

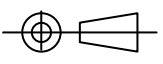
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THIRD ANGLE PROJECTION		CUSTODIAN NATIONAL AEROSPACE STANDARDS COMMITTEE	REVISION 3
PROCUREMENT SPECIFICATION	TITLE NUT, SELF-LOCKING, 235 °C, METRIC, PROCUREMENT SPECIFICATION FOR	③	CLASSIFICATION SPECIFICATION DA0009
NONE			SHEET 1 OF 15



1. SCOPE

This specification covers the requirements for high quality, self-locking nuts for use in temperatures up to 235 °C in conjunction with bolts and screws having threads in accordance with FED-STD-H28/21. These nuts are divided into classifications depending upon their axial tensile stress ratings as follows:

CLASS	MINIMUM AXIAL TENSILE STRESS RATING (MPa)
I	900
II	1 100
III	1 250
IV	1 550

2. APPLICABLE DOCUMENTS

2.1 Specifications and Standards

Federal

(TBD)	Wrenches, Box and Open End, Nonadjustable
(TBD)	Wrench, Bolt and Nut, Socket, Hand, Including Handles and Attachments
FED-STD-H28/21	Screw Threads, Controlled Root Radius (MJ Thread) – Metric Series
FED-STD-H28/20	Screw Threads, Inspection Methods for Acceptability

Copies can be obtained from the Department of Defense Single Stock Point (DODSSP). <http://dodssp.daps.dla.mil>

American Society for Quality

ANSI/ASQ Z1.4 Sampling Procedures and Tables for Inspection by Attributes

Copies can be obtained from the American Society for Quality, 600 North Plankinton Ave., Milwaukee, WI 53203. www.asq.org

ASTM International

ASTM E1444/E1444M	Inspection, Magnetic Particle
ASTM E1417/E1417M	Inspection, Liquid Penetrant

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

Aerospace Industries Association

NA0010	Stud and Mandrel Test Fixture, Self-Locking Nuts
NA0011	Fixture, Stress Embrittlement Test, Self-Locking Nuts, Metric
NA0012	Fixture, Bearing Surface Squareness Test, Self Locking Nuts
NAS3356	Lubricant Coatings, Suitability of Self-Locking Nuts
NAM1312	Fasteners, Test Methods, Metric
NASM1312	Fastener Test Methods, Metric

Copies can be obtained from the Aerospace Industries Association, 1000 Wilson Blvd., Suite 1700, Arlington, VA 22209. www.aia-aerospace.org

SAE International

AMS-QQ-P-416	Plating, Cadmium (Electrodeposited)
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Copies can be obtained from SAE International, 400 Commonwealth Dr., Warrendale, PA 15096-0001. www.sae.org

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3. REQUIREMENTS

3.1 Design

The nut designs shall conform to the applicable standard part drawings.

3.2 Materials

As specified on applicable part drawings.

3.3 Construction

The nut shall be a self-contained, all-metal unit including the self-locking device. The locking device shall be of the prevailing torque type and shall not operate by means of separate movement as a result of installation and shall not depend upon pressure on the bearing surface for locking action.

3.3.1 Threads

Threads shall be MJ form in accordance with FED-STD-H28/21 prior to introduction of self-Locking feature. For acceptability, see Paragraph 3.4.1.2. FED-STD-H28/20 is not applicable for nuts with the short thread engagement stated in 3.4.1.2 (i.e.; 3/4 of one turn and one turn).

3.3.2 Finish

The finish shall be in accordance with the requirements of the applicable drawing.

3.3.3 Lubrication

Nuts may be provided with an additional coating which will prevent nut-bolt seizure provided the coating has passed the applicable tests of NAS3356, Suitability of Lubricant Coatings. The applicable drawing shall classify it as either dry-film or non-dry film. The lubricant shall not be changed without requalification of nuts.

3.4 Performance and Testing Methods

The nuts furnished under this specification shall be a product capable of passing the tests as specified in Paragraph 4, Quality Assurance Provisions. Unless otherwise specified, test bolts shall be in accordance with Paragraph 7, Test Bolts. All tests shall be conducted in accordance with NAM1312 and NASM1312 unless otherwise specified.

3.4.1 Acceptance Tests

The Acceptance Tests consist of the tests specified in 3.4.1.1 through 3.4.1.11 which may be applied to any or all lots by the purchaser. Manufacturer shall use sufficient in-process controls, which include tests of unfinished parts, and/or inspection of product to assure conformance to the requirements of this specification. Tests of unfinished parts shall be accomplished subsequent to any operation that could affect the test results.

3.4.1.1 Examination of Product

Check for:

- (1) Package Marking
- (2) Visual Presence of Locking Configuration
- (3) Finish (3.3.2)
- (4) Loose or Hanging Burrs
- (5) Dimensional Characteristics
- (6) Product Marking (Where Applicable)

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3.4.1.2 Thread Fit

Thread gaging shall be performed after plating in accordance with the applicable thread specification except that the nut with locking device incorporated, but without lubricant, shall allow the go plug gage members to enter the threaded element 3/4 of one turn minimum. When parts are received with lubricant which prevents use of standard gages, the nut shall permit free rotational (finger torqued) engagement of at least one turn with a bolt having MJ threads conforming to FED-STD-H28/21. Acceptability of bolt threads shall be in accordance with FED-STD-H28/20, system 22.

3.4.1.3 Axial Tensile Strength

Static tensile tests shall be conducted in accordance with DOD-STD-1312-108. The nuts shall support the axial tensile force specified in Tables II, III, IV or V without rupture. Bolt failure below rated axial strength of nut is not cause for rejection. Such failure shall not constitute a valid test; nut shall be retested.

3.4.1.4 Discontinuities

The presence of discontinuities such as laps, seams, and inclusions shall be determined by magnetic particle inspection unless such discontinuities can be disclosed by visual inspection. Magnetic particle inspection shall be performed in accordance with ASTM E1444/E1444M in thread sizes MJ5 and larger. Such inspection shall, in general, be performed on finished nuts, free of lubrication, but in any case subsequent to any processing operations which could adversely affect the part. The nuts shall be magnetically inspected circularly only. The magnetizing field shall be normal to the longitudinal axis of the nut. Magnetic indications in themselves shall not be cause for rejection. The specific nuts which show indications shall be sectioned and measured microscopically for conformance to Table VI. Nuts shall not be marked as an indication of magnetic particle inspection. Discontinuities exceeding Table VI limits shall be cause for rejection of the lot.

3.4.1.5 Bearing Surface Squareness

The nut, and nut element of an assembly, shall be assembled on a squareness gage as shown on NA0012. The seated nut shall be checked with a feeler gage of thickness equal to the "A" dimension of Table IX. The bearing surface squareness shall be in conformance with the values shown in Table IX.

3.4.1.6 Torque Effectivity – Room Temperature

Install and remove nuts 15 times using a standard test bolt as specified in Paragraph 7.6 and a bushing per NA0011. Apply assembly torque per Tables II, III, IV or V. Record maximum locking torque (Paragraph 6.1.5) and minimum breakaway torque (Paragraph 6.1.4) on first, seventh and fifteenth cycles. All values shall be within limits of Table I.

3.4.1.7 Hardness

Surface hardness shall be determined in accordance with MIL-STD-1312-6 (metric). Any hardness value not in accordance with the requirements of the drawing or standard shall be cause for rejection of the lot. Hardness test may be omitted for Class III and Class IV nuts if nuts pass tensile tests (3.4.1.3) and have satisfactory microhardness (3.4.1.9).

3.4.1.8 Stress Embrittlement

Nuts shall be installed on a standard test bolt as specified in Paragraph 7.6, in a test fixture in accordance with NA0011, and torqued to the assembly torque test values in Tables II, III, IV or V. The test bolt shall be clean and dry and the nut in the as received condition. The assembly shall be then stored at $235^{\circ}\text{C} \pm 15^{\circ}\text{C}$ for 96 hours. The nuts while still assembled and torqued tight, shall be visually examined at 10X magnification. Cracks found in any nut during this test shall be cause for rejection of the entire lot. Test for stress embrittlement is not mandatory but may be applied to any nut at the discretion of the receiving contractor.

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3.4.1.9 Microhardness

Class III and IV only. Microhardness tests of the cross section of nuts shall be used to check for correct heat treatment, excessive decarburization, or recarburization. Hardness readings at the core, and at 0,13 mm from the surface shall be within the limits specified on the applicable standard. The difference between the microhardness reading at 0,13 mm and the reading 0,08 mm from the surface shall not exceed forty (40) points on any one specimen. Readings at 0,03 mm and 0,05 mm from the surface shall not show an increase of more than forty (40) points over the 0,13 mm depth reading. Any total decarburization is limited to a depth of 0,03 mm. Microhardness reading shall not be taken adjacent to the exterior wrenching surface of nuts machined from hexagon bar stock. Knoop microhardness readings with a one (1) newton force shall be taken on a cross section of nuts used for metallurgical examination. Five traverse readings shall be taken, starting at 0,03 mm from the surface, 0,03 mm apart. Two readings shall be taken at the center of the thickest section.

3.4.1.10 Untempered Martensite and Transformed Structure

Class III and IV only, sizes MJ12 and larger. Strip lubricant and plating. Metallographically polish bearing surface, etch and examine at 10X to 100X. No cracks are allowed. Nuts shall be rejected if untempered martensite or transformed structure are present on the outside circumference of the thread chamfer or the bearing surface.

3.4.1.11 Microstructure

Class III and IV. Section nuts through thread axis, etch and examine at 6X or greater. Grains shall be of uniform size. Material shall be free of bursts and voids. Alloy segregation, which adversely affects nut mechanical or physical properties, is not allowed.

3.4.2 Qualification Tests

Qualification tests are those tests to which an article is subjected as a prerequisite to being approved under this specification. The nut manufacturer shall be responsible for conducting these tests. Manufacturer shall also furnish certified test report and drawings specifying part number, significant dimensions and tolerances, material, hardness, finish and lubrication in addition to the test results. The purchaser may perform these tests at any time. Qualification tests shall consist of all the Acceptance Tests and, in addition, the following. Qualification test samples shall be selected in accordance with Table VII. Parts for qualification shall be of same material and manufactured by the same method as production parts.

3.4.2.1 Axial Strength After Baking

The nuts shall be assembled on a standard test bolt as specified in Paragraph 7.6, baked for six hours at $235^{\circ}\text{C} \pm 10^{\circ}\text{C}$, returned to room temperature and subjected to the axial tensile forces specified in Tables II, III, IV or V. The bolt clearance hole in test fixture shall be in accordance with NA0011. The nut shall support the axial tensile force without rupture. Failure of the bolt below rated axial strength of nut shall not be cause for rejection of the nut. Such failure shall not constitute a valid test; nut shall be retested.

3.4.2.2 Wrench Torque

This requirement shall apply to wrenchable type nuts only. The nut shall be installed on a standard test bolt as specified in Paragraph 7.6 with a steel test fixture in accordance with NA0011, using the wrench-torque test values in Tables II, III, IV or V. This test shall be repeated for a total of 15 cycles. Wrenches shall be of the box or socket type having openings in accordance with specifications (to be developed) best commercial practices. Deformation of the wrenching surfaces shall not be of sufficient magnitude to prevent proper assembly and removal of the nut with the wrench. Wrench failure below requirements of this specification shall not be cause for rejection of the nut. Such failure shall not constitute a valid test; nut shall be retested.

AEROSPACE INDUSTRIES ASSOCIATION OF AMERICA, INC.
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