



**NACE SP0186-2007**  
**(formerly RP0186-2001)**  
**Item No. 21031**

## **Standard Practice**

# **Application of Cathodic Protection for External Surfaces of Steel Well Casings**

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## Foreword

Oil and gas wells represent a large capital investment. It is imperative that corrosion of well casings be controlled to prevent loss of oil and gas, environmental damage, and personnel hazards, and in order to ensure economical depletion of oil and gas reserves.

This NACE International standard practice identifies procedures to determine the need for cathodic protection (CP) and the current requirements to achieve CP of well casings associated with oil and gas production and gas storage. It also outlines practices for the design and installation of CP systems and for their operation and maintenance. The purpose of this standard is to ensure more effective prevention of corrosion of well casings by making available reliable information about CP as it relates to well casings. This standard is intended for use by corrosion engineers in oil and gas production, especially those concerned with the CP of steel well casings.

This standard was originally prepared in 1986 by Unit Committee T-1E on Cathodic Protection and Task Group (TG) T-1J-2, a component of Unit Committee T-1J on Storage Wells. It was reaffirmed in 1994 by Unit Committee T-1E, and in 2001 and 2007 by Specific Technology Group (STG) 35 on Pipelines, Tanks, and Well Casings. The STG membership consists of representatives from oil and gas producing and storage companies, equipment manufacturers, consulting firms, and CP service companies. Included in the membership are persons involved in design, consulting, research, construction, maintenance, and manufacturing and supply of materials, all of whom are concerned with the establishment and maintenance of cathodic protection systems used with well casings. This standard is issued by NACE under the auspices of STG 35.

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.

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**Standard Practice**

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## Section 1: General

1.1 This standard presents acknowledged procedures for the control of external corrosion of steel well casings by applying CP. This standard is intended to be a guide for establishing minimum requirements for corrosion control when CP is practical and cost-effective.

1.2 This standard does not designate practices for specific situations. The complexity of some casing spacing, subsurface proximity to other casings, and environmental conditions preclude standardizing the application of CP. Deviation from this standard may be warranted in specific situations, provided those in responsible charge can demonstrate that the objectives expressed in this standard have been achieved.

1.3 This standard does not include corrosion control methods based on chemical control of the environment.

1.4 This standard applies only to well casing exteriors and not to internal corrosion, or to corrosion of other surface or downhole equipment.

1.5 The provisions of this standard should be applied under the direction of competent persons knowledgeable in the physical sciences, principles of engineering, and mathematics. They may have acquired knowledge by professional education and related practical experience and should be qualified to practice corrosion control for well casings by the use of CP. Such persons may be registered professional engineers recognized as being qualified as corrosion specialists in the appropriate fields of corrosion control by NACE International. Their professional activities should include suitable experience in well casing corrosion control practices.

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## Section 2: Definitions<sup>(1)</sup>

**Alternating Current (AC):** Current whose direction changes with time.

**Ampere:** Unit of current that is one coulomb per second.

**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.

**Casing Potential Profile:** Voltage (IR) drop and current direction versus casing depth is plotted. Amount of current is determined from the IR drop and casing resistance. (See nonmandatory Appendix A.)

**Casing-to-Electrolyte:** See *Structure-to-Electrolyte Potential*.

**Casing-to-Reference Electrode:** See *Structure-to-Electrolyte Potential*.

**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.

**Cement:** Cement slurry fills the space between the casing and the sides of the wellbore to a predetermined height above the bottom of the well.

**Continuity Bond:** A connection, usually metallic, that provides electrical continuity between structures that can conduct electricity.

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

**Counterpoise:** A conductor or system of conductors arranged beneath a power line, located on, above, or most frequently, below the surface of the earth and connected to the footings of the towers or poles supporting the power line.

**Coupling (or Collar):** Well casing joint connector.

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

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<sup>(1)</sup> Definitions in this section are those presented in the *NACE Glossary of Corrosion-Related Terms* and those that reflect the common usage among practicing corrosion control personnel. In many cases, in the interest of brevity and practicality, the strict scientific definitions are abbreviated or paraphrased.