



Designation: D4939 – 89 (Reapproved 2020)

Standard Test Method for Subjecting Marine Antifouling Coating to Biofouling and Fluid Shear Forces in Natural Seawater¹

This standard is issued under the fixed designation D4939; 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 test method covers the determination of antifouling performance and reduction of thickness of marine antifouling (AF) coatings by erosion or ablation (see Section 3) under specified conditions of hydrodynamic shear stress in seawater alternated with static exposure in seawater. An antifouling coating system of known performance is included to serve as a control in antifouling studies.

1.2 The values stated in SI 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.* For a specific hazards statement, see Section 8.

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

A569/A569M Specification for Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip Commercial (Withdrawn 2000)³

D1186 Test Methods for Nondestructive Measurement of

Dry Film Thickness of Nonmagnetic Coatings Applied to a Ferrous Base (Withdrawn 2006)³

D2200 Practice for Use of Pictorial Surface Preparation Standards and Guides for Painting Steel Surfaces

D3623 Test Method for Testing Antifouling Panels in Shallow Submergence

2.2 U.S. Military Specifications:⁴

MIL-P-24441 Primer, Epoxy (Formula 150, Formula Sheet 24441/1)

MIL-P-15931B Paint, Antifouling, Vinyl, Red (Formula 121/63)

MIL-S-22698A Steel Plate, Carbon, Structural

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *ablation, n*—in this test method, the removal or wearing away of the outer layers of coating caused by the combined action of hydrolysis and hydrodynamic shear stress. This action is often, but not necessarily, achieved by the combined effects of hydrolysis and hydrodynamic shear stress.

3.1.2 *hydrolysis, n*—softening or weakening of the outer layers, permitting the hydrodynamic shear stresses gradually to remove them, continually exposing a fresh antifouling surface.

3.1.3 *hydrodynamic shear stress, n*—the force tangential to the surface resulting from water in contact with and flowing parallel to the surface.

4. Summary of Test Method

4.1 The antifouling coatings to be tested and a control coating are applied to steel panels and exposed in natural seawater at a site where the fouling rate is high. The exposure consists of alternate static and dynamic cycles of typically 30 days each for a total length of time to be specified (such as one or two years) or until some selected degree of fouling is reached. The static exposure is conducted in accordance with Test Method **D3623** except that the panels are smaller and are preformed to fit a rotating drum. The dynamic exposure consists of subjecting the test panels to a shear stress by

¹ This test method is under the jurisdiction of ASTM Committee **D01** on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee **D01.45** on Marine Coatings.

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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 The last approved version of this historical standard is referenced on www.astm.org.

⁴ Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, <http://www.dodssp.daps.mil>.