Designation: D5139 – 12

Standard Specification for Sample Preparation for Qualification Testing of Coatings to be Used in Nuclear Power Plants[1]

This standard is issued under the fixed designation D5139; 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 (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification defines the size, composition, surface preparation, and coating application variables for preparing samples for evaluating coatings and linings over various substrates.

1.2 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.

1.3 *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]

A36/A36M Specification for Carbon Structural Steel
C33/C33M Specification for Concrete Aggregates
C150/C150M Specification for Portland Cement
C192/C192M Practice for Making and Curing Concrete Test Specimens in the Laboratory
C260 Specification for Air-Entraining Admixtures for Concrete
C494/C494M Specification for Chemical Admixtures for Concrete
C618 Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
D3912 Test Method for Chemical Resistance of Coatings and Linings for Use in Nuclear Power Plants
D4258 Practice for Surface Cleaning Concrete for Coating
D4259 Practice for Abrading Concrete
D4260 Practice for Liquid and Gelled Acid Etching of Concrete
D4538 Terminology Relating to Protective Coating and Lining Work for Power Generation Facilities
D4541 Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
D7234 Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers

2.2 *American Concrete Institute:*[3]

ACI 308 Guide to Curing Concrete
ACI Cement and Concrete Terminology

2.3 *American National Standards Institute (ANSI):*[4]

ANSI N5.12–1974 Protective Coatings (Paints) for the Nuclear Industry, paragraph 7.4.3

3. Terminology

3.1 *Definitions*—Definitions for use with this standard are shown in Terminology D4538 or other applicable standards.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *bughole (surface air void), n*—a small regular or irregular cavity, usually not exceeding 1.5 mm in diameter, resulting from entrapment of air bubbles in the surface of formed concrete during placement and consolidation (ACI Cement and Concrete Terminology).

3.2.2 *curing compound, n*—a liquid that can be applied as a coating to the surface of newly placed concrete to retard the loss of water and, in the case of pigmented compounds, to reflect heat so as to provide an opportunity for the concrete to develop its properties in a favorable temperature and moisture environment (ACI Cement and Concrete Terminology).

4. Significance and Use

4.1 This specification provides uniform requirements for the preparation of test samples used for testing of coatings and linings to be used in nuclear power plants.

[1] This specification 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 American Concrete Institute (ACI), P.O. Box 9094, Farmington Hills, MI 48333-9094, http://www.concrete.org.

[4] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

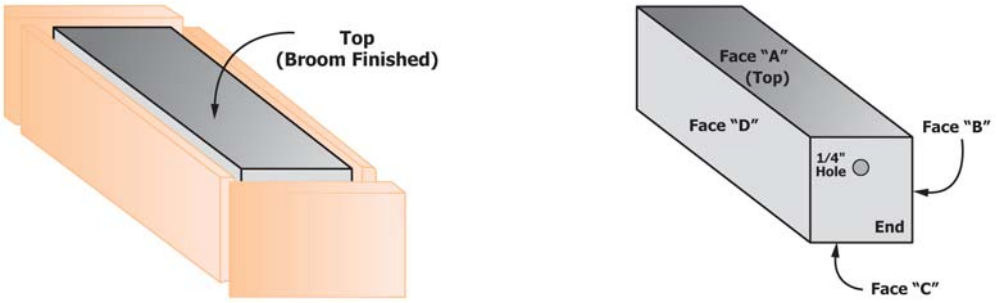

FIG. 1 Concrete Test Block Face Designation

4.2 At the users discretion, this standard may also be used when preparing samples to be tested for the purpose of assessing performance attributes for coating and lining systems that may be applied in other types of power plants or for other industrial facilities.

4.3 Users of this guide must ensure that coatings work complies not only with this guide, but also with the licensee's plant-specific quality assurance program and licensing commitments.

5. Steel Panels

5.1 Panel size shall be a minimum of 2-in. wide by 4-in. long by ⅛-in. thick (50.8-mm wide by 101.6-mm long by 3.175-mm thick) unless otherwise stated in the referenced test method. Edges and corners may be rounded. A suitably located ¼ in. (6.35 mm) diameter hole may be provided in the test panel as appropriate when required by the test method.

5.1.1 For Test Method D4541 the minimum size shall be 3-in. wide by 5-in. long by ¼-in. thick (76.2-mm wide by 127-mm long by 6.35-mm thick).

5.2 Unless otherwise required, all panels shall be carbon steel, meeting the requirements of Specification A36/A36M.

6. Concrete Blocks

6.1 The minimum size shall be 2-in. wide by 2-in. deep by 4-in. long (50.8-mm wide by 50.8-mm deep by 101.6-mm long) unless otherwise stated in the referenced test method. The edges may be chamfered up to ¼ in. (6.35 mm) maximum.

6.1.1 The dimensions of the block to be tested should be sufficient to accommodate the adhesion tester to be used (for example, Test Method D7234).

6.2 Composition shall be as follows:

Cement	Specification C150/C150M, Type II	7 sacks/yd^3
Gravel	Specification C33/C33M, size ⅜ in.	45 % by volume
Sand	Specification C33/C33M	55 % by volume
Air-entraining admixture	Specification C260	As recommended 4 to 7 %
Water-reducing admixture	Specification C494/C494M	As recommended
Pozzolan	Specification C618	As recommended to 15 % amount
Water, demineralized or distilled		3 in. slump
		Nominal 1 Cubic Foot Batch
Cement	Specification C150/C150M, Type II low alkali	22.2 lb (10.07 kg)
Gravel	Specification C33/C33M, Size ⅜ in.	45.3 lb (20.55 kg)
Sand	Specification C33/C33M	55.5 lb (25.17 kg)
Air-entraining admixture	Specification C260	1.05 fl oz (31 mL)
Pozzolan	Specification C618	2.2 lb (1.0 kg)
Water-reducing admixture (Type A)	Specification C494/C494M	As recommended by the manufacturer
Water, demineralized or distilled		As required to produce 3-in. (76.2-mm) slump (approximately)

6.3 Blocks shall be cast horizontally in forms using release agents that are compatible with the coatings/linings to be used. The top surface, as cast, shall be given a broom finish, unless otherwise specified in the project specification. The block surface is to be covered with plastic during the first 24 hours to simulate water curing unless otherwise specified.

6.4 The block shall be removed from the form after 24 hours and wet cured in accordance with ACI 308 or Practice C192/C192M.

6.5 If a curing compound is to be used, apply the compound to the top surface immediately after finishing and to all other surfaces of the block within 2 hours after its removal from the form.

6.6 Allow the block to cure for 28 days in accordance with ACI 308 before application of the coating system unless otherwise specified.

6.7 A suitable hanger compatible with the testing apparatus shall be affixed at the mid-point of one end of the block as appropriate when required by the test method.

6.8 After removing the block from the form, place or mark a reference indicator on one end of each block, (for example, mark with a permanent marker or otherwise describe the reference being used). This indicator will allow referencing each face by means of the following convention (refer to Fig. 1):

(a) Face "A" is the top (non-formed) face

(b) Viewing the indicator on the block end, Faces "B, " "C," and "D" are located clockwise from Face "A."

7. Miscellaneous Materials

7.1 Follow 5.1 and 5.2 for metallic materials such as aluminum, galvanized steel, and other metals.

7.2 Follow 6.1 and 6.3 for castable materials such as grout, fireproofing, and other castables.

8. Surface Preparation

8.1 *Steel:*

8.1.1 Surface preparation parameters shall be established.

8.1.2 Users of this standard may identify project specific conditions, for example, weld configuration, corrosion pitting, interfaces/overlaps with pre-existing coatings, etc. These conditions shall be specified as appropriate.

8.2 *Concrete:*

8.2.1 Surface preparation parameters shall be established.

8.2.2 Users of this standard may identify project specific conditions, for example, configuration, texture, bugholes, interfaces/overlaps with pre-existing coatings, etc. These conditions shall be required as appropriate.

8.2.3 After curing, remove loose material on Face A (non-formed, broom finished surface) by light wire brushing. Remove loose material on a cast surface by blowing with air (80 to 100 psi), unless otherwise specified, such as Practices D4258, D4259, or D4260.

8.2.4 Bugholes, honeycomb, and other surface defects may be simulated by drilling holes to test coating systems for patching surface defects.

9. Application

9.1 All test samples shall be coated with the coating/lining system(s) intended for evaluation, including any applicable fillers, internal reinforcement, curing compounds and sealants. Different systems may be applied to different surfaces of the same sample. The manufacturer's latest published application instructions shall be followed for mixing, thinning (as applicable), and coating/lining application unless otherwise required. Any special procedures or conditions shall be noted in the documentation including thinning, mixing, use of accelerators, drying/curing times, force curing, aging between coats/systems, and intermediate surface preparations.

9.2 The film thickness range shall be representative of the specific work for which the testing is being conducted.

9.3 The coating system shall be fully cured as specified by the manufacturer or licensee. Historically, some coated test panels were cured for 30 to 45 days at 70 to 80°F (21 to 27°C) or force cured at a maximum temperature of 150°F (66°C) for a maximum of 72 hours prior to commencement of testing (see ANSI N5.12–1974, paragraph 7.4.3).

9.4 Test samples for painting test programs may include simulated aging of the coating when applicable, intermediate surface preparation and wide ranges of coating film thicknesses, as required. The sample preparation procedure shall reflect actual field conditions as closely as possible, including surface preparation, coating/lining application and curing methods. Any additional special requirements shall be recorded.

9.5 All surfaces of concrete blocks shall be coated when testing in accordance with Test Method D3912. One end of the blocks shall be left uncoated for all other testing.

10. Documentation and Records

10.1 *Coating/Lining Material Data:*

10.1.1 Manufacturer's product identification.

10.1.2 Product batch number for each component.

10.1.3 Product color.

10.2 *Minimum Sample Preparation Data:*

10.2.1 All sample preparation times and dates for each coat.

10.2.2 Surface preparation details.

10.2.3 Thinners, accelerators, additives, reinforcement, and fillers added during the mixing and application process.

10.2.4 Method of application.

10.2.5 Coating/lining sequence.

10.2.6 Individual dry film thickness ranges of each coat and total thickness range.

10.2.7 Environmental conditions.

10.2.8 Cure times and temperatures.

10.3 Record any deviations or non-conformances.

11. Keywords

11.1 concrete blocks; nuclear power plants; sample preparation; steel panels; surface preparation and coating application variables; test samples