specification

# Impressed Current Cathodic Protection Water Tank Interior

## 1. Scope of Work

The contractor shall provide and install a complete automatic impressed current cathodic protection system, to prevent corrosion on the interior submerged surface of the water tank. Contractor will provide all equipment, rectifiers, wiring, and wiring devices, necessary to produce a continuous flow of direct current from electrodes in the water electrolyte to the metal tank surfaces. The installation shall meet the standards of AWWA D 104 and NACE SP0388-2014 for system design and the ANSI/NSF Standard 61 for drinking water exposure.

## 2. Quality Assurance and Qualifications of Personnel

Obtain the services of a corrosion engineer to design, supervise and inspect the installation and performance of the cathodic protection system. Corrosion engineer will be someone, who, by reason of thorough knowledge of the physical sciences and the principles of engineering and mathematics acquired by professional education and related practical experience, is qualified to engage in the practice of corrosion control on steel water tanks. Such a person must be accredited or certified by the National Association of Corrosion Engineers (NACE) as a NACE Corrosion Specialist or a NACE certified Cathodic Protection (CP) Specialist or be a registered professional engineer who has certification or licensing that includes education and experience in corrosion control on steel water tanks, if such certification or licensing includes 10 years' experience in corrosion control on steel water tanks.
Corrosion Engineer may use a NACE Certified Level II technician to conduct field testing. Level II tech will be on site for all installation of the cathodic protection system.

## 3. Submittal Documents

Provide drawings showing tank dimensions, anode arrangement, and reference cell location for both elevated, plan and sectional views of the tank, anode size and number, anode material, anode-suspension details, conduit size, wire size, rectifier size and location, handhole details, test access ports or wire gland penetration details, wiring diagram, and any other pertinent information considered necessary for the proper installation and performance of the system. Corrosion engineer will determine if the tank is located geographically to warrant system design to avoid icing conditions. Drawings shall also contain complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will function as a unit. Cathodic protection design will use material and design parameters that will yield a minimum 20 year system life.

Produce calculations for current requirement, anode to electrolyte resistivity, rectifier sizing and any other information to provide a complete design. Test local water for resistivity, or obtain through dissolved solids data, for use in the calculations. All drawings and calculations must be signed or sealed by the corrosion engineer whose qualifications are a part of the submittal.

Submit a list of materials and equipment that shall include catalog cuts diagrams, and other descriptive data required by the owner/engineer to show a complete system. ANSI/NSF Standard 61 compliance documents shall be a part of the submittal package.

4. Equipment and System Components
   (All Interior system components must meet ANSI/NSF Standard 61)

Rectifier:

Rectifier will be an auto potential controlled unit housed in one of the following case types, (Fiberglass UV resistant or hot dipped galvanized steel at owner option).

Rectifier unit shall consist of a transformer, rectifying elements, transformer tap adjuster, auto potential control circuitry, terminal block, one dc output voltmeter, one dc output ammeter, one structure to water potential meter, switches for all meters, an ac power-supply circuit breaker, lightning arresters for both input and output; all wired and assembled in a weatherproof cabinet. Digital meters will be minimum 1" high and have an on/off switch. All shunts, meters, switches and breakers shall be mounted on a front panel with engraved notations for each component. Analog meters will be a minimum of 2" D'Arsonval movement type.

The overall efficiency of the rectifier shall be not less than 65 percent when operated at nameplate rating and shall be capable of supplying continuous full rated output at an ambient temperature of 110 degrees F in full sunlight with expected life in excess of 10years.

Anodes:

Anodes will be platinum or mixed metal oxide wire or ribbon and be listed in the NSF approved product listing for the system. Corrosion engineer will design and provide the anode material size on the drawings.

Reference Electrodes:

Electrodes will be the product of a national manufacturer and be factory calibrated to within 5mv of the manufacturer's standard. Calibration stickers or labels will appear on the cell package and included in the engineers final testing report. Site reference cell calibration will not be accepted. Reference electrode lead wire will be #14 HMWPE length sufficient to run to the penetration gland or the tank roof junction box without splicing. Reference cell in the bowl of the tank will be used for system potential control. Remaining 3 reference cells will be terminated in a test station next to the rectifier or in the rectifier cabinet marked for location inside the tank.

Reference cells will be located a minimum of two in the riser, two in the tank bowl. Ground storage tanks or standpipes will have a minimum of two cells located, one at the floor and one at mid-point water level. All lead wires will be terminated in the rectifier cabinet on a terminal block properly identified or in a test station box located next to the rectifier.

Wiring:

Tank interior or submerged wiring will be HMWPE #8 or #10 sized by the designer. Conduit wiring will be stranded THWN minimum #12 AWG.

Interior Anode header cable will be #10 HMWPE or larger.

Conduit

Rigid galvanized steel conduit and accessories shall conform to UL 6.

Suspension Method

For floating suspended systems floats and connecting ropes will be as follows: Rope will be minimum 3/8" Θ. Floats will have a minimum buoyancy to support anodes, reference cells and wiring and suspend those components. Total buoyancy of the floats is to be a factor of two times the weight of suspended components.

Roof suspended systems will use holes cut by the tank fabricator in the tank roof for anode suspension and mounting. "Hand Holes" will be 5" Θ with two 3/8"Θ drilled hole approximately 7" on center. Two clevis suspension insulators will be used at each hole. One insulator will be used to suspend the anode string and the other to hold the header cable. Hole pattern will be established in the design described in section 3 Submittal Documents. Anodes will be attached to the roof using a porcelain insulator with stainless steel or galvanized hardware. Header cable will interconnect all anodes in the bowl circuit and be connected to the rectifier bowl terminal. Separate circuit for the riser string will be provided.

## 5. Testing and Reporting

The corrosion engineer will use the following to prepare the final report

Acceptance criteria for determining the adequacy of protection on the internal submerged surfaces of steel water tanks shall be in accordance with NACE SP0388-2014. At no point in the tank will the measured polarized potential exceed 1v (1000mv) with respect to the permanent copper sulfate reference cells. System controller will be set to operate at 950mv CSE.

If the system is installed on a tank with coating age in excess of one year the engineer or the technician must provide potential profile criteria that will prove consistent potentials throughout the tank submerged surfaces.

Test Report

The corrosion engineer will provide a written report to the owner containing all pertinent rectifier name plate information, settings and internal potential profile to indicate a properly operating cathodic protection system that will provide the proper level of corrosion protection for a life of 20 years. The report shall contain the following measurements native/on/polarized or instant off:

- Potential profile measured at a minimum of 4 places in the riser, near top, near bottom and two intermediate measurements for the riser length.
- Potential profile in the tank bowl, one vertical profile at maximum 3' interval from floor to HWL at the hatch. One profile $180^0$ from hatch at a point between two anode strings.
- Two points on the floor of the tank directly under anode strings.

Final Report shall be signed by the corrosion engineer and contain the above data, complete submittal package, submitted under "Submittals", as built drawings, reference cell calibration and written operating instructions; all bound in a three ring binder and on a CD in easily read portable document format.

End of Section