



NACE Standard RP0193-2001  
Item No. 21061

## Standard Recommended Practice

# External Cathodic Protection of On-Grade Carbon Steel Storage Tank Bottoms

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## Foreword

It is extremely important to maintain the integrity of on-grade carbon steel 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 on-grade carbon steel storage tanks.

The purpose of this standard recommended practice is to outline practices and procedures for providing cathodic protection to the soil side of bottoms of on-grade carbon steel storage tanks that are in contact with an electrolyte. Recommendations for both galvanic anode systems and impressed current 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 new on-grade carbon steel storage tanks, upgrade cathodic protection on existing storage tanks, or install new cathodic protection on existing storage tanks.

This NACE standard was originally prepared by Task Group T-10A-20, a component of NACE Unit Committee T-10A on Cathodic Protection, in 1993. It was technically revised by Task Group 013 in 2001. Task Group 013 is administered by Specific Technology Group (STG) 35 on Pipelines, Tanks, and Well Casings and sponsored by STGs 03 on Protective Coatings and Linings—Immersion/Buried and STG 05 on Cathodic/Anodic Protection. This standard is issued by NACE International under the auspices of STG 35 on Pipelines, Tanks, and Well Casings.

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Standard  
Recommended Practice**

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Storage Tank Bottoms**

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## Section 1: General

1.1 This standard presents guidelines for the design, installation, and maintenance of cathodic protection for the exterior bottoms of on-grade carbon steel storage tanks. Cathodic protection can be installed to protect new or existing tanks, but cannot protect carbon steel surfaces that are not in contact with an electrolyte.

1.2 This standard is applicable to welded, bolted, and riveted carbon steel tanks that are either field- or shop-fabricated.

1.3 It is understood in this standard that cathodic protection may be used alone or in conjunction with protective coatings.

1.4 All cathodic protection systems should be installed with the intent of conducting uninterrupted, safe operations. When cathodic protection is applied, it should be operated continuously to maintain polarization.

1.5 The criteria for cathodic protection are based on current industry standards.

1.6 Corrosion control must be a consideration during the design of on-grade carbon steel storage tanks.

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## Section 2: Definitions

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

**Anode:** The electrode of an electrochemical cell at which oxidation occurs. Electrons flow away from the anode in the external circuit. Corrosion usually occurs and metal ions enter the solution at the anode.

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

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

**Cell:** See *Electrochemical Cell*.

**Current Density:** The current to or from a unit area of an electrode surface.

**Deep Groundbed:** One or more anodes installed vertically at a nominal depth of 15 m (50 ft) or more below the earth's surface in a drilled hole for the purpose of supplying cathodic protection.

**Differential Aeration Cell:** An electrochemical cell, the electromotive force of which is due to a difference in air (oxygen) concentration at one electrode as compared with that at another electrode of the same material.

**Electrical Isolation:** The condition of being electrically separated from other metallic structures or the environment.

**Electrochemical Cell:** A system consisting of an anode and a cathode immersed in an electrolyte so as to create an electrical circuit. The anode and cathode may be different metals or dissimilar areas on the same metal surface.

**Electrolyte:** A chemical substance containing ions that migrate in an electric field.

**External Circuit:** The wires, connectors, measuring devices, current sources, etc., that are used to bring about or measure the desired electrical conditions within an electrochemical cell. It is this portion of the cell through which electrons travel.

**Foreign Structure:** Any metallic structure that is not intended as a part of a system under cathodic protection.

**Galvanic Anode:** A metal that provides sacrificial protection to another metal that is more noble when electrically coupled in an electrolyte. This type of anode is the electron source in one type of cathodic protection.

**Groundbed:** One or more anodes installed below the earth's surface for the purpose of supplying cathodic protection. For the purposes of this standard, a groundbed 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.

**Impressed Current:** An electric current supplied by a device employing a power source that is external to the electrode system. (An example is direct current for cathodic protection).

**On-Grade Storage Tank:** A tank constructed on sand or earthen pads, concrete ringwalls, or concrete pads.