MIL-STD-1761(USAF)
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MILITARY STANDARD

FASTENER RECESS TEST,

METHOD FOR

DAMAGE TOLERANCE EVALUATION

FSC 53GP

DEPARTMENT OF DEFENSE
WASHINGTON, DC 20360

Fastener Recess Test, Method for Damage Tolerance Evaluation

MIL-STD-(USAF)

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2. Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addresssed to: ASD/ENESS, Wright-Patterson AFB, OH 45433 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

FOREWORD

The purpose of this document is to establish a standard test method for the evaluation of fastener internal recess drive damage tolerance.

CONTENTS

1. SCOPE

1.1 General. This military standard describes a standard test procedure for the evaluation of fastener internal recess drive damage tolerance in terms of their torque capability. The test procedure is not limited by recess style, size, or configuration or bolt material and strength level.

1.2 Intended use. This test may be used to obtain engineering data for recess evaluation, selection and maintainability information.

2. REFERENCED DOCUMENTS

2.1 Issues of documents. The following documents of the issue in effect on date of invitation for bids or request for proposal, form a part of this standard to the extent specified herein.

SPECIFICATIONS

FEDERAL

GGG-W-686	Wrench, Torque

MILITARY

MIL-B-9946	Bits, Screwdriver, General Specification for
MIL-P-23377	Primer Coating, Epoxy Polyamide, Chemical and Solvent Resistant
MIL-C-83286	Coating, Urethane, Aliphatic Isocyanate, For Aerospace Applications

STANDARDS

MILITARY

MIL-STD-1312	Fasteners, Test Methods

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

3. EQUIPMENT

3.1 Fixture. The test fixture shall be capable of maintaining alignment with the fastener axis, insuring non-rotation of the fastener, applying a specified end load and applying torque in the installation and removal direction. The fixture shall not limit any tendency of the driver bit to cam out of the recess during the test.

3.2 Torque wrench. Hand torque wrenches shall conform to the requirements of GGG-W-686.

3.3 Torsion machine. Torsion machines shall be accurate within ±2 percent. The torque indicating device of the torsion machine shall be selected such that the anticipated torque readings are within the range between 10 and 90 percent of the scale capacity.

3.4 Driver bits. The driver bits shall be appropriate for the recess being tested as defined in the applicable Military Standards, Industry Standards, or manufacturer's data. The driver bits shall be in accordance with the requirements of MIL-B-9946, Industry Standards, or the manufacturer's specification.

3.5 Specimens. The recess shall conform to the appropriate Military Standards, Industry Standards or manufacturer's specifications. The shank of the fastener may be modified to insure non-rotation during testing. The clamp or non-rotation device should be located within two diameters of the head-to-shank juncture.

4. TEST PROCEDURE

4.1 Test sequence. The test sequence is as follows:

a. Place the fastener in the fixture or non-rotation device.

b. Mate the driver bit with the recess of the fastener, insuring that the bit is free to move in or out of the recess,then position bit axis until it is within 1^{o} of the required angular alignment.

c. Apply the selected end load. The total end load shall be effective at the bit/fastener juncture. The end load tolerance shall be ± 0.5 pounds. Unless otherwise specified, the end loads shall be as specified in 6.2.2.

d. With the bit mated to the recess and the end load applied (but no torque applied), zero the torque measuring device.

e. Apply torque slowly in the removal direction at a smooth, continuous rate until the maximum torque has been reached as evidenced by camout (complete disengagement), bit failure, or at least a 90 percent decrease in torque from the maximum value noted.

f. Record the maximum torque and the mode of failure.

g. Disengage the fastener and driver, removing any debris from recess.

h. Using the same fastener, driver bit and test conditions, rotate the driver in the same direction as before, repeating steps b through f. If, at the first torque application, failure at f was due to the bit breaking, report torque, and condition of recess.

4.2 Installation torque test. When specified, the above procedure may also be used to evaluate characteristics by applying torque in the installation direction and utilizing the sequence in 4.1.

5. TEST REPORTS

5.1 Test reports. The test report shall contain at least the following data:

a. Fastener description including part number, size, manufacturer, material and strength level. Typical tensile, shear or hardness data shall be included.

b. Full recess identification including appropriate Military Standards, Industry Standards or manufacturer's specifications.

c. Driver bit data (includes applicable specification, manufacturer, size, material and hardness level).

d. Actual sequence test (includes description of fixtures, torque measuring devices, date of calibration, end load and angularity control).

e. Test results including mode of failure. (Figure 1 illustrates a method of presenting test data.)

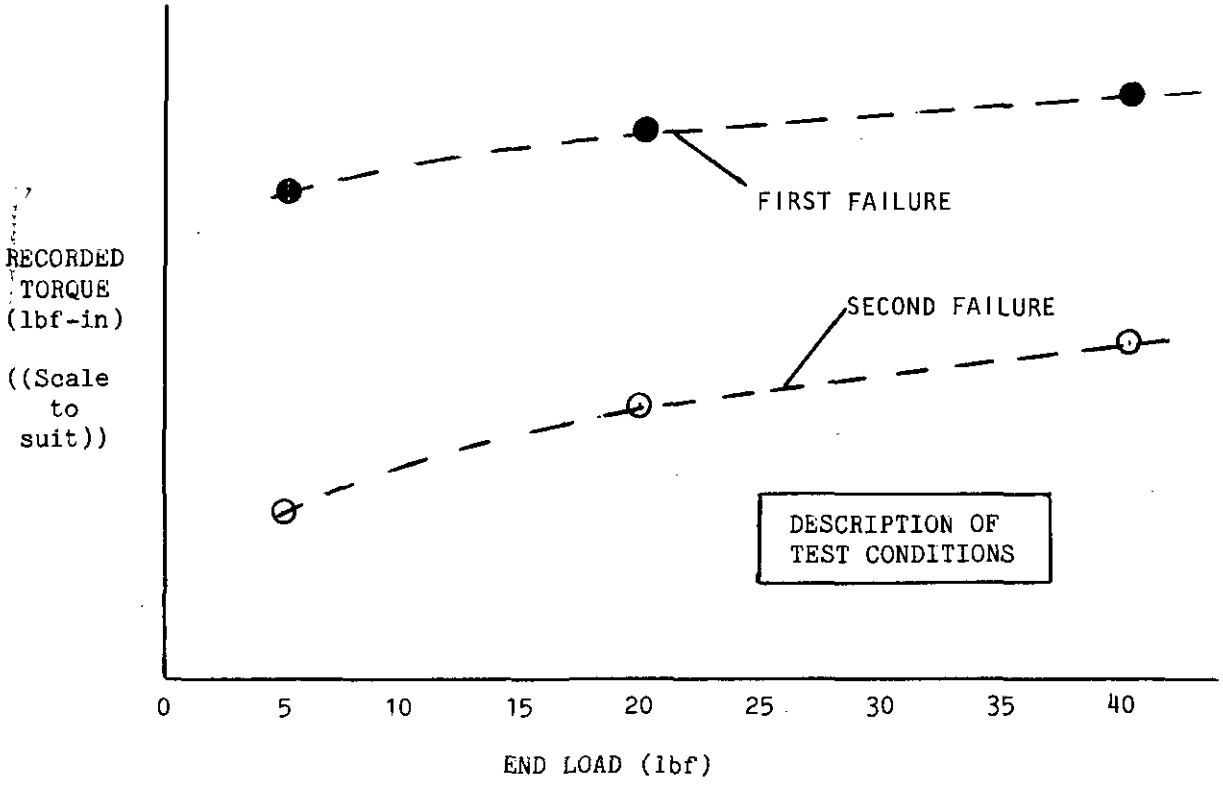

FIGURE 1. Suggested data chart.

6. DEFINITIONS AND NOTES

6.1 Damage tolerance. The damage tolerance of an internal recess is its torque capability after its initial damage. This test is not intended to endorse the continued reuse of damaged recess fasteners, but to evaluate the capability of the fastener if the recess is damaged. Damage tolerance is, nevertheless, a factor in maintenance when, because of excessive installation torque, corrosion, thread galling or shank loading, the recess is damaged during the initial attempt at removal. The preferred characteristic is one where the recessed fastener can still be removed without costly and time-consuming drill-out. Consequently, the removal or counterclockwise direction is specified in this test method. Obviously, the damage tolerance of a recess in the installation direction could as easily be evaluated; however, this capability would not be as critical.

6.2 Damage tolerance evaluation. This method can be used to determine the damage tolerance of the recess under various conditions of end loading, angularity, paint and driver bit (standard or undersize). Therefore, each complete test sequence would consist of two series of torque values. The first value is with a new fastener and new driver bit; the second value is with the same fastener and driver bit pair as was used to measure the first torque value. Table I is a suggested matrix of test sequences with results presented as shown in figure 1. (For other fastener tests, see MIL-STD-1312.)

TABLE I. Test sequence matrix.

SEQUENCE CONDITIONS	1	2	3	4	5	6	7	8	9	10	11	12
End Load (5, 20, & 40 lbf)	X	X	X	X	X	X	X	X	X	X	X	X
Angle (0^{o}, 4^{o}, & 7^{o})	0	4	7	0	4	7	0	4	7	0	4	7
Bit Size (Standard & Undersize)	S	S	S	U	U	U	S	S	S	U	U	U
Paint (Yes/No)	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y

6.2.1 Table I usage. In utilizing table I, five specimens should be tested at each sequence condition of the test matrix to provide a representative indication of recess damage tolerance.

6.2.2 End loads. Unless otherwise specified, end loads of 5, 20, and 40 pounds-force should be used for each of the 12 conditions of the test matrix. If only one end load is to be tested, use 20 lbf.

6.2.3 Angularity. The apex of the angle shall be at the intersection of the driver bit and the top of fastener head. Unless otherwise specified, angles of 0^{o}, 4^{o}, and 7^{o} should be used. If only one angle is to be tested, use 4^{o}.

6.2.4 Driver bit. Test should be conducted with correct or recommended bit and with the next size smaller bit as indicated in the test matrix of table I.

6.2.5 Paint. If the effect of paint on recess capability is to be evaluated, the following procedure is suggested:

a. Clean the fasteners with methyl ethyl ketone (MEK) and dry.

b. Paint the fastener heads with one coat of MIL-P-23377 primer to a thickness of .7 to .9 mils.

c. Paint the fastener heads with two coats of MIL-C-83286 polyurethane paint. The two-coat thickness should be between 2.0 and 2.5 mils.

The total thickness of primer and paint should be not less than 2.7 mils nor greater than 3.4 mils.

6.2.6 Other parameters. Other parameters, such as, alternate fastener materials, finishes, paints and painting methods, may be used as additional test conditions.

6.3 Reference. This test method has its basis in a test program reported in ASD TR-78-5, "Recess Fasteners". Copies are available through the Defense Documentation Center. This report contains the results of tests using this test on common aeronautical recess fasteners. The report may be of use in choosing which parameters to evaluate.

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