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NACE INTERNATIONAL
THE CORROSION SOCIETY

Standard Practice

Control of External Corrosion on Underground or Submerged Metallic Piping Systems

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Foreword

This standard presents methods and practices for achieving effective control of external corrosion on underground or submerged metallic piping systems. These methods and practices are also applicable to many other underground or submerged metallic structures. It is intended for use by corrosion control personnel concerned with the corrosion of underground or submerged piping systems, such as those used for the transport of oil, gas, water, and other fluids. This standard describes the use of electrically insulating coatings, electrical isolation, and cathodic protection (CP) as they relate to external corrosion control. This standard does not include corrosion control methods based on injection of chemicals into the environment, on the use of electrically conductive coatings, or on the use of nonadhered polyethylene encasement (refer to NACE Publication 10A292).[1] The standard contains specific provisions for the application of CP to existing uncoated, existing coated, and new piping systems. Also included are methods for control of stray currents on pipelines.

This standard should be used in conjunction with the practices described in the following NACE standards and publications, when appropriate (use latest revisions):

SP0572[2]

SP0177[3]

SP0285[4]

SP0286[5]

SP0188[6]

TPC 11[7]

TM0497[8]

For accurate and correct application, this standard must be used in its entirety. Using or citing only specific paragraphs or sections can lead to misinterpretation and misapplication of the practices contained in this standard.

This standard does not designate practices for every specific situation because of the complexity of conditions to which underground or submerged piping systems are exposed. This standard is not intended to apply to offshore pipelines and structures. For these facilities, the recommended NACE standards are NACE SP0607/ISO 15589-2[9] for offshore pipelines, and SP0176[10] for offshore structures. Definitions of onshore and offshore vary, and it is the responsibility of the user to determine which of the above standards apply to pipelines that cross coastal boundaries.

This standard was originally published in 1969, and was revised by NACE Task Group T-10-1 in 1972, 1976, 1983, and 1992. It was reaffirmed in 1996 by NACE Unit Committee T-10A, "Cathodic Protection," and in 2002 and 2007 by Specific Technology Group (STG) 35, "Pipelines, Tanks, and Well Casings." It was revised in 2013 by Task Group (TG) 360, "Piping Systems: Review of SP0169-2007 (formerly RP0169), 'Control of External Corrosion on Underground or Submerged Metallic Piping.'" This standard is issued by NACE International under the auspices of STG 35, which is composed of corrosion control personnel from oil and gas transmission companies, gas distribution companies, power companies, corrosion consultants, and others concerned with external corrosion control of underground or submerged metallic piping systems.

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.

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Contents

Section 1: General

1.1 This standard presents accepted methods and practices for the control of external corrosion on buried or submerged steel, stainless steel, cast iron, ductile iron, copper, and aluminum piping systems.

1.2 This standard is intended to serve as a guide for establishing requirements for control of external corrosion on the following systems:

1.2.1 New piping systems: A proven method of corrosion control (e.g., coating supplemented with CP) should be provided in the initial design and maintained during the service life of the piping system, unless investigations indicate that corrosion control is not required. Consideration should be given to the construction of piping in a manner that facilitates the use of in-line inspection (ILI) tools.

1.2.2 Existing coated piping systems: CP should be provided and maintained (which includes the maintenance of coating as necessary), unless investigations indicate that CP is not required.

1.2.3 Existing uncoated piping systems: Studies can be made to determine the extent and rate of corrosion on existing uncoated piping systems. When these studies indicate that corrosion affects the safe or economic operation of the system, adequate corrosion control measures shall be taken.

1.3 The provisions of this standard are intended to be applied under the direction of competent persons who, by reason of knowledge of the physical sciences and the principles of engineering and mathematics acquired by education and related practical experience, are qualified to engage in the practice of corrosion control on underground or submerged metallic piping systems.

Note: Such persons might be, but are not limited to, registered professional engineers or persons recognized as Corrosion Specialists or CP Specialists by NACE, if their professional activities include suitable experience in external corrosion control of underground or submerged metallic piping systems.

1.4 Special conditions in which CP is ineffective or only partially effective sometimes exist (see Paragraph 6.2.1.4 for examples). Deviation from this standard might be warranted in specific situations, provided that corrosion control personnel in responsible charge are able to demonstrate that the objectives expressed in this standard have been achieved.

1.5 This standard is not intended for use in the control of internal corrosion.

Section 2: Definitions,[1] Abbreviations, and Acronyms

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. It is usually the electrode where corrosion occurs and metal ions enter solution.)

Anode Bed: One or more anodes installed—underground or submerged—for the purpose of supplying cathodic protection. It is often called a groundbed.

Backfill: Material placed in a hole to fill the space around the anodes, vent pipe, and buried components of a cathodic protection system. For the purposes of this standard, "backfill" is also defined as the material (native or imported) used to fill a pipeline trench.

Bode Curve: A plot of dynamic (fluctuating) stray current or related proportional voltage (ordinate) versus the corresponding structure-to-electrolyte potentials at a selected location on the affected structure (abscissa). For the purposes of this standard,

[1] Definitions in this section reflect common usage among practicing corrosion control personnel and apply specifically to how the terms are used in this standard. In many cases, in the interests of brevity and practical usefulness, the scientific definitions are abbreviated or paraphrased.