NACE SP0575-2007
(formerly RP0575-2001)
Item No. 21015

Standard Practice

Internal Cathodic Protection (CP) Systems in Oil-Treating Vessels

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Reaffirmed 2007-03-15
Reaffirmed 2001-09-20
Revised March 1995
Approved October 1975
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ISBN 1-57590-135-8

Foreword

This standard practice is a general guide for the application of effective cathodic protection to all oil-treating vessels. This standard covers design criteria, the selection and installation of applicable systems, and the operation, monitoring, and maintenance of installed systems. There are many design variations in existing oil-treating vessels, with new designs being introduced continually. The preparation of a standard practice for the cathodic protection of each individual vessel design is not practical. Therefore, this standard is not specific with respect to one or more vessel designs. It is intended for use by corrosion engineers involved in oil and gas production, especially those concerned with surface facilities. Nothing contained in this standard is intended to conflict with applicable codes, including OSHA[1] regulations.

This standard was originally prepared in 1975 by Task Group (TG) T-1E-6, a component of Unit Committee T-1E on Cathodic Protection of Oilfield Equipment, and revised in 1995 by TG T-1E-11. It was reaffirmed in 2001 and in 2007 by Specific Technology Group (STG) 35 on Pipelines, Tanks, and Well Casings. This STG is composed of corrosion consultants, corrosion engineers from oil and gas producing companies, representatives from manufacturers, and others concerned with internal corrosion control in oil-treating vessels.

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*, 4th ed., Paragraph 7.4.1.9. *Shall* and *must* are used to state mandatory requirements. The term *should* is used to state something considered good and is recommended but is not mandatory. The term *may* is used to state something considered optional.

[1] Occupational Safety and Health Administration (OSHA), 200 Constitution Ave. NW, Washington, DC 20210.

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Section 1: General

1.1 This standard presents recommended practices for the cathodic protection (CP) of internal surfaces of oil-treating vessels, heat exchangers, or the water side of process vessels.

1.2 The provisions of this standard should be applied under the direction of a 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, acquired by professional education and related practical experience, is qualified to engage in the practice of corrosion control in oil-treating vessels.

1.3 Effective performance of the CP system requires operation within the limits of the design, monitoring of the system, and maintenance to replace damaged and consumed parts.

1.4 CP is not effective when applied to steel surfaces in the oil or gas phase because of the absence of an electrolyte. Coatings or chemical inhibitors should be used to control corrosion on the steel surfaces in the oil and gas phase.

Section 2: Definitions

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.

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 of a metal surface by making that surface the cathode of an electrochemical cell.

Coating: A liquid, liquefiable, or mastic composition that, after application to a surface, is converted into a solid protective, decorative, or functional adherent film.

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

Corrosion Engineer: A person, who by reason of 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.

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

Driving Potential: Difference in potential between the anode and the steel structure.

Electrode: A conductor used to establish contact with an electrolyte and through which current is transferred to or from an electrolyte.

Electrolyte: A chemical substance containing ions that migrate in an electric field. For the purpose of this standard, electrolyte refers to the water, including the chemicals contained therein, adjacent to and in contact with a submerged metal surface.

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.

Holiday: A discontinuity in a protective coating that exposes unprotected surface to the environment.

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.)

Passivation: A reduction of the anodic reaction rate of an electrode involved in corrosion.

Polarization: The change from the open-circuit potential as a result of current across the electrode/electrolyte interface.

Reference Electrode: An electrode whose open-circuit potential is constant under similar conditions of measurement, which is used for measuring the relative potentials of other electrodes.

Salt Bridge: A salt solution used with a reference electrode to bridge a gap in an electrical circuit to obtain potential data with a reference electrode.

Steel-to-Water Potential: The potential difference between a steel vessel surface and a reference electrode immersed in the water with which the steel vessel surface is in contact (sometimes referred to as cathodic solution potential).