

FOREWORD:

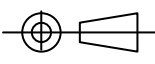
This standard sets forth standard test procedures to define tests to determine the tensile strength of externally and internally threaded fasteners.

TABLE OF CONTENTS

Paragraph		Sheet
1.	SCOPE	3
1.1	Applicability	3
2.	REFERENCED DOCUMENTS	3
3.	DEFINITIONS	3
4.	GENERAL REQUIREMENTS	3
4.1	Test apparatus	3
4.1.1	Testing machine	3
4.1.2	Extension measuring device	3
4.1.3	Test fixtures	4
4.1.3.1	Insert fixture	4
4.1.3.2	Tension plate fixture	4
4.1.3.3	Angularity evaluation	4
4.2	Test specimens	4
4.2.1	General	4
4.2.2	Externally threaded fasteners	4
4.2.3	Internally threaded fasteners	4
4.2.4	Grip length	4
4.2.4.1	Specified grip range	4
4.2.4.2	Unspecified grip range	4
4.2.4.3	Grip length adjustment	4
4.2.5	Washers or spacers	4
5.	DETAIL REQUIREMENTS	5
5.1	Test procedures	5
5.1.1	Test setup	5
5.1.1.1	Insert fixture	5
5.1.1.2	Tension plate fixture	5
5.2	Loading rate	5
5.3	Load-deflection curves	5
5.4	Failing load determination	5
5.5	Yield load determination	6
5.6	Number of specimens	6
6.	NOTES	6
6.1	Test report	6

① COMPLETELY REVISED

THE INITIAL RELEASE OF THIS DOCUMENT SUPERSEDES DOD-STD-1312-108.
DESIGNATION FOR THIS TEST METHOD REMAINS DOD-STD-1312-108.

THIRD ANGLE PROJECTION		CUSTODIAN NATIONAL AEROSPACE STANDARDS COMMITTEE	REVISION 1
PROCUREMENT SPECIFICATION NONE		TITLE FASTENER TEST METHODS, METRIC METHOD 108 TENSILE STRENGTH	CLASSIFICATION STANDARD PRACTICE NAM1312-108



AEROSPACE INDUSTRIES ASSOCIATION OF AMERICA, INC.
1000 WILSON BLVD.
ARLINGTON, VA 22209

THIS DRAWING SUPERSEDES ALL ANTECEDENT STANDARD DRAWINGS FOR THE SAME
PRODUCT AND SHALL BECOME EFFECTIVE NO LATER THAN SIX MONTHS FROM THE LAST
REVISION DATE.

FORM 09-01

① COMPLETELY REVISED

FIGURES

Figure		Sheet
1	Loading grips	7
2	Typical insert fixture	8
3	Tension fixture for short grip fasteners	9
4	Tension set-up	10
5	Test plate	11
6	Tension fixture assembly.....	12
7	Sample load deflection curve.....	13
8	Johnson's two-thirds approximate method for determining yield strength.....	14

REVISION

1

NAM1312-108

SHEET 2

1. SCOPE

- 1.1 Applicability. This method covers a procedure for testing all types of structural fasteners in tension at room temperature. This procedure is intended to define the test required to determine the tensile strength of the fastener itself, not the strength of the fastener in any sheet combination.

2. REFERENCED DOCUMENTS

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.

ASTM International

ASTM E4 Standard Methods of Verification of Testing Machines
ASTM E83 Tentative Method of Verification and Classification of Extensometers

Copies can be obtained from ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959. www.astm.org

NCSL International

NCSL Z540.3 Requirements for the Calibration of Measuring and Test Equipment

Copies can be obtained from NCSL International, 2995 Wilderness Place, Suite 107, Boulder, CO 80301.
www.ncsli.org

3. DEFINITIONS

Not applicable.

4. GENERAL REQUIREMENTS

4.1 Test apparatus

- 4.1.1 Testing machine. The testing machine shall be capable of applying a tensile load at a controllable rate. The calibration system for the machine shall conform to the requirements of NCSL Z540.3. Its accuracy shall be verified every 6 months by a method complying with ASTM E4, using a calibration device which shall have been calibrated by the National Bureau of Standards not more than 2 years prior to its use. The yield loads, ultimate loads and structural failure loads of the fasteners tested (5.4 and 5.5) shall be within the loading range of the testing machine as defined in ASTM E4.

- 4.1.2 Extension measuring device. The extension measuring device shall be an averaging, differential-transformer extensometer, or equivalent, preferably of the separable type. It shall conform to the requirements of class B-1 in ASTM E83 when used in conjunction with an autographic recorder. The extensometer shall be capable of installation so as to measure either the relative movement between the movable and stationary crossheads of the testing machine or the extension of the fastener only, preferably the latter. Load and extension ranges shall be used which give the initial portion of the load-extension curve a slope between 45 and 60 degrees.

① COMPLETELY REVISED

REVISION
1
NAM1312-108
SHEET 3

- 4.1.3 Test fixtures. Two types of test fixtures are permissible under this specification. Other types of fixtures may be used provided all of the following specifications are met:
- a. Hole size for any fastener shall be the maximum shank diameter of the fastener to be tested plus 0,025 millimeter with a +0,100/–0,000 millimeter tolerance. Alternately, the hole shall be to the diameter and limits specified by the fastener manufacturer.
 - b. The hole shall be perpendicular to the fixture surfaces within 1 degree.
 - c. Where applicable, the hole shall be chamfered to provide clearance for the head-to-shank fillet of the fastener.
 - d. The fixture shall be capable of applying an axial tensile load through the center line of the fastener by means of suitable supporting fixtures.
- 4.1.3.1 Insert fixture. The preferred test fixture is the cup or insert type which contains the features shown in Figure 1. A typical test fixture arrangement is illustrated in Figure 2.
- 4.1.3.2 Tension plate fixture. The tension plate type fixture may be used for short grip length fasteners. The fixture configuration shall be as shown on Figures 3 and 4 or Figures 5 and 6. The upper and lower plate shall be parallel within 0,25 degree.
- 4.1.3.3 Angularity evaluation. When tests being made are to evaluate the effect of angularity under the head or nut (collar) end of the fastener, the angularity shall be applied by the use of tapered spacers of the required angularity. The spacers shall be made of material harder than those of the fastener and ground flat. The outside diameter shall be greater than the head size of the fastener. The hole diameter shall be the maximum shank diameter plus 0,125 mm with a +0,080/–0,000 mm tolerance. Alternately, the hole shall be to the diameter and limits specified by the fastener manufacturer.
- 4.2 Test specimens
- 4.2.1 General. When specific bolt-nut combinations, pin and collar fasteners, or integral fasteners supplied complete in one assembly are being evaluated, the tests must be performed on the entire assembly. Tests resulting in failure of any component of the assembly shall be considered a satisfactory test of the fastener.
- 4.2.2 Externally threaded fasteners. The nut used for testing of the externally threaded fastener alone shall be of sufficient strength to insure bolt failure. The nut portion can be an integral part of the test fixture. Tests resulting in nut failure shall not be considered a satisfactory test of the bolt.
- 4.2.3 Internally threaded fasteners. The bolt used for testing of the internally threaded fastener alone shall be of sufficient strength to insure nut failure. Tests resulting in bolt failure shall not be considered a satisfactory test of the nut.
- 4.2.4 Grip length
- 4.2.4.1 Specified grip range. Fasteners having a specific range (such as lockbolts and blind fasteners) shall be tested in such grip conditions as required by applicable specifications or procurement documents.
- 4.2.4.2 Unspecified grip range. Threaded fasteners having no specified grip range shall be tested at the grip length where two to three bolt threads extend below the face of the nut. The bolt chamfer should extend beyond the top of the nut.
- 4.2.4.3 Grip length adjustment. The grip length for fasteners which must be installed with installation preload shall be adjusted with washers or shims located between the test fixtures, not under nuts, collars or heads.
- 4.2.5 Washers or spacers. The use of washers under fastener heads, nuts or collars is specifically prohibited unless the use of such washers is specifically required in the product application. Where spacers are required to evaluate the effect of angularity (as mentioned in 4.1.3.3) or to provide clearance for the head fillet, they shall be hardened and ground as specified in 4.1.3.3.

① COMPLETELY REVISED

REVISION

1

NAM1312-108

SHEET 4

USE OF OR RELIANCE UPON THIS DOCUMENT OR ANY NATIONAL AEROSPACE STANDARD IS ENTIRELY VOLUNTARY. AIA DOES NOT QUALIFY SUPPLIERS OR CERTIFY

Copyright Aerospace Industries Association of America, Inc. ALL RIGHTS RESERVED. AIA MAKES NO REPRESENTATION OR CLAIM RESPECTING (1) THE SUITABILITY OF
Provided by IHS under license with AIA/NAS. ANY PARTICULAR APPLICATION OR (2) THE EXISTENCE OF OR APPLICABLE LAWS, REGULATIONS, ORDINANCES, OR
No reproduction or networking permitted without license from IHS. Licensee= www.sepana.ir/5991803002, User=sam, albert
Not for Resale, 01/04/2016 15:48:48 MST TRADEMARKS RIGHTS.

Full document details: AIA NAM1312-108 2012

5. DETAIL REQUIREMENTS

5.1 Test procedures

5.1.1 Test setup

5.1.1.1 Insert fixture. The specimen shall be installed in the holding fixture at the proper grip using normal installation procedures. Preload shall not be used except for those fasteners where preload is a normal result of the installation. The assembly of specimen and fixtures shall be placed between the machine tension heads. The difference between the maximum and the average stress caused by misalignment or eccentric loading shall not exceed 3 percent average stress.

5.1.1.2 Tension plate fixture. The specimens shall be installed in the fixture at the proper grip using normal installation procedures. Preload shall not be used except for those fasteners where preload is a normal result of the installation. The assembly of specimen and plates shall be installed in a suitable test jig as shown on Figures 4 or 6 and placed between the compression heads of the testing machine. Locate the jig at the center of the piston when hydraulic testing machines are used.

5.2 Loading rate. Tension load shall be applied to the fastener slowly and evenly. Unless otherwise specified by the fastener manufacturer, or by applicable detail specification or procurement document, the rate of loading shall be in accordance with Table I. Larger or smaller fasteners than those shown in Table I shall be tested at rates producing 750 Newtons per minute (+10 percent) per square millimeter of nominal shank area.

TABLE I – TENSION LOAD RATES

NOMINAL DIAMETER	LOAD RATE KILONEWTN/MIN	NOMINAL DIAMETER	LOAD RATE KILONEWTN/MIN
3	5	16	140
4	9	18	180
5	14	20	220
6	20	22	270
7	27	24	320
8	35	27	400
10	55	30	500
12	90	33	600
14	108	36	700

- (a) As an alternate loading method, the rate of loading can be determined as a constant head travel that gives strain rates consistent with the above load rates in the elastic range.

5.3 Load-deflection curves. Load-deflection curves shall be made by autographic recording. The movement sensing element shall be so installed as to either measure the relative movement between the movable cross-head and the stationary crosshead or to measure the deflection of the fastener only, preferably the latter. The latter measurement shall be accomplished by placing the movement sensing elements adjacent to the fastener between the facing surfaces of the fastener holding fixtures for the insert fixture, or on the external opposed surfaces of the tension plate, or over the ends of the fastener. The fixture shall have the capability of being non-yielding at ultimate load.

5.4 Failing load determination. When a structure failure occurs before the ultimate or fracture load, it may be detected on the load-deflection curve as a peak load followed by severe permanent deformation without increase in load or with a decrease in load. A sample load-deflection curve illustrating a "structural failure" is shown on Figure 7. The first peak load shall be designated as the "structural failure load" and the highest peak shall be the "ultimate" load.

① COMPLETELY REVISED

REVISION

1

NAM1312-108

SHEET 5