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MILITARY STANDARD

FASTENER TEST METHODS

METHOD 15,

TORQUE - TENSION



FSC 53GP

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DEPARTMENT OF DEFENSE
WASHINGTON, DC 20301

Fastener Test Methods, Method 15, Torque-Tension

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FOREWORD

This standard sets forth standard test procedures for determining the room temperature torque-tension relationship for threaded fasteners.

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1. SCOPE

1.1 Applicability. This test method outlines standard procedures for determining the room temperature torque-tension relationship for threaded fasteners. It is not limited by configuration size. The following methods are specified:

- a. Hand torque method using torque wrenches.
- b. Machine torque method using torsion machine.

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.

STANDARD

FEDERAL

GGG-W-686 Wrench, Torque

(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 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 SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 74 Verification of Calibration Devices for
Verifying 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.

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4. GENERAL REQUIREMENTS

4.1 Test apparatus.

4.1.1 Hand torque method. 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. A suitable method conforming to 4.1.3 shall be used to determine the tension. Fixtures shall conform to 4.1.4.

4.1.2 Machine torque method. A torsion machine capable of measuring and indicating within an accuracy of 2 percent of the scale employed shall be required as well as the necessary adaptors to fit the configuration of the fastener under test. A suitable method (see 4.1.3) shall be used to determine the tension. Fixtures shall conform to 4.1.4.

4.1.3 Tension. The induced tensile load shall be measured by one of the following instruments, which shall have been verified for accuracy not more than 3 months before being used.

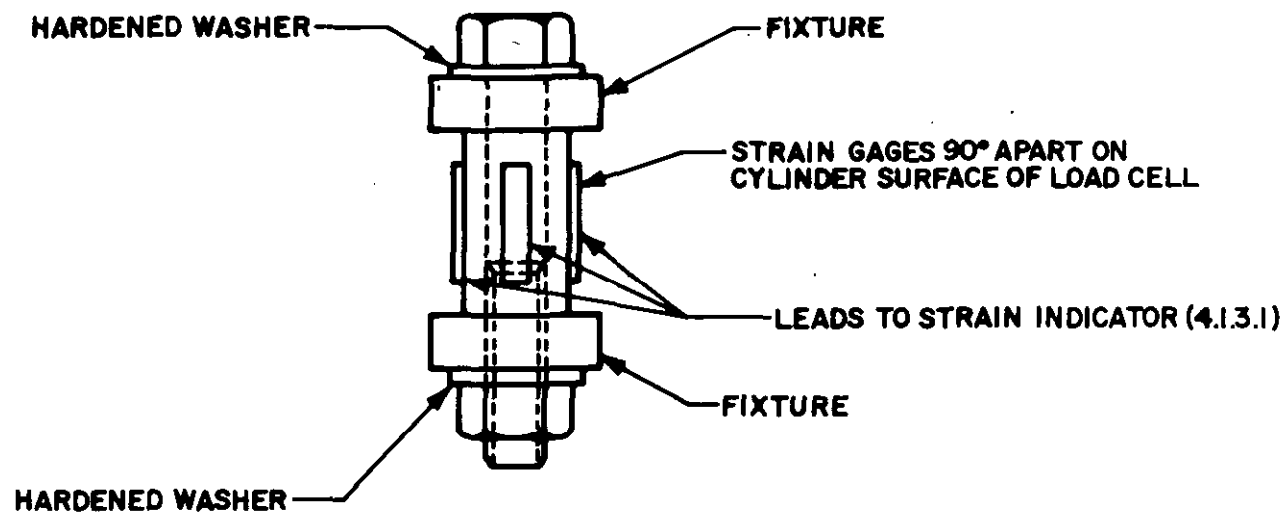
4.1.3.1 Load cell system. A precision load cell, which has been calibrated in accordance with ASTM E 74 in a universal testing machine, and of sufficient capacity to develop the full tensile load of the fastener under test shall be used. Appropriate strain gages shall be fastened by standard approved methods to the load cell essentially as indicated on figure 1. Hardened steel washers or plates as shown on figure 1, of sufficient strength to sustain the full tensile load of the fastener shall be required. In addition, a strain indicator is required. The complete system shall be accurate within 2 percent of the test load.

4.1.3.2 Tensile machine. A tension or universal tension machine capable of measuring and indicating the induced tension to within one percent of the test load shall be used. The machine shall be capable of maintaining the induced load upon cessation of the torque process.

4.1.3.3 Bolt tension calibrator. A bolt tension calibrator of the closed hydraulic system type with suitable dials to read the induced loading directly shall be used. The calibrator shall be accurate within 4 percent of the test load and shall be capable of maintaining the induced load upon cessation of the torque process.

4.1.3.4 Strain gage. A precision strain gaged bolt or stud calibrated in a tensile machine shall be used, together with an accurate strain indicator. The complete system shall be accurate within 2 percent of the test load.

4.1.4 Test fixtures. Unless otherwise specified, all fixtures used shall meet all the following requirements:



NOTE: FIXTURE TO PREVENT ROTATION AND WASHERS TO BE RESTRAINED

FIGURE 1. Testing assembly.

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4.1.4.1 Fixture bolt size shall be the basic diameter of the externally threaded fastener being tested plus 0.001-inch with a tolerance of +0.004 -0.000-inch. (Note that sufficient clearance must be provided to prevent bending of long shank bolts.) In the case of long shank bolts, the hole size in all fixtures other than the ones in contact with the bolt head bearing surface and the nut bearing surface may be enlarged to provide clearance for the shank. The hole in the plate washer in contact with the head bearing surface of the external fastener shall be chamfered to provide clearance of the head to shank fillet of the external fastener. The hole shall be perpendicular to the fixture bearing surface within +10 minutes.

4.1.4.2 Fixtures shall be steel, heat treated to a hardness of 45HRC min, with a surface finish on bearing surfaces not to exceed 32 micro inches. When washers are required they shall be hardened and finished as fixtures. Unless otherwise specified, washers may be reused provided that they are resurfaced and that they remain thick enough to sustain the load without distortion. Unless otherwise specified, the bearing surface shall be free of dirt or lubricant.

4.1.4.3 All fixtures and washers shall be retained in such a manner that they are not permitted to rotate.

4.1.4.4 Companion fasteners, when required shall be in accordance with the product specification. Unless otherwise specified, new fasteners shall be used for each test.

4.2 Test specimen. The number of specimens to be tested from each lot shall be in accordance with the procurement document or product specification. The test specimen shall not be altered in any manner beyond the specification prior to testing. Unless otherwise specified, all tests shall be run without supplementary lubrication.

5. DETAIL REQUIREMENTS

5.1 Test procedures. Torque-tension tests may be performed using any of the indicated methods to determine the torque and tension. In the event of controversy, the hand torque method (see 4.1.1) in conjunction with a tensile machine (see 4.1.3.2) shall be used as the referee method. Automatic recording devices may be used provided system accuracy is maintained.

5.1.1 Assembly. Unless otherwise specified, assemble the fasteners with two to three full form threads disengaged between the nut or internal thread bearing face and the external thread run-out. When nuts are used, a minimum of one complete thread shall extend beyond the top of the nut.

5.1.2 Loading. Unless otherwise specified, the externally threaded member should be fixed with the torque applied through the nut. It shall be applied at a rate that will permit the torque readings to be read while the nut is in motion. The induced load shall be read simultaneously.

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6. NOTES

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

6.1.1 Load-torque diagram. Unless otherwise specified, the test data shall be plotted as an induced load vs. torque curve. The induced load in pounds (or psi as applicable) shall be plotted on the abscissa and the torque values on the ordinate (figure 2).

6.1.1.1 Single value data. When a single load requirement is specified the torque required to develop the load shall be reported as the range for the samples tested.

- a. Fastener description.
- b. Part number.
- c. Manufacturer.
- d. Test method used (hand torque or machine torque).
- e. Test results.
- f. Load-torque diagram or single value data (as applicable).

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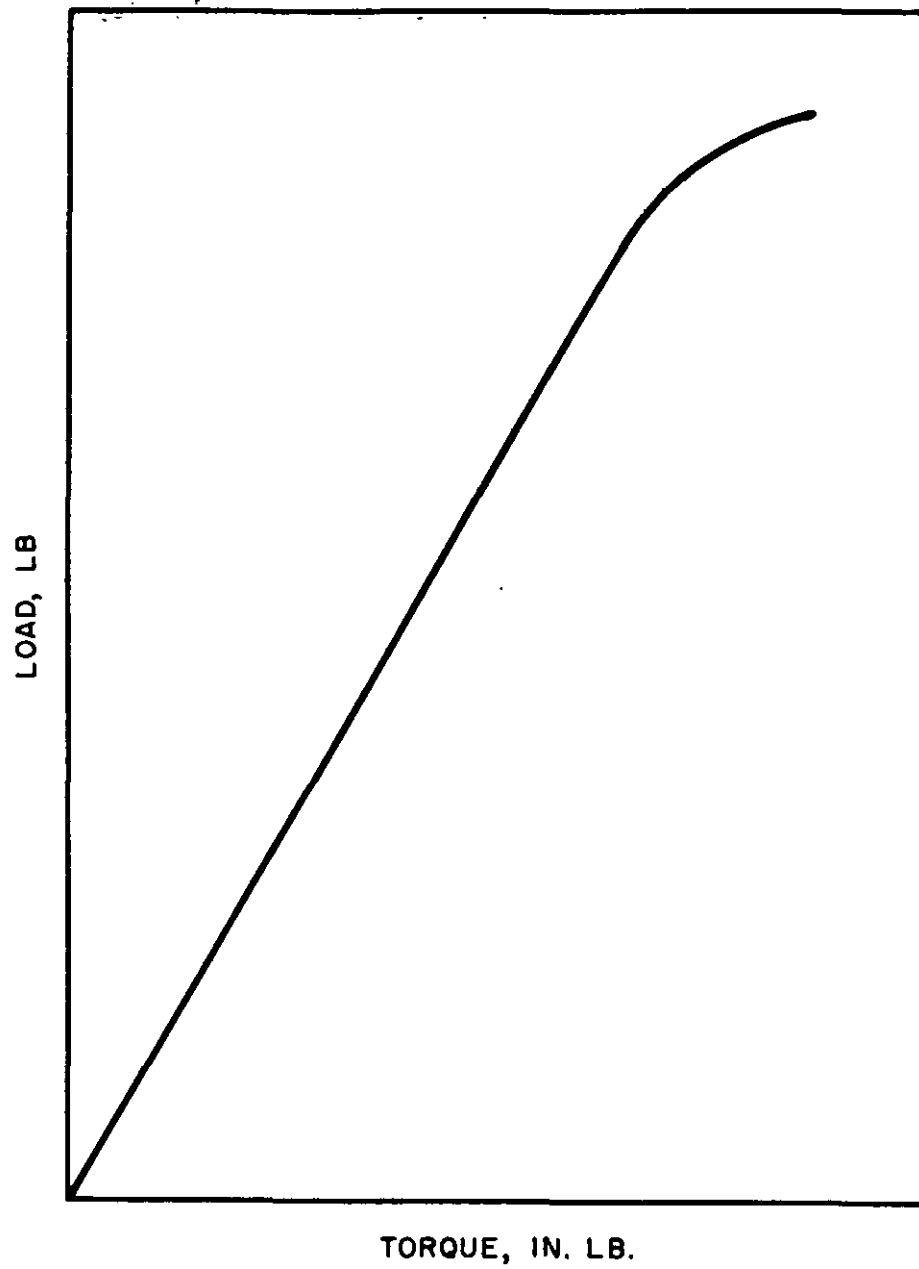


FIGURE 2. Load-torque diagram.

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