

NASM1312-10
29 August 1997

ADOPTION NOTICE

NASM1312-10, "Fastener Test Methods Method 10 Stress Rupture" was adopted on 29 August 1997 for use by the Department of Defense (DoD). Proposed changes by DoD activities must be submitted to the DoD Adopting Activity: Commander, Naval Air Warfare Center Aircraft Division, Code 414100B120-3 Highway 547, Lakehurst, NJ 08733-5100. DoD activities may obtain copies of this standard from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094. The private sector and other Government agencies may purchase copies from the Aerospace Industries Association, 1250 Eye Street NW, Washington, DC 20005.

NASM1312-10 Should be used instead of MIL-STD-1312-10, which was cancelled on 29 August 1997.

Custodians:

Army - AV
Navy - AS
Air Force - 11

Preparing activity:

Navy - AS
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NASMI312-10
STANDARD PRACTICE

FASTENER TEST METHODS

METHOD 10

STRESS RUPTURE



THE INITIAL RELEASE OF THIS DOCUMENT SUPERSEDES MIL-STD-1312-10

DESIGNATION FOR THIS TEST METHOD REMAINS MIL-STD-1312-10

LIST OF CURRENT SHEETS									
NO.	1	2	3	4	5	6	7	8	9
REV.	NEW	NEW	NEW	NEW	NEW	NEW	NEW	NEW	NEW

SHEET 1 OF 12

APPROVAL DATE AUGUST 1997
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FOREWORD

This standard sets forth a standard test method to determine the stress rupture limits of fasteners under controlled temperature conditions.

SHEET 2

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TABLE OF CONTENTS

<u>Paragraph</u>		<u>Sheet</u>
1.	SCOPE	5
1.1	Applicability	5
2.	REFERENCED DOCUMENTS	5
2.1	Government documents	5
2.2	Other publications	5
3.	DEFINITIONS	5
4.	GENERAL REQUIREMENTS	5
4.1	Test apparatus	5
4.1.1	Testing machines	5
4.1.2	Alignment	6
4.1.3	Elapsed time-indicator	6
4.1.4	Temperature measurement and control	6
4.1.5	Thermocouples	6
4.1.5.1	Junction	6
4.1.5.2	Wire	6
4.1.5.3	Instrumenting the specimen	6
4.1.6	Temperature recorder	6
4.1.7	Fixturing	7
4.2	Test specimens	7
4.2.1	Bolt/nut combination	7
4.2.2	Reduced gage section specimens	7
4.2.3	Fabrication of specimens from finished parts	7
4.2.4	Surface	7
5.	DETAIL REQUIREMENTS	7
5.1	Test procedures	7
6.	NOTES	8
6.1	Test report	8
6.2	Extrapolation/interpolation of data	9
6.3	References	9

SHEET 3

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FIGURES

<u>Figure</u>		<u>Sheet</u>
1.	Combination smooth and notched test specimen	10
2.	Smooth bar test specimen.....	11
3.	L-M parameter curve	12

SHEET 4

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1. SCOPE

1.1 Applicability. This test method covers the equipment and procedures to be used for stress rupture testing of bolts, screws, nuts, and of associated materials.

2. REFERENCED DOCUMENTS

2.1 Government documents. Not applicable.

2.2 Other publications. The following document(s) forms a part of this specification to the extent specified herein. The issues 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)

(Applicable 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 4 Load Verification of Testing Machines

(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 Test apparatus

4.1.1 Testing machines. Stress rupture machines shall be of the type that will not permit shock loading, overloading, or the introduction of torque to the test member. They shall be capable of maintaining the applied load within specified limits until rupture or the end of the test period. The loading mechanism shall be capable of ensuring the necessary accuracy of within 1 percent of the applied load, including all variables. The accuracy shall be verified annually by a method complying with ASTM E 4, or equivalent, with a force measuring system traceable to the National Bureau of Standards within the previous two years.

4.1.2 Alignment. Alignment shall be controlled using spherical washers, pin and clevis joints, or bearings as required to ensure that no greater than 10 percent difference in strain exists on diametrically-opposed surfaces of a machined test sample.

4.1.3 Elapsed-time indicator. The elapsed-time indicator shall have an accuracy of 1 percent and shall indicate the time in increments of 0.1 hours.

4.1.4 Temperature measurement and control. The heating apparatus shall be capable of controlling the gradient temperatures within the allowable temperature maximum deviations. The controller shall be of the high/low current, saturable reactor, or silicon controlled rectifier type. The cycle of the controller shall not exceed 4 °F total indicated cycle. All critical areas of the test specimen must be controlled to a temperature within 5 °F (up to 1200 °F) and to within 3 °F (above 1200 °F) indicated, of the test temperature using good pyrometric practices.

4.1.5 Thermocouples.

4.1.5.1 Junction. All thermocouple junctions shall have welded beads, with no electrical short circuits between positive and negative leads. The beads shall be in contact with the test specimen insulated from the furnace environment. Welding of the thermocouple to the specimen shall be allowed.

4.1.5.2 Wire. Instrument grade thermocouple wire shall be used, with calibration traceable to the National Bureau of Standards. Individual thermocouples shall not be calibrated, nor any correction factors used from calibration.

4.1.5.3 Instrumenting the specimen. Three thermocouples shall be used to indicate the temperatures; one each at the top, middle, and bottom of the test section. The temperature control limits shall apply to all thermocouples.

EXCEPTION: When parts have less than two inches exposed length, the gradient thermocouples shall be placed on the adapters adjacent to the test section. In such cases, the allowable temperature variation of the end thermocouple readings shall be two times that indicated in paragraph 4.1.4.

4.1.6 Temperature recorder. The temperature recorder shall be of the potentiometric type with an accuracy of 1/2 percent of full scale or better. All indicating thermocouple readings shall be recorded for the duration of the test. A multi-point strip-chart recorder of the stated accuracy is satisfactory, which provides an indication of controller drift prior to exceeding the allowable limits.

4.1.7 Fixture. The fixture design is optional. In the case of a bolt being tested, a threaded fixture may be used. Two to three threads must be exposed adjacent to the shank when bolts or bolt/nut combinations are being tested.

4.2 Test specimens.

4.2.1 Bolt/nut combination. When specific bolt/nut combinations or integral fasteners supplied in one assembly must be evaluated, the stress rupture test must be performed on the entire assembly. Tests resulting in failure of any component of the assembly shall be considered an assembly failure.

4.2.2 Reduced gage section specimens. Unless specifically noted, the ratio of gage diameter to gage length shall be 1 to 4 (see figure 1 and 2).

4.2.3 Fabrication of specimens from finished parts. For bolts and screws whose test loads would normally exceed 20,000 pounds, a specimen made from the finished part may be tested in lieu of the fastener (see figure 1 for dimensions and configuration). When the test temperature becomes impossible to maintain in both the smooth and notched sections, separate specimens shall be prepared in accordance with figure 2 and individually tested.

4.2.4 Surface. Unless otherwise specified, uncoated or metallic-coated test specimens 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. Specimen cleaning must be done within one hour of test. Specimen shall be processed with a minimum of handling and handled only with clean, lintless cotton gloves after the cleaning operation.

5. DETAIL REQUIREMENTS

5.1 Test procedures.

5.1.1 Assemble the test member into the appropriate test fixtures. Attach thermocouples to the test member in accordance with paragraph 4.1.5.3. Assemble the furnace or heating apparatus over the test member. Care shall be taken that the furnace neither adds nor detracts from the test load.

5.1.2 When the test temperature is attained, and the gradient established, maintain the test temperature for at least thirty minutes to ensure uniform test member heating and temperature equilibrium prior to loading.

5.1.3 Apply the load at the prescribed rate. If load rate is not defined, apply the load over a time frame not to exceed one minute to ensure that the test member is not shocked or overloaded.

5.1.4 Maintain the test load and temperature until specimen fracture occurs or the required test time has elapsed.

5.1.5 Any temperature change outside of the limits specified, shall be cause for rejection of the test, and shall require retesting.

5.1.6 Unless otherwise specified, the maximum test duration shall be 24 hours. For development work, continue stress rupture testing until failure occurs.

6. NOTES

6.1 Test report. The test report shall contain the following data:

- a. Fastener description.
 1. Part number.
 2. Lot identification.
 3. Material.
 4. Heat treatment.
 5. Grip length.
 6. Mating part.
 7. Measured diameter.
- b. Test machine
 1. Model and serial number.
 2. Calibration date.
- c. Test method (where options are available).
- d. Test load.
- e. Load rate.
- f. Test duration.
- g. Type of failure.
- h. Temperature reading.

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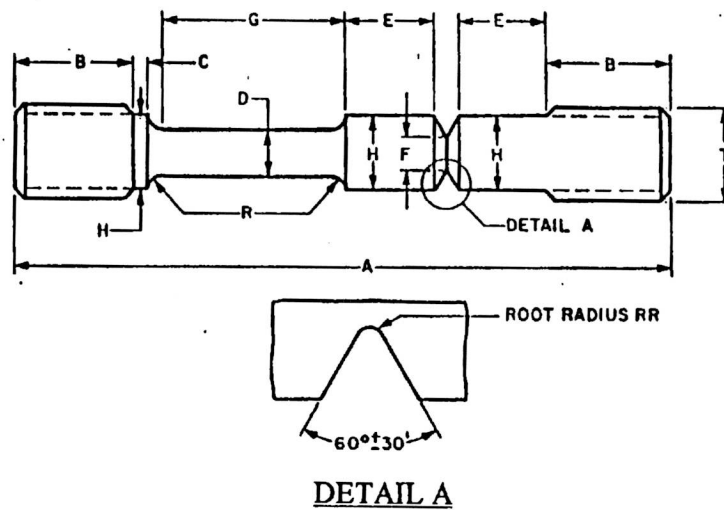
NASM1312-10

- i. Cause and length of interruption during test
- j. Results of all inspections.
- k. Specimen preparation.
- l. Installation procedure.

6.2 Extrapolation/interpolation of data. For development or when time is not available for prolonged testing, the Larson-Miller parameter can be used to estimate the stress-rupture properties at different times and temperatures. Test data are plotted on an L-M parameter curve for the material being tested (see figure 3). This method takes advantage of a general correlation of applied stress and time to rupture over a wide range of temperatures.

In the parameter, C is a constant or an empirical number obtained from test data over a variety of temperatures. For different materials, this constant may vary from a value of 10 to 30. In general, a constant of 20 provides good correlation of data.

6.3 References. For detailed description, application, and limitations of the L-M parameter, refer to ASME Transactions, Vol 74, page 756 (1952) and ASM Metals Handbook, Volume 1, Properties and Selection of Metals, 8th Edition. For guides to pyrometric practice, see Temperature, Its Measurement and Control in Science and Industry, American Institute of Physics.

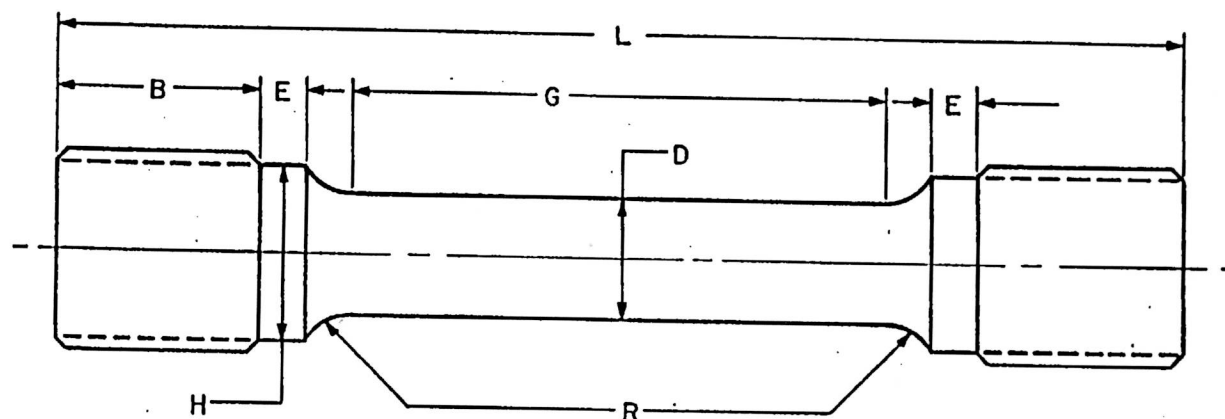


Specimen No.	D Center gage diameter ± 0.0001 (in.)	C ± 0.0625 (in.)	G min (in.)	E min (in.)	F ± 0.001 (in.)	H ± 0.003 (in.)	R min ± 0.0005 (in.)	RR ± 0.0005 (in.)	T Min thd size UNF-3A
1	0.125	0.125	0.5	0.375	0.125	0.177	0.125	0.005	0.2500-28
2	0.150	0.125	0.6	0.375	0.150	0.212	0.125	0.005	0.3125-24
3	0.160	0.125	0.65	0.375	0.160	0.226	0.125	0.005	0.3125-24
4	0.178	0.125	0.75	0.375	0.178	0.250	0.125	0.005	0.3125-24
5	0.252	0.125	1.0	0.375	0.252	0.375	0.125	0.007	0.5000-20
6	0.357	0.125	1.5	0.375	0.357	0.500	0.125	0.010	0.6250-18
7	0.505	0.125	2.0	0.375	0.505	0.750	0.125	0.015	0.8750-14

NOTES:

1. Unless otherwise specified, surface texture 125 microinches in accordance with ANSI B46.1.
2. The difference between "F" and "D" shall not exceed 0.0005-inch for specimens 1, 2, 3 and 4; and 0.0001 for specimens 5, 6 and 7.
3. Taper gage length "G" to center so that "D" at the ends of the gage length exceeds "D" at the center of the gage length by 0.0005 to 0.0015-inch.
4. All sections shall be concentric about the specimen axis within 0.001-inch.
5. Dimensions "A" and "B" are not specified.
6. Where fastener length is insufficient to produce a specimen to figure 1, separate smooth and notched specimens may be individually tested.

FIGURE 1. Combination smooth and notched test specimen.



Specimen no.	Diameter D (in.)	L ±0.0625 (in.)	E nominal (in.)	R (in.)	B nominal (in.)	Thread UNF-3A	H nominal (in.)
1	0.125	1.10	0.04	0.250	0.25	0.2500-28	0.177
2	0.160	1.40	0.06	0.250	0.30	0.3125-24	0.226
3	0.252	2.20	0.08	0.375	0.50	0.5000-20	0.375
4	0.357	3.30	0.12	0.375	0.68	0.6250-18	0.500
5	0.505	4.40	0.16	0.375	0.88	0.8750-14	0.750

NOTES:

1. Unless otherwise specified, the maximum surface texture shall be 125 microinches in accordance with ANSI B46.1.
2. Taper gage length "G" to center so that "D" at the ends of the gage length exceeds "D" at the center of the gage length by 0.0005-inch to 0.0015-inch.
3. All sections shall be concentric about the specimen axis within 0.0001-inch.

FIGURE 2. Smooth bar test specimen.

NASM1312-10

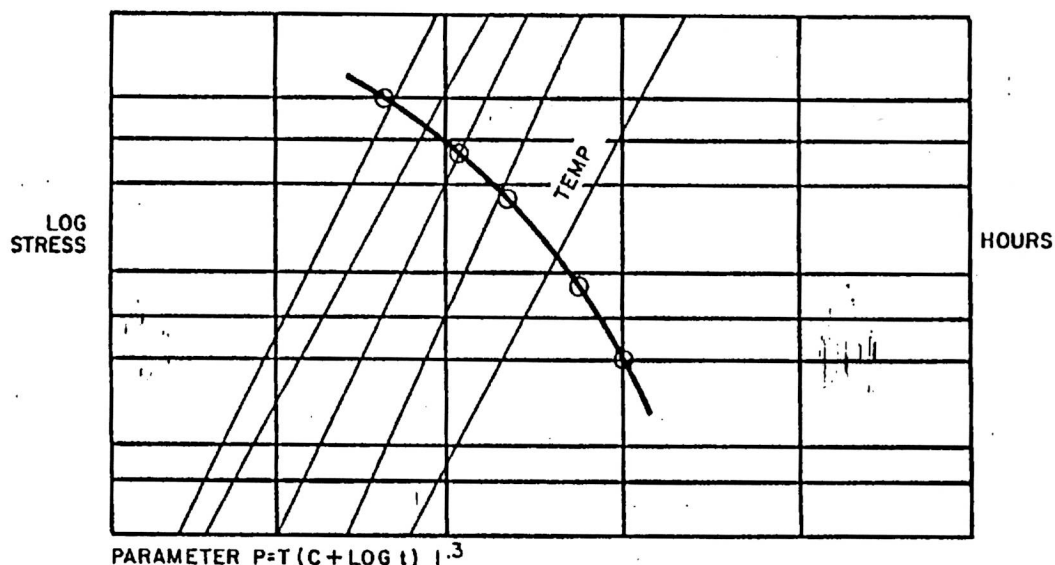
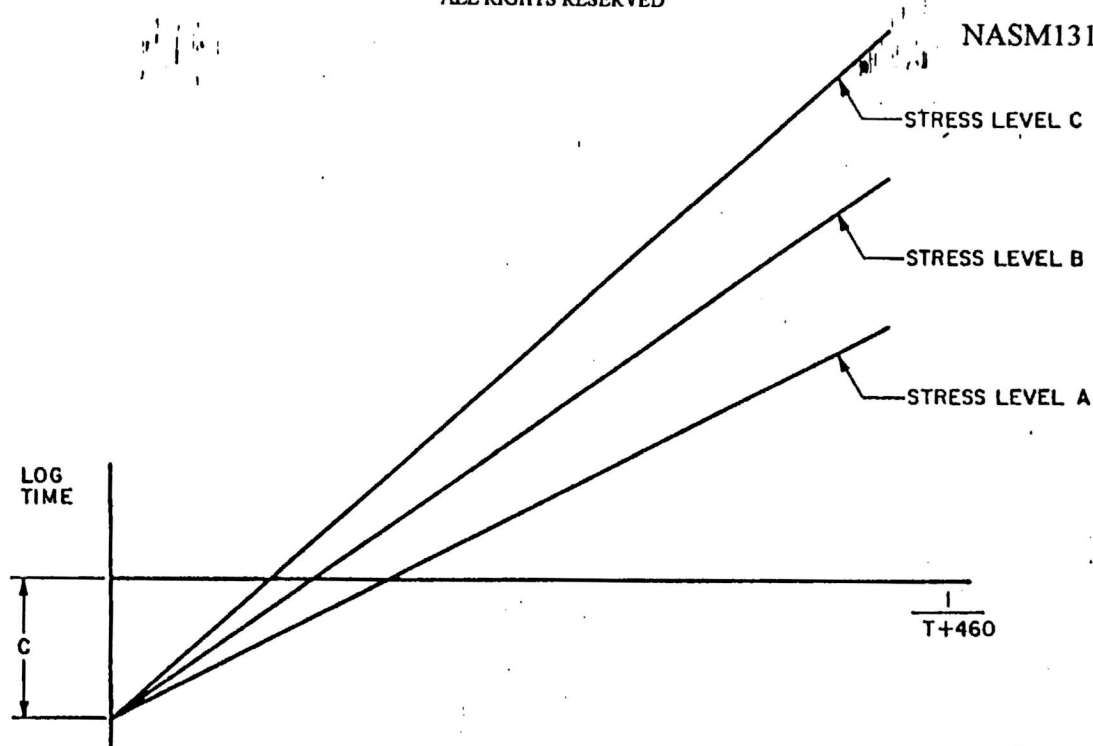


FIGURE 3. L-M parameter curve.