

Test Method for Evaluation of Protective Coatings for Use Under Insulation

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AMPP values your input. To provide feedback on this standard, please contact standards@ampp.org

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Foreword

This AMPP standard test method provides a comprehensive methodology to evaluate the relative performance of coatings in accelerated and simulated field conditions under insulation. This test method is intended for use by corrosion control personnel, design engineers, project managers, purchasing personnel, and construction engineers and managers. It is applicable to insulated piping and equipment in the oil and gas gathering, distribution, transmission, refining and chemical industries.

Scope

This AMPP standard provides a test methodology to establish the relative performance of a coating under accelerated and simulated field conditions under insulation.

Rationale

Corrosion Under Insulation (CUI) test methods currently available in industry do not mimic field conditions and are based on a pass-fail criterion conducted for a fixed exposure time and are unsuitable for estimating coating service life and performance. This AMPP standard provides a comprehensive test methodology to simulate field conditions under insulation in order to establish the performance of a coating in service.

Referenced Standards and Other Consensus Documents

The latest edition, revision, or amendment of the referenced standards in effect shall govern unless otherwise dated.

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

NACE/ASTM G193	Standard Terminology and Acronyms Relating to Corrosion
NACE SP0198	Control of Corrosion Under Thermal Insulation and Fireproofing Materials—A Systems Approach
NACE SP0188	Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates
SSPC-Guide 15	Field Methods for Extraction and Analysis of Soluble Salts on Steel and Other Nonporous Substrates
SSPC-PA 2	Procedure for Determining Conformance to Dry Coating Thickness Requirements
SSPC-VIS 1	Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning

ASTM International, www.astm.org:

ASTM D610	Standard Practice for Evaluating Degree of Rusting on Painted Steel Surfaces
ASTM D661	Standard Test Method for Evaluating Degree of Cracking of Exterior Paints
ASTM D714	Standard Test Method for Evaluating Degree of Blistering of Paints
ASTM D1293	Standard Test Methods for pH of Water
ASTM D4541	Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
ASTM D3359	Standard Test Methods for Rating Adhesion by Tape Test
ASTM D6677	Standard Test Method for Evaluating Adhesion by Knife
ASTM D2583	Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
ASTM D2240	Standard Test Method for Rubber Property—Durometer Hardness
ASTM G106	Standard Practice for Verification of Algorithm and Equipment for Electrochemical Impedance Measurements

ASTM D4417 Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel
International Organization for Standardization (ISO), www.iso.org:

ISO 8502-6	Preparation of steel substrates before application of paints and related products — Tests for the assessment of surface cleanliness — Part 6: Extraction of water soluble contaminants for analysis (Bresle method)
ISO 8502-9	Preparation of steel substrates before application of paints and related products — Tests for the assessment of surface cleanliness — Part 9: Field method for the conductometric determination of water-soluble salts
ISO 8503	Preparation of steel substrates before application of paints and related products — Surface roughness characteristics of blast-cleaned steel substrates
ISO 9223	Corrosion of metals and alloys — Corrosivity of atmospheres — Classification, determination, and estimation
ISO 12944	Paints and varnishes – Corrosion protection of steel structures by protective paint systems
ISO 16773	Electrochemical impedance spectroscopy (EIS) on coated and uncoated metallic specimens

Standards Norway, www.standard.no:

NORSOK M-004 Piping and Equipment Insulation

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: General

- 1.1 This document provides four different methods for the evaluation of coatings used to mitigate corrosion under insulation (CUI).
- 1.2 The test methods are intended to standardize test procedures used in determining the effectiveness of protective coatings under insulation. Effectiveness is defined as the ability to maintain corrosion protection.
- 1.3 The test methods provide a means to evaluate protective coatings under various conditions that can lead to corrosion under insulation.
- 1.4 The test methods can be used to determine the relative influence of different insulation materials on CUI.

Section 2: Definitions

Cycle: A cycle is defined as one wet/dry event and one hot/cold temperature event.

Dew Point: Temperature to which the air must be cooled (at constant pressure) in order to achieve a relative humidity (RH) of 100%.

End-User: The entity ultimately receiving and/or utilizing the results of the test.

Manufacturer: The entity that produces the final coating product.

Section 3: Objectives of This Standard Test Method

- 3.1 This standard test method does not contain defined pass/fail criteria. Instead, it is to be used as a means of establishing the relative performance of a coating given the test criteria.
- 3.2 The design of the test method is based on an approach that is representative of accelerated corrosive field conditions under insulation.
- 3.3 The test methods are designed to replicate severe degradative but realistic conditions under insulation in an accelerated fashion.
- 3.4 The CUI environments can be modeled to represent specifically the requirements of the end-user.
- 3.5 The results of the tests provide useful information on the performance of a given coating.
- 3.6 The test methods allow for the use of any polymeric materials, e.g., coatings, tape wraps, shrink sleeves, composite wraps, or metallic coatings.
- 3.7 The test methods allow for the use of any insulation materials.

Section 4: Limitations of This Standard Test Method

- 4.1 The test methods included in this document are designed to test the coatings and insulation materials applied to cylindrical surfaces. The intent is to simulate actual piping and equipment in operating facilities when exposed to severely corrosive environments, and in an accelerated fashion.
- 4.2 The test protocol does not provide any guidance for the application of the coating materials. Application procedures shall follow the instructions of the manufacturer or end-user.
- 4.3 The test protocol does not provide any guidance for the installation of the insulation and jacketing materials. Installation details shall be in accordance with the guidance provided by the insulation vendor or end-user.
- 4.4 To ensure reproducibility of the results of the tests, the installation of the test cells shall follow this testing protocol, or the requirements of the end-user. [Appendix A](#) (nonmandatory) provides informative test conditions.
- 4.5 The test methods require the use of metallic jacketing materials without a liner on the inside surface. Non-metallic jacketing materials or jacketing with internal liners can interfere with the electrochemical measurements (see [Appendix B](#)) (nonmandatory).

Section 5: Description of the Test Method

- 5.1 This test method aims to simulate the following CUI temperature conditions:
 - a. Within the CUI temperature range (in accordance with NACE SP0198). CUI temperature range -4 °C (25 °F) to 175 °C (350 °F).
 - b. Within the CUI temperature range but below the dew point.
 - c. Within the CUI temperature range cycling above or below it intermittently.
 - d. Above or below the CUI temperature range cycling into it intermittently.
- 5.2 The variability of temperature and dry/wet environments shall be stipulated by the end user. Typical standard temperature profiles are listed in [Appendix A](#).