



Designation: D3912 – 10

# Standard Test Method for Chemical Resistance of Coatings and Linings for Use in Nuclear Power Plants<sup>1</sup>

This standard is issued under the fixed designation D3912; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This test method establishes procedures for the evaluation of the chemical resistance of coatings and linings for use in Coating Service Level I and II applications in nuclear power plants.

1.2 This test method is intended to be used as a screening test to evaluate coatings and linings on steel and concrete substrates.

1.3 This test method addresses two exposure intervals:

(1) Short Term (Typically 5 days): Such exposures are primarily applicable for coatings exposed to chemical splash or spill.

(2) Long Term (Typically 180 days): Such exposures are primarily applicable for linings exposed to continuous or near-continuous chemical immersion.

1.4 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

2.1 *ASTM Standards:*<sup>2</sup>

**D714** Test Method for Evaluating Degree of Blistering of Paints

**D1193** Specification for Reagent Water

**D5139** Specification for Sample Preparation for Qualification Testing of Coatings to be Used in Nuclear Power Plants

**D7230** Guide for Evaluating Polymeric Lining Systems for Water Immersion in Coating Service Level III Safety-Related Applications on Metal Substrates

2.2 *NACE Standard:*

**NACE Standard TM-01-74–2002** Laboratory Methods for the Evaluation of Protective Coatings Used as Lining Materials in Immersion Service<sup>3</sup>

## 3. Significance and Use

3.1 The lining test described in 6.2 may be used to evaluate the chemical resistance characteristics of coating systems for lining surfaces of tanks, vessels and similar facilities used in Coating Service Level I and II applications in a nuclear power plant. For the evaluation of linings in Coating Service Level III water immersion applications in nuclear power plants use the test methods and guidance found in Guide **D7230**.

3.2 The specific chemical resistance tests described in 6.1 are dependent upon the relative severity of the service conditions. The specific chemical reagents to be used shall be specified to reflect the intended service conditions.

3.3 At the discretion of the user, the methods presented may also be used to evaluate coatings and linings for applications in other types of power plants or other industrial services.

## 4. Sampling

4.1 Prepare individual specimens for testing.

4.2 Prepare one additional specimen as a control. Multiple tests may be performed.

## 5. Preparation of Test Specimens

5.1 *Steel Panels:*

5.1.1 Prepare steel panels in accordance with Specification **D5139**.

5.2 *Concrete Blocks*—Prepare blocks in accordance with Specification **D5139** with the exception that the top and bottom ends of the block shall be coated.

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee **D33** on Protective Coating and Lining Work for Power Generation Facilities and is the direct responsibility of Subcommittee **D33.02** on Service and Material Parameters.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> Available from NACE International (NACE), 1440 South Creek Dr., Houston, TX 77084-4906, http://www.nace.org.

## 6. Procedure

### 6.1 Short Term Tests:

6.1.1 Test the chemical resistance properties of the coatings by immersion in the appropriate test solutions for duration of 5 days or as required.

6.1.2 Maintain a temperature of  $72 \pm 5^{\circ}\text{F}$  ( $22 \pm 3^{\circ}\text{C}$ ) unless the service conditions require a higher temperature.

6.1.3 Use reagent grade chemicals and distilled or deionized water for all solutions. Regarding the water, see Specification **D1193** and identify the grade used.

NOTE 1—Any grade or type described in Specification **D1193** will be acceptable for use unless otherwise specified.

### 6.2 Long Term Test:

6.2.1 Test in accordance with NACE TM-01-74-2002. Use Procedure B, “Immersion Testing” except when a significant temperature differential (that is, “Cold Wall” phenomenon) is anticipated across the lining, as may be applicable for tanks. If “Cold Wall” conditions apply, use Procedure A, “One-Side Testing” or the alternative testing referenced in Section 1.5 of NACE TM-01-74-2002.

6.2.2 Immerse lining test specimens in the appropriate test solution specified for a minimum of 180 days.

6.2.3 Use reagent grade chemicals and distilled or deionized water for all solutions. Regarding the water, see Specification **D1193** and identify the grade used.

## 7. Examination and Evaluation

### 7.1 Short Term Tests:

7.1.1 Examine the test specimens at the end of the test period.

7.1.2 Evaluate the condition of the specimens within 1 h after removal from the test solutions.

7.1.3 Evaluate the test specimens upon completion of testing for changes in physical properties such as delamination,

blistering (Test Method **D714**), cracking, checking, discoloration of coating or test solution, softening, any other indications of physical degradation, and as specified by the licensee.

NOTE 2—A qualitative rating scale such as “slight, moderate, extreme” can be used to report the severity of the effects if no reference to an ASTM standard exists.

### 7.2 Long Term Test:

7.2.1 Examine the test specimens weekly for the first month and then monthly thereafter.

7.2.2 Inspect specimens immediately upon completion of the test period. Make a final inspection not later than 24 h after removal from the test solution.

7.2.3 Evaluate the test specimens at each inspection for effects such as delamination, blistering (Test Method **D714**), discoloration, and softening.

## 8. Documentation and Report

8.1 Document the testing procedure and test results, such as test solution used, concentration, test temperature, inspection frequency and evaluation at each inspection.

8.2 Report all procedures and conditions relating to the test specimen preparation, such as sample substrate, surface preparation, coating system, batch numbers, application method, dry film thickness, and environmental conditions during sample preparation and curing.

## 9. Precision and Bias

9.1 These tests are qualitative in nature. Precision and bias are not definable.

## 10. Keywords

10.1 chemical resistance; coatings; Coating Service Level I; Coating Service Level II; Coating Service Level III; linings; nuclear

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