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> NASM1312-9 STANDARD PRACTICE

FASTENER TEST METHODS

METHOD 9

STRESS CORROSION



THE INITIAL RELEASE OF THIS DOCUMENT SUPERSEDES MIL-STD-1312-9

DESIGNATION FOR THIS TEST METHOD REMAINS MIL-STD-1312-9

	LIST OF CURRENT SHEETS									
NO.	1	2	3	i 4	5	6	7	8	9	
REV	NEW	NEW	NEW	NEW	NEW	NEW	NEW	NEW	NEW	
NO.	10	11	12							
REV.	NEW	NEW	NEW	÷						

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> NASM1312-9 53GP

FOREWORD

This standard sets forth standard test procedures for determining the capability of externally threaded fasteners to withstand the various stress corrosion conditions encountered when used in military weapons systems.

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1. SCOPE

1.1 <u>Applicability</u>. This test method establishes the procedure for determining the relative susceptibility of threaded fasteners to stress corrosion cracking. This is an accelerated test in which the test specimen is subjected to a uniaxial tensile stress and exposed to an alternate immersion cycle in a 3-1/2 percent sodium chloride solution.

1.2 <u>Potential hazard</u>. This test is potentially hazardous since the fastener is subjected to a high sustained load. It is recommended that the testing area be completely enclosed to prevent injury to personnel working in the proximity of the test area. It is also recommended that safety masks be worn when loading and examining the specimen.

2 REFERENCED DOCUMENTS

2.1 Government documents.

2.1.1 <u>Specifications, standards and handbooks</u>. Unless otherwise specified, the following specifications, standards and handbooks of the issue listed in the current Department of Defense Index of Specifications and Standards (DoDISS) and the supplement thereto (if applicable), form a part of this standard to the extent specified herein.

SPECIFICATIONS

MILITARY

MIL-I-6866 Inspection, Penetrant Method of

MIL-I-6868 Inspection Process, Magnetic Particle

(Copies of specifications, standards, handbooks, drawings and publications required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.2 <u>Other publications</u>. The following document(s) forms a part of this specification to the extent specified herein. The issue of the documents which are indicated as DOD adopted shall be the issue in the current DoDISS and the supplement thereto, if applicable.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B46.1 Surface Texture (Surface Roughness, Waviness, and Lay)

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(Applications for copies should be addressed to the American National Standards Institute, 1430 Broadway, New York, NY 10018.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 126 Inspection, Test, and Standardization of Hydrometers

(Applications for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

3 DEFINITIONS

Not applicable.

4 GENERAL REQUIREMENTS

4.1 <u>Test apparatus</u>. The apparatus used in the stress corrosion test shall include the following:

- a. Test units (see 4.1.1).
- b. Length-measuring instrument (see 4.1.2).
- c. Test chamber equipped with devices for producing an alternate immersion cycle, racks for supporting the specimens and a circulating air system (see 4.1.3).
- d. Salt solution reservoir (see 4.1.4).

4.1.1 Test units.

4.1.1.1 <u>Test cylinders.</u> Test cylinders shall be as specified in procurement or other documents. Unless otherwise specified, the test cylinders shall conform to figure 1. The test cylinder may be reused provided that:

- a. It has not been damaged by a previous test.
- b. It has been reworked by machining or cleaning to remove all corrosion or rust products that affect the test conditions.
- c. Dimensions are within tolerances.

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4.1.1.2 <u>Test nuts or collars.</u> The companion test nuts used for testing the externally-threaded fasteners shall be as specified in the product specification. Test collars shall be made from materials compatible with that of the test cylinder, to eliminate galvanic action.

4.1.1.3 <u>Test bolts.</u> The companion test bolts used for testing the nuts or collars shall be as specified in the product specification.

4.1.1.4 <u>Lubricant coatings</u>. Lubricant coatings on test units and externally threaded fasteners are prohibited, unless specifically required in the product specification.

4.1.1.5 <u>Washers</u>. Washers under fastener heads or under nut bearing surfaces are prohibited, unless specifically required in the product specification.

4.1.2 <u>Length-measuring instrument</u>. The length-measuring instrument shall be capable of directly reading changes in length of 0.0001-inch. Its accuracy shall be such that the error of indication shall be within 0.0001-inch.

4.1.3 Test chamber. The test chamber and all its accessories shall be made of materials such as hard rubber, plastics, or suitably covered materials that will not affect the test conditions. The test chamber shall be properly vented and shall be of such volume that the bulk of the equipment under test will not interfere with the operating conditions as specified in 5.2.1. An alternate immersion device shall be provided for and shall be so constructed that it will produce an alternate immersion cycle as specified in 5.1.2. In addition, the test chamber shall be provided with such devices as fans or blowers that will produce a circulatory air system. The chamber and its accessories shall be constructed and arranged as follows:

- a. There shall be racks or fixtures for supporting the loaded test specimen assembly. There shall be no direct contact between the racks and the salt solution.
- b. Fans or blowers shall be arranged to provide the necessary circulatory air system to dry the test specimens within the limits specified in 5.1.2.

4.1.4 <u>Salt solution</u>. The salt used shall be substantially free of nickel and copper, and containing, on the dry basis, not more than 0.01 percent sodium iodide and not more than 0.3 percent of total impurities. A 3-1/2 percent sodium chloride solution shall be prepared by dissolving 3-1/2. $\pm 1/2$ parts, by weight, of salt in 96-1/2 parts, by weight, of distilled water or deionized water containing total chlorides of less than 200 ppm.

4.1.4.1 The salt solution shall be maintained at a pH of 6.5 to 7.5 at a solution temperature of 75°F \pm 5°F (24°C \pm 3°C). The pH of the solution shall be checked every 24 hours and shall be

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measured electrometrically, using a glass electrode with a saturated potassium chloride bridge, or colorimetrically, using bromothynol blue as an indicator. Only diluted analytical reagent grade (AR) hydrochloric acid or cp sodium hydroxide, whichever is appropriate, shall be used to adjust the pH of the solution.

4.1.4.2 Only one type of alloy fastener system shall be tested at a time in the same solution reservoir. A fresh salt solution shall be used for each test. The time lapse between solution changes shall be not more than 7 days. The 3-1/2 percent salt solution shall be maintained by the addition of distilled or deionized water, and the concentration shall be checked with a hydrometer that has been tested in accordance with ASTM E 126.

4.2. Preparation of test specimens.

4.2.1 The ends of the externally threaded test specimen shall be prepared such that accurate and repeatable length measurements can be obtained. Ends of a plated specimen shall be sealed to eliminate corrosion after loading has been completed.

4.2.2 Unless otherwise specified, uncoated and metallic coated test specimens and test units shall be thoroughly free of dirt, oil, and grease. Specimens shall be cleaned with detergent and rinsed with deionized water to obtain a water-break-free surface, followed by rinsing with isopropyl alcohol and air or blow drying. No halogenated solvents or abrasives of any type are permitted. Cleaning must be done within one hour of test, shall be processed with a minimum of handling. The specimen shall be handled only with clean, lintless cotton gloves after the cleaning operation.

5. DETAIL REQUIREMENTS

5.1 Test procedures.

5.1.1 <u>Assembly</u>. Prior to assembly, the test specimen and test units shall be prepared and cleaned in accordance with 4.2. The test bolt, or externally threaded specimen, shall be inserted into the test cylinder and the test nut shall be installed until finger tight (do not load assembly). There should be not less than three unengaged threads between the thread runout area of the externally threaded member and the bearing face of the nut or collar. Before applying any load, the overall length of the externally threaded member shall be measured to within the nearest 0.0001-inch with a length-measuring instrument as specified in 4.1.2. The assembly shall be loaded by applying torque to the nut until the bolt elongates to the predetermined amount to within the nearest 0.001inch. The required elongation shall be determined from a load vs. elongation curve. All length measurements shall be made at 75°F \pm 5° F (24°C \pm 3°C) (see 1.2).

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5.1.2 <u>Alternate immersion cycle</u>. The loaded assembly shall be recleaned in accordance with 4.2. After cleaning, the loaded assembly shall be attached to the supporting fixture by means of a nylon cord, plastic hook, or other nonmetallic materials. The loaded assemblies shall be so positioned that:

- a. They do not contact each other or any metallic material.
- b. Corrosion products and condensate from one assembly does not fall upon another assembly.
- c. Pockets or recesses on the test specimen are adequately drained during the 50-minute drying cycle.

The alternate immersion cycle shall be accomplished by subjecting the loaded assembly to the salt solution for a steady period of 10 minutes per hour, $\pm 1 \text{ min/hr}$, followed by drying in air for a steady period of 50 minutes per hour, $\pm 1 \text{ min/hr}$, for the test duration. Parts shall be dry, as determined by visual inspection. It is recommended that the loaded assembly be visually examined at least once every 24 hours for any indication of cracks or failure by fracture (see 1.2).

5.2 Test conditions.

5.2.1 <u>Operating conditions</u>. The air entering the exposure chamber shall be free from all impurities, such as oil and dirt, and shall be maintained at a temperature of 75°F \pm 5°F (24°C \pm 3°C). A satisfactory method of controlling the temperature accurately is by housing the apparatus in a properly controlled constant temperature room.

5.2.2 <u>Test load</u>. Unless otherwise specified, the induced test load shall be equivalent to 75 percent of the minimum ultimate tensile strength of the product specification.

5.2.3 <u>Test duration</u>. The test duration shall be as specified in the product specification. The test shall be run continuously for the time indicated or until definite indication of failure is observed, with interruptions only for adjustment of the apparatus, changing of solution, and inspection of the specimen.

5.3 <u>Specimen examination</u>. Upon completion of the test, the test specimens shall be disassembled from the test units and cleaned, and then examined for the presence of cracks in accordance with MIL-I-6866 or MIL-I-6868, whichever is applicable.

5.4 <u>Test results.</u> The development of cracks or failures by fracture of any test specimen constitutes failure of the specimen and shall be reported.

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5.4.1 Tests resulting in cylinder failure shall not be considered a satisfactory test of the test specimen.

5.4.2 Tests resulting in nut or collar failure shall not be considered a satisfactory test of the externally threaded fastener.

5.4.3 Tests resulting in bolt failure shall not be considered a satisfactory test of the nut or collar.

5.4.4 Tests resulting in failures specified in 5.4.1, 5.4.2, and 5.4.3 shall be repeated using new fasteners.

6 NOTES

6.1 <u>Test report.</u> The test report shall contain the following data:

a. Fastener description.

1. Part number.

2. Lot identification.

3. Manufacturer.

4. Heat treatment.

5. Material.

6. Measured fastener diameter.

7. Fastener strength level.

b. Instrumentation.

1.

1. Model and serial number.

2. Calibration date.

c. Description of component test units.

d. Installation elongation.

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- e. Method of supporting specimen.
- f. Test duration.
- g. Description of mating part.
- h. Location of failure.
- i. Cause and duration of any interruptions during test.
- j. Results of all inspections.
- k. Solution concentration.
- I. Temperature reading.
- m. Specimen preparation.

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NOTES:

- Slot width & depth to be equal to bearing surface fillet +0.03125, ±0.010, but not less than 0.062.
- 2. Slot or hble optional on nut end.
- 3. Countersink to clear bearing surface fillet.
- 4. Break sharp internal and external edges 0.015 radius (approx) on both ends.
- 5. Surface texture: 125 microinches in accordance with ANSI B46.1.
- 6. Material & heat treat: As specified by product specification. For testing fastener, compatible material shall be used.
- 7. D is the nominal fastener diameter.
- .8. Dimensions in inches.

FIGURE 1. Test cylinder.

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