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Application of Cathodic Protection to Control External Corrosion of Carbon Steel On-Grade Storage Tank Bottoms

ABSTRACT

The purpose of this standard practice is to present practices for application of CP to control external corrosion of carbon steel on-grade storage tank bottoms that are in contact with an electrolyte. Practices for application of both galvanic anode CP systems and impressed current CP systems are included. Design criteria for the upgrade of existing tanks as well as for newly constructed tanks are included. This standard is maintained by Task Group 013.

KEYWORDS

pipelines, tanks, and underground systems, cathodic protection, TG 013, metals, storage tanks

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Foreword

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.

It is important to maintain the integrity of carbon steel on-grade storage tanks for both economic and environmental reasons. The proper design, installation, and maintenance of cathodic protection (CP) systems can help maintain the integrity and increase the useful service life of carbon steel on-grade storage tanks.

The purpose of this standard practice is to present practices for application of CP to control external corrosion of carbon steel on-grade storage tank bottoms that are in contact with an electrolyte. Practices for application of both galvanic anode CP systems and impressed current CP systems are included. Design criteria for the upgrade of existing tanks as well as for newly constructed tanks are included. This standard is intended for use by personnel planning to install a CP system on new carbon steel on-grade storage tanks, upgrade the CP system on existing carbon steel on-grade storage tanks, or install a new CP system on existing carbon steel on-grade storage tanks.

This NACE standard was originally prepared by Task Group (TG) T-10A-20, a component of NACE Unit Committee T-10A, "Cathodic Protection," and issued in 1993. It was revised by TG 013, "Tanks, Aboveground: External Cathodic Protection of On-Grade Metallic Storage Tank Bottoms," in 2001 and 2015. TG 013 is administered by Specific Technology Group (STG) 35, "Pipelines, Tanks, and Well Casings," and sponsored by STG 05, "Cathodic/Anodic Protection." This standard is issued by NACE International under the auspices of STG 35.

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Figures

Section 1: General

1.1 This standard defines the process necessary to design, install, and operate a thermoplastic-lined oilfield pipeline. The design process includes an assessment of the service conditions, materials, chemical compatibilities of liner materials with any service fluids and additives, pipeline geometry, and risk analysis. The installation process includes site surveys, pipeline preparation, insertion, termination, pressure testing, reburial, and safety. Operation of a lined system must take into consideration the service fluids, materials of construction, safety and environment, commissioning, normal operation, depressuring, and upset conditions, and inspection for liner integrity.

Section 2: Definitions

Amphoteric Metal: A metal that is susceptible to corrosion in both acidic and alkaline environments.

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 Bed: One or more anodes installed below the earth's surface for the purpose of supplying cathodic protection current. For the purposes of this standard, an anode bed is defined as a single anode or group of anodes installed in the electrolyte for the purposes of discharging direct current to the protected structure.

Backfill: Material placed in a hole to fill the space around the anodes, vent pipe, and buried components of a cathodic protection system.

Cable: One conductor or multiple conductors insulated from one another.

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

Cathodic Disbondment: The destruction of adhesion between a coating and the coated surface caused by products of a cathodic reaction.

Cathodic Polarization: (1) The change of electrode potential caused by a cathodic current flowing across the electrode/electrolyte interface. (2) a forced active (negative) shift in electrode potential. [See *Polarization.*]

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

Cell: See *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.

Concentration Cell: An electrochemical cell, the electromotive force of which is caused by a difference in concentration of some component in the electrolyte. (This difference leads to the formation of discrete cathodic and anodic regions.)