NATIONAL AEROSPACE STANDARD

NASM1312-5
STANDARD PRACTICE

FASTENER TEST METHODS

METHOD 5

STRESS DURABILITY

Aerospace Industries Association

THE INITIAL RELEASE OF THIS DOCUMENT SUPERSEDES MIL-STD-1312-5A

DESIGNATION FOR THIS TEST METHOD REMAINS MIL-STD-1312-5

LIST OF CURRENT SHEETS									
NO.	1	2	3	4	5	6	7	8	9
REV.	NEW	NEW	NEW	NEW	NEW	NEW	NEW	NEW	NEW
NO.	10	11	12	13	14				
REV.	NEW	NEW	NEW	NEW	NEW				

FSC 53GP

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FOREWORD

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

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FIGURES

1. SCOPE

1.1 Applicability. This method outlines a standard procedure for testing the stress durability of externally, threaded fasteners. This procedure applies to all types of externally threaded fasteners which may be subject to any type of embrittlement and is not limited by configuration or size.

2. REFERENCED DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards and handbooks. 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

FEDERAL

GGG-W-686 Wrench, Torque

MILITARY

MIL-T-5544 Thread Compound, Antiseize, Graphite-Petrolatum

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.)

3. DEFINITIONS Not applicable.

4. GENERAL REQUIREMENTS

4.1 Test apparatus.

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4.1.1 Torque method of loading. Torque wrenches calibrated for accuracy within the limits specified by GGG-W-686 will be required, as well as the necessary adapters to fit the configuration of the fastener under test. Also required are steel blocks as shown on figure 1, heat treated to a minimum hardness of Rockwell C 45, or steel spacers as shown on figure 2, heat treated to a minimum hardness of Rockwell C 45, and an internally threaded member (figures 3 and 4) with sufficient strength to develop full tensile strength of the fastener being tested.

4.1.2 Elongation method of loading. Equipment in accordance with 4.1.1 shall be used, except that any suitable wrenching device may be used and a precision measuring instrument is required to measure elongation of the test fastener according to acceptable methods.

4.1.3 External loading method. Suitable equipment and fixtures, such as those used in tensile testing of fasteners, shall be used to develop and maintain the required test load on the fastener.

4.1.4 Strain gage method of loading. A precision calibrated load cell of sufficient capacity to develop full tensile strength of the fastener under test shall be used, and be of proper dimensions to accommodate the fastener. Strain gages shall be fastened by standard approved methods to the load cell as indicated on figure 5. Hardened steel washers or plates, as shown on figure 5 of sufficient strength to develop full tensile strength of fastener, shall be required. In addition, an accurate strain indicator is required which, at the option of the tester, may be coupled with a multi-channel switch and balance unit. Also required are a suitable wrenching device for the test fastener, and an internally threaded member as specified in 4.1.1.

4.2 Test specimen sample size. The number of specimens to be tested from each lot shall be as specified in the acquisition document or product specification. The test specimen shall not be altered other than as specified in 5.2.

5. DETAIL REQUIREMENTS

5.1 Test procedures. Unless otherwise specified, stress durability tests shall be conducted in accordance with one of the following methods listed below. Selection of method to be an option of the manufacturer. In the event of controversy, the external loading method shall be used as the referee method.

5.1.1 Torque method. Test fastener shall be assembled in the test units, utilizing not more than three spacers in accordance with figure 4. The threads of the fastener, the bearing surface of the fastener head, and the bearing surface of the nut shall be lubricated with a lubricant conforming to MIL-T-5544. A minimum of two full threads of the test specimen shall extend above the face of the nut or tapped block toward the head of the bolt. The tapped test block or the untapped block nearest to the nuts shall be held in a vise. The specimen shall be tightened with a torque wrench to a torque equivalent to the required test load. Unless otherwise specified, the induced load shall be 75-80 percent of the minimum ultimate tensile strength specified in the product specification. The specimen assembly shall remain in a torqued condition at room temperature for a period of time specified by the procurement document.

5.1.1.1 The torque value may be determined from the following equation or torque tension curves developed from tests utilizing hardened steel threaded members:

$$T = KDL$$

where T = torque in inch-pounds
K = 0.1 (friction factor)
D = nominal diameter of specimen (inches)
L = induced load (pounds)

5.2 Elongation method. The test fastener shall be assembled in the test units, utilizing not more than three blocks in accordance with figure 4. The threads of the fastener, the bearing surface of the fastener head, and the bearing surface of the nut shall be lubricated with a lubricant conforming to MIL-T-5544. A minimum of two full threads of the test specimen shall extend above the face of the nut or tapped block toward the head of the bolt. The tapped test block or the untapped block nearest the nut shall be held in a vise. The specimen shall be tightened with any suitable wrenching device until the predetermined elongation of the specimen has been reached by actual measurement with a precision measuring device, usually a micrometer, over the ends of the specimen. The assembly shall be allowed to stand at room temperature for the period of time specified by the procurement document. The predetermined amount of elongation shall be obtained from a load versus elongation curve developed from data obtained utilizing a standard tensile testing machine, comparable fixtures, and fasteners from the lot being evaluated. The test load shall be equal to 75-80 percent of the minimum ultimate tensile strength of the detail specification. The predetermined elongation can be computed using the formula:

$$e = \frac{P}{E}\left(\frac{L}{A} + \frac{L_t}{A_t}\right)$$

where e = total bolt elongation (in.)
P = clamping force (lb)
A = area of shank (sq in.)
L = length of grip (in.)
A_t = thread stress area (sq in.)
L_t = thread length between bearing faces (in.)
E = modulus of elasticity (psi)

NOTE: Approximately two pitches should be added to the thread length portion when using a nut.

If the condition of the end surfaces on which the measurement is taken is not suitable for precise measurement, the surfaces shall be prepared by grinding or center-drilling prior to assembly in the test fixture.

5.3 External load method - flexure fixture. The specimen shall be assembled in test fixtures designed to ensure axial loading as shown in figure 6. Sufficient external load shall be applied to the fastener/head spacer to develop an induced load of 75-80 percent of the minimum ultimate tensile strength of the product specification. A minimum of two full threads of the test specimen shall extend above the face of the nut toward the head of the bolt. While the applied external load is maintained, the nut shall be cinched up by wrenching to have the load apply to the specimen. The external load shall be removed and the specimen shall remain in this condition at room temperature for the time specified by the product specification.

5.4 Strain gage method. The test specimen shall be assembled with the washers, the calibrated load cell to which strain gages have been attached, and the nut as shown on figure 5. The assembly shall be lubricated as shown on figure 5. The balance of the procedure shall be performed in accordance with 5.1 except that the strain indicator with leads attached to the strain gages shall be used to indicate when the proper relative load has been reached and is being maintained throughout the test period.

5.5 Alternative loading method. Any other method of applying and maintaining a load which results in a load of 75-80 percent of the product minimum tensile strength being induced in the specimen is acceptable.

5.6 Specimen examination. The test specimen shall be disassembled and inspected for the presence of transverse cracks in accordance with MIL-I-6868 for magnetic materials or MIL-I-6866 for other materials.

5.7 Test results. Cracks or fracture of any test specimen constitutes failure of the specimen.

6. NOTES

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

a. Fastener description.

1. Part number.

2. Lot identification.

3. Manufacturer.

4. Material.

5. Measured fastener diameter.

b. Test machine.

1. Model and serial number.

2. Calibration date.

c. Fastener strength level.

d. Installation procedure.

e. Installation torque or elongation.

f. Stress durability test load.

g. Test duration.

h. Type of failure.

i. Description of test method used.

j. Calculations

k. Cause and duration of any interruptions during test.

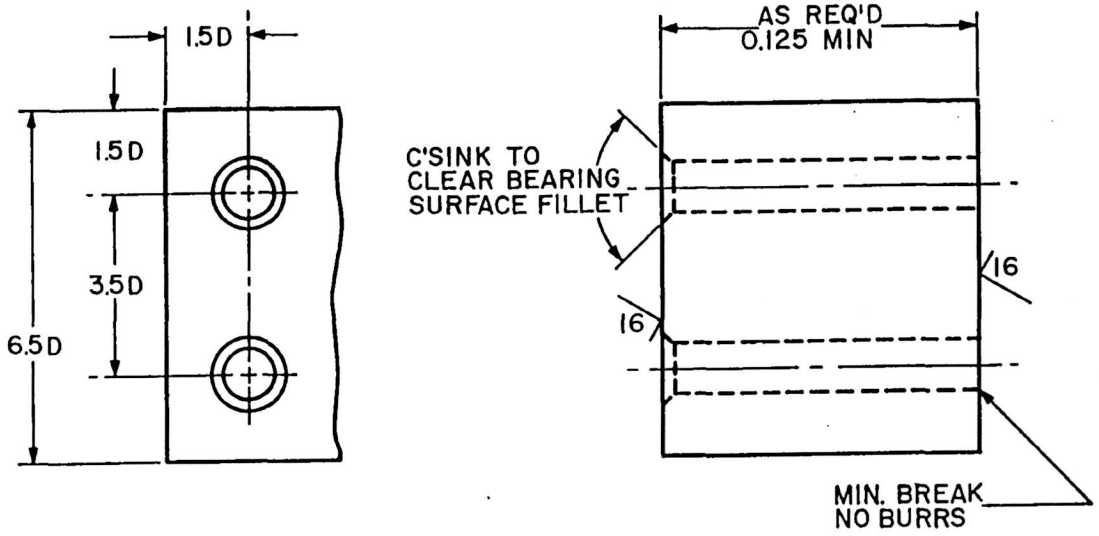
l. Results of all inspections.

NOTE: For quality assurance testing, the report shall only specify:

a. That the test was conducted in accordance with MIL-STD-1312-5A

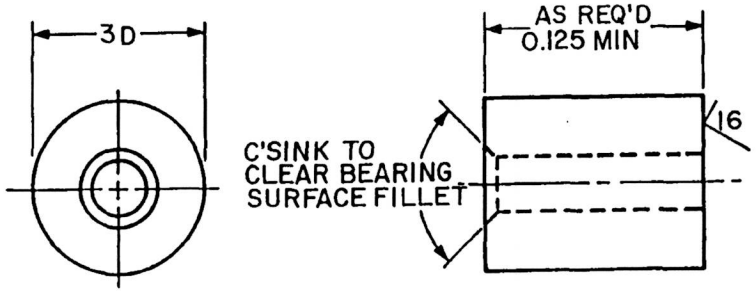
b. The exposure time, and

c. The results of final inspection reported.



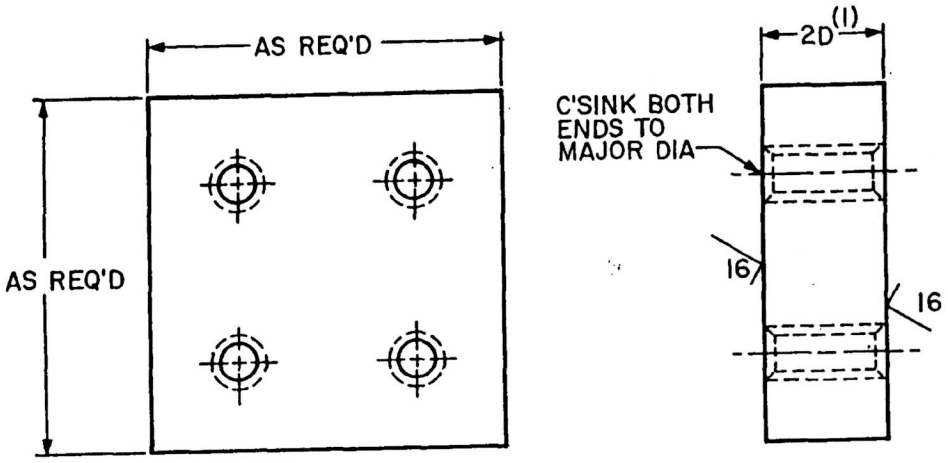
NOTES:
1. One or more holes perpendicular to top and bottom within ± 0°30'.
2. Diameter to fit shank of fastener as close as possible without interference.
3. D = Nominal diameter of fastener.
4. Top and bottom parallel within 1°.
5. Countersink for flush head fastener.
6. All dimensions in inches.

FIGURE 1. Test block



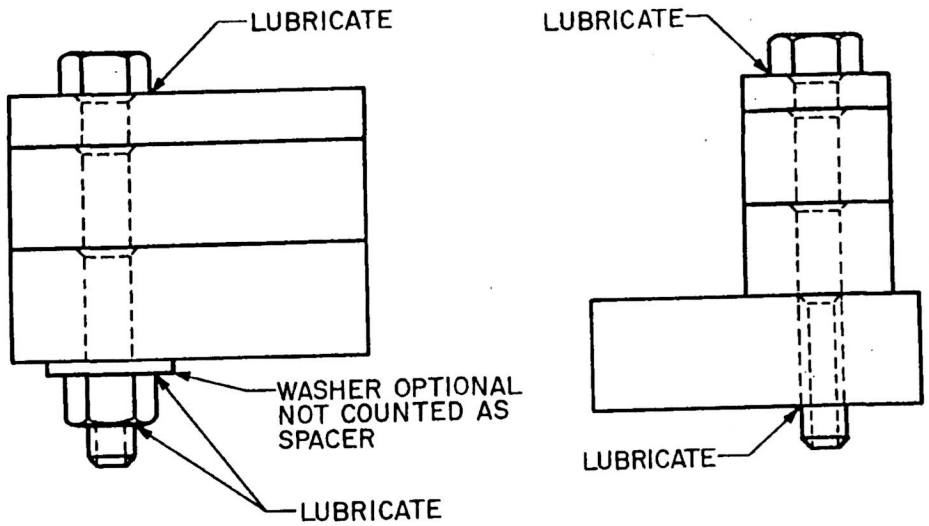
NOTES:
1. Hole perpendicular to top and bottom within ± 0°30'.
2. Top and bottom surfaces parallel within 1°.
3. D = Nominal diameter of fastener.
4. Diameter to fit shank of fastener as close as possible without interference.
5. Countersink for flush head fastener.
6. All dimensions in inches.

FIGURE 2. Test spacer



NOTES:
1. D = Nominal fastener diameter.
2. Class 3B threads to match specimen being tested.
3. Top and bottom surfaces parallel within 1°.
4. Holes located to provide clearance for spacer and match figure 1 block.
5. Hole perpendicular to top and bottom within ± 0°30'.

FIGURE 3. Tapped block



NOTES:
1. Hole size = (D +0.001) +0.004, -0.000 within 1D of ends.
2. Internally threaded member must not contact the bearing face of the block or spacer having chamfered holes.

FIGURE 4. Torque and elongation testing assembly

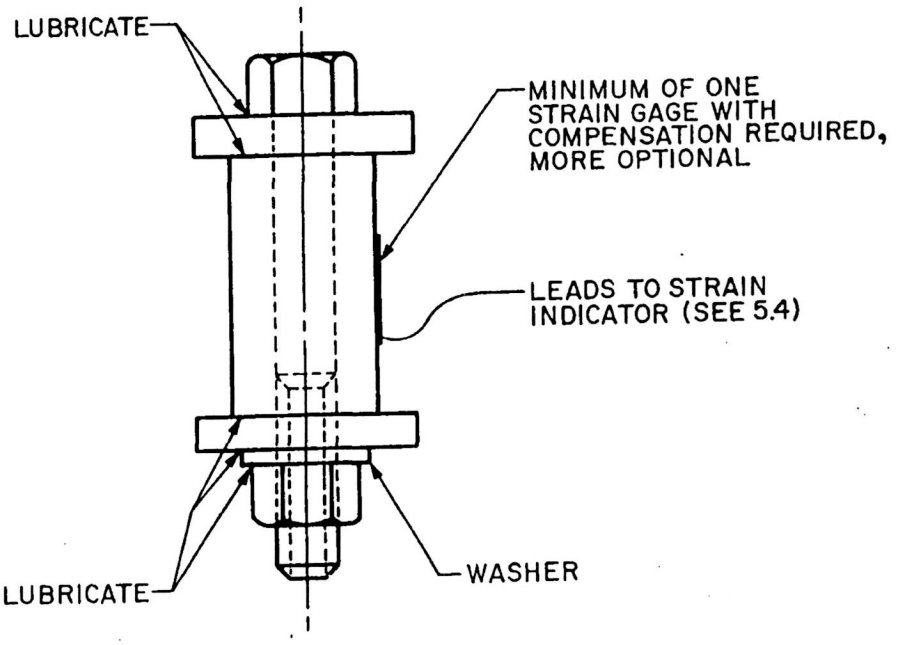


FIGURE 5. Testing assembly

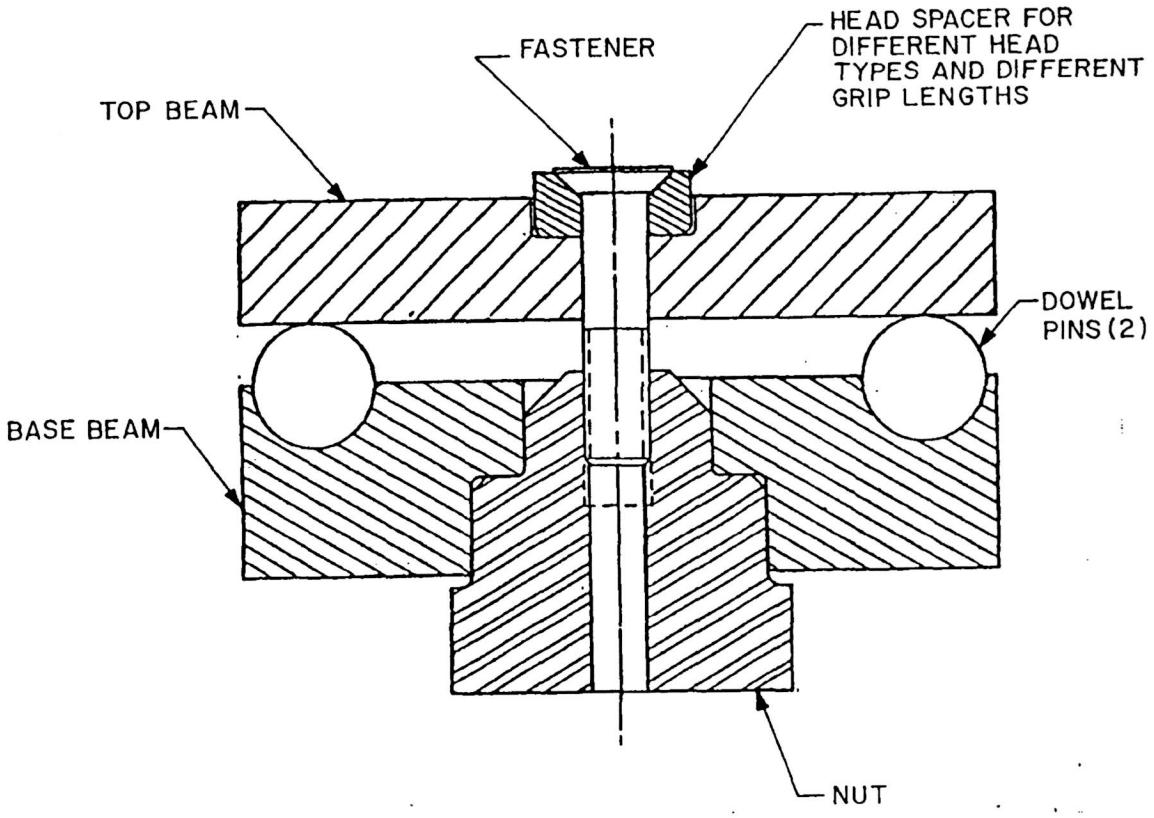


FIGURE 6. Flexure type test fixture