



Standard Test Method for Chemical Resistance of Coatings Used in Light-Water Nuclear Power Plants¹

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1. Scope

1.1 This test method establishes procedures for the evaluation of the chemical resistance of coatings used in light-water nuclear power plants.

1.2 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

1.3 *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:²

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

2.2 NACE Standard:

NACE TM-01-74-91 Laboratory Methods for the Evaluation of Protective Coatings Used as Lining Materials in Immersion Service³

3. Significance and Use

3.1 The specific chemical resistance tests to be performed are dependent upon the relative severity of the service conditions. **Fig. 1** lists some chemical solutions that may be applicable to nuclear power plants and may be considered for

use in testing chemical resistance of coatings when applicable. Testing these, or other chemical solutions should not be construed as mandatory, but may be specified by the owner when desired.

3.2 The lining test may be used to evaluate the resistance characteristics of coating systems for lining surfaces of tanks, vessels and similar facilities used in a light-water nuclear power plant.

4. Sampling

4.1 Prepare individual specimens for testing in each of the pertinent solutions.

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**.

5.1.2 Use carbon steel panels in lining tests at least 7 by 7 by ¼ in. (178 by 178 by 6.4 mm) thick for Procedure A only.

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.

6. Procedure

6.1 Test in accordance with **NACE TM-01-74-91**, Procedure B, Immersion Testing, except use Procedure A, One-Side Testing (cold wall) when a significant temperature differential is anticipated across the coating film as for tank linings.

6.2 Lining Test:

6.2.1 Immerse lining test specimens in the appropriate test solutions listed in **Fig. 1** or as otherwise specified for a minimum of 180 days.

6.2.2 Maintain a temperature of $72 \pm 5^\circ\text{F}$ ($22 \pm 3^\circ\text{C}$) unless otherwise specified by the owner.

6.2.3 Use deionized water with an initial resistivity of not less than 2.5 mΩ/in. at 77°F (1 MΩ/cm at 25°C) and with a total solids of no more than 0.5 ppm, no more than 0.15 ppm of chloride or no more than 0.15 ppm of fluoride. Maintain the pH range from 6.0 to 8.0.

¹ 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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² 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.

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



CHEMICAL-EXPOSURE TEST RESULTS

Specimen No. _____ Date _____

Coating System: Primer _____ DFT _____

Intermediate _____ DFT _____

Finish _____ DFT _____

Batch Number(s) _____ Method of Application _____

Temperature _____ °F, Relative Humidity _____ %, Curing Time _____ at _____ °F.

Surface Preparation _____

Panel Substrate _____

Chemical	Concentration, weight %	8 h	24 h	5 days
<i>General Service:</i>				
Hydrazine (NH ₂ NH ₂)	5			
Sodium borate (Na ₂ B ₄ O ₇ · 10H ₂ O)	5			
Deionized water				
Boric acid	5			
Sulfuric acid	5			
<i>Decontamination Solutions:</i>				
Hydrogen peroxide (H ₂ O ₂)	1.03			
Trisodium phosphate (Na ₃ PO ₄ · 12H ₂ O)	11.5			

FIG. 1 Sample Form

6.2.4 Change the deionized water daily during the first week and weekly thereafter. Measure any constituents leached out before the water is changed.

6.3 Chemical Exposure Tests:

6.3.1 Test the chemical resistance properties of the coatings by immersion in the appropriate test solutions with duration as required.

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

6.3.3 Use reagent grade chemicals and water conforming to Specification D1193, Type III, for all solutions.

7. Examination and Evaluation

7.1 Lining Test:

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

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

7.1.3 Evaluate the test specimens at each inspection for peeling, delamination, blistering (Test Method D714), discoloration, and softening.

7.2 Chemical Exposure Tests:

7.2.1 Examine the test specimens at the end of the test period or every 24 h, whichever is the shorter time.

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

7.2.3 Evaluate the test specimens at each inspection as in 7.1.3.

8. Documentation and Report

8.1 Report all procedures and conditions relating to the test specimen preparation.

8.2 Document the testing procedure and test results. A suggested format is illustrated by Fig. 1.

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 and linings; nuclear