

Application of Cathodic Protection for External Surfaces of Steel Well Casings

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Foreword

Throughout human history, “wells” facilitated the transport of products such as oil, gas, and water from land-based underground reservoirs to the surface. With continuously improving exploration technology, wells are now exploiting offshore reservoirs, facilitating product reinjection underground for storage, reservoir pressure or product flow maintenance, and/or product disposal. The drilling completion, operation, and maintenance of each well are complex and represent a large capital investment. Corrosion of well casings must be controlled to prevent loss of conveyed product, environmental damage, and personnel hazards, and to ensure continuity of production and economical extraction and/or use of reservoir deposits.

This AMPP standard practice identifies procedures to determine the need for cathodic protection (CP) and the current requirements to achieve CP of well casings associated with land-based and offshore oil and gas production and gas storage. The standard is applicable to single or multi-phase production (oil, gas and water), reinjection (for product storage, product disposal, or reservoir maintenance) as well as for geothermal wells. 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.

For accurate and correct application of this standard, the standard must be used in its entirety. Using or citing only specific paragraphs or sections can lead to misinterpretation and misapplication of the recommendations and practices contained in this standard. This standard does not designate practices for every specific situation because of the complexity of conditions to which well casings are exposed.

Rationale

This document has been revised for readability, updating for current technology and to expand on the methods of corrosion control.

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.

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

The provisions of this standard should be applied under the direction of a Corrosion Engineer or designated competent person, knowledgeable in the physical sciences, principles of engineering, and mathematics. They may have acquired knowledge through professional education and related practical experience and should be qualified to practice corrosion mitigation techniques for metallic well casings by CP. Such persons may be Registered Professional Engineers recognized as being qualified as corrosion specialists in the appropriate fields of corrosion control by AMPP. Their professional activities should include hands-on experience in practices for the mitigation of external corrosion of metallic (steel) well casings.

Referenced Standards and Other Consensus Documents

Unless specifically dated, the latest edition, revision, or amendment of the documents listed in the table below shall apply.

AMPP/NACE/SSPC, www.ampp.org:

NACE SP0169	Control of External Corrosion on Underground or Submerged Metallic Piping Systems
NACE SP0286	The Electrical Isolation of Cathodically Protected Pipelines
NACE SP0572	Design, Installation, Operation, and Maintenance of Impressed Current Deep Anode Beds
NACE TM0497	Measurement Techniques Related to Criteria for Cathodic Protection on Underground or Submerged Metallic Piping Systems
NACE Publication 2B160	Use of High Silicon Cast Iron for Anodes

American Society of Mechanical Engineers (ASME), www.asme.org:

ANSI/ASME B31.8	Gas Transmission and Distribution Piping Systems
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ASTM International, www.astm.org:

ASTM G79	Standard Practice for Evaluation of Metals Exposed to Carburizing Environments
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In AMPP standards, the terms *shall* and *must* are used to state requirements and are considered mandatory. The term *should* is used to state something that is recommended, but is not considered mandatory. The term *may* is used to state something considered optional.

Section 1: Scope

- 1.1** This standard acknowledges procedures for the control of external corrosion of metallic 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** External cathodic protection of external surfaces of uncoated or coated metallic (steel) well-casings directly impacts only the casing outer surfaces in direct contact with the borehole or through the cement (i.e., the cement used to fill the annular space between the borehole and the well-casing outer surface). Under some circumstances, external cathodic protection has been shown to reduce the prevalence of external corrosion on the inner (production) casing even when encapsulated in a multi-string concentric well-casing assembly. External cathodic protection does not prevent internal corrosion of single or multi-string concentric well-casing assemblies.
- 1.3** This standard applies to all onshore and offshore “wells” with metallic (steel) casings. Included in this group are single or multi-phase production (oil, gas and water), reinjection (for product storage, product disposal, or reservoir maintenance), as well as geothermal wells. The basic CP principles for mitigation of external corrosion for all these types of wells are identical. In some situations (shallow water in particular) the offshore well casing may run through a metallic (steel) conductor that stretches between the platform and the seafloor. The enclosed portion of the well casing within the conductor does not receive CP, since it is shielded by the conductor pipe. The external water-wet surface of the conductor pipe is subject to corrosion and receives corrosion protection from the CP. Corrosion mitigation methods for the well casing section encapsulated within the conductor pipe are not discussed in this standard.