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Galvanic Anode Cathodic Protection of Internal Submerged Surfaces of Steel Water Storage Tanks

ABSTRACT

This standard presents the practices used in providing galvanic anode cathodic protection (CP) to the normally submerged steel surfaces inside steel water storage tanks. It provides owners, engineers, and contractors a standard practice for the application of CP to the submerged surfaces of steel water storage tanks; for determining the effectiveness of these CP systems; and for the operation and maintenance of these CP systems.

This standard is applicable to steel water storage tanks of various sizes used in municipal water supply and fire protection, including elevated tanks and flat-bottom tanks at ground level. Although the practices presented in this standard generally are applicable to all such tanks, the galvanic anode CP system described in this standard may not be practical for tanks with large CP current demands.

KEYWORDS

Cathodic protection, galvanic anode, steel water storage tank, potable water, reclaimed water, drinking water, irrigation water, fire protection water, TG 284

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Foreword

The purpose of this standard is to present the standard practices used in providing galvanic anode cathodic protection (CP) to the normally submerged steel surfaces inside steel water storage tanks. It provides owners, engineers, and contractors a standard practice for the application of CP to the submerged surfaces of steel water storage tanks; for determining the effectiveness of these CP systems; and for the operation and maintenance of these CP systems.

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This standard was originally prepared in 1996 by NACE Task Group (TG) T-7L-1, a component of Unit Committee T-7L, "Cathodic Protection." It was revised in 2004, 2011, 2015, and 2020 by TG 284, "Cathodic Protection, Galvanic Anode for Internal Submerged Surfaces of Steel Water Storage Tanks—Review of NACE SP0196." TG 284 is administered by Specific Technology Group (STG) 05, "Cathodic/Anodic Protection." It is sponsored by STG 11, "Water Treatment," and STG 35, "Pipelines, Tanks, and Well Casings." This standard is issued by NACE under the auspices of STG 05.

In NACE standards, the terms ***shall, must, should,*** and ***may*** are used in accordance with the definitions of these terms in the NACE Publications Style Manual. The terms ***shall*** and ***must*** are used to state a requirement, and are considered mandatory. The term ***should*** is used to state something good and is recommended, but is not considered mandatory. The term ***may*** is used to state something considered optional.

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Section 1: General

1.1 This standard presents standard practices for using galvanic anodes to apply CP to the internal submerged surfaces of steel tanks used for the storage of potable and reclaimed water, drinking water, irrigation water, and fire protection water. Appendix A (nonmandatory) provides guidance for the use of CP for the internal surfaces of tanks and vessels containing other waters.

1.2 Impressed current CP systems are used extensively for the internal surfaces of water storage tanks; however, this standard addresses only galvanic anode CP systems. For a description of impressed current CP systems, refer to NACE SP0388.[1]

1.3 The ground level and elevated storage tanks considered in this standard are of welded, bolted, or riveted-steel construction, and include many shapes and sizes. The guidance and recommendations in this standard may be considered by the corrosion engineer for application to similar buried or vaulted tanks or tanks of other construction, where appropriate.

1.4 CP as described in this standard may be used alone to control corrosion of submerged steel surfaces or may be used as a complement to the protection provided by protective coatings compatible with CP.[2] CP cannot protect surfaces that are not submerged. Non-submerged surfaces should be protected by coatings alone. CP does not reverse metal loss already caused by corrosion.

1.5 CP may be installed to control corrosion in both newly constructed and existing tanks. When installing CP on existing tanks, it is not necessary to recoat the surfaces to be protected, but it may be necessary to drain the tank during installation.

1.6 Tanks under consideration for application of CP are often associated with potable water and fire protection systems that may be subject to public health and safety regulations.[3] This standard shall not infringe on those regulations. Proper disinfection of the tanks may be required after installation.

1.7 The provisions of this standard should be applied under the direction of a competent corrosion engineer. The term “corrosion engineer,” as used in this standard, refers to a person who, by reason of knowledge of the physical sciences and the principles of engineering and mathematics as acquired by professional education and related practical experience, is qualified to practice corrosion control, including CP, for water storage tanks. Such persons may be Registered Professional Engineers or persons recognized as being qualified or certified as Corrosion Specialists or CP Specialists by NACE, if their professional activities include suitable experience in corrosion control and CP.

1.8 This standard may not be applicable in all situations. The responsible corrosion engineer may consider alternate corrosion control methods.

Section 2: Definitions

Anode: The electrode of an electrochemical cell at which oxidation occurs. (Electrons flow away from the anode in the external circuit. It is usually the electrode where corrosion occurs and metal ions enter solution.)

Anode Circuit: The path from a single anode or multiple anodes connected through a shunt, a resistor, and the connection to the tank.

Cathode: The electrode of an electrochemical cell at which reduction is the principal reaction. (Electrons flow toward the cathode in the external circuit.)

Cathodic Protection: A technique to reduce the corrosion rate of a metal surface by making that surface the cathode of an electrochemical cell.

Coating: (1) a liquid, liquefiable, or mastic composition that, after application to a surface, is converted into a solid protective, decorative, or functional adherent film; (2) (in a more general sense) a thin layer of solid material on a surface that provides improved protective, decorative, or functional properties.

Conductivity: (1) a measure of the ability of a material to conduct an electric charge; (2) the current transferred across a material (e.g., coating) per unit area per unit potential gradient. (Conductivity is the reciprocal of resistivity).

Corrosion: The deterioration of a material, usually a metal, that results from a chemical or electrochemical reaction with its environment.

Corrosion Potential: The potential of a corroding surface in an electrolyte measured under open-circuit conditions relative to a reference electrode. [also known as electrochemical corrosion potential, free corrosion potential, open-circuit potential]