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AEROSPACE MATERIAL SPECIFICATION

AMS 7250B
Superseding AMS 7250A
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NUTS, SELF-LOCKING, CORROSION AND HEAT RESISTANT
High Strength, Prevailing-Torque, All Metal
1200 F (649 C) Use, Unified (MIL-S-7742) Thread Form

1. ACKNOWLEDGMENT: A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.

2. TYPE: All-metal, self-locking, prevailing-torque nuts, plate nuts, and gang channel nuts for use up to 1200 F (649 C) and having Unified (MIL-S-7742) Thread form.

3. MATERIAL: Shall be a corrosion and heat resistant steel, such as AMS 5735 or AMS 5737, as specified on the drawing.

4. TECHNICAL REQUIREMENTS:

4.1 General:

4.1.1 Construction: Each nut shall be a self-contained unit, including the self-locking device. The locking device shall not operate by means of separate movement from the installation and shall not depend on pressure on the bearing surface for the locking action. The locking device shall be set to meet the locking torque requirements of 4.2.3 when mated with external threads that meet the requirements of 4.3.

4.1.2 Threads: Unless otherwise specified on the drawing, threads shall conform to the latest issue of MIL-S-7742 on the finished product. Except as noted in 4.1.2.2, there shall be no anti-seizure allowance on the nut thread to provide a clearance fit.

4.1.2.1 Thread Squareness: The bearing surface shall be square with the thread pitch diameter axis within the limits specified on the drawing. Squareness shall be determined by a method agreed upon by purchaser and vendor. The measurement shall be made at the outer periphery of the bearing surface of the nut or, if the bearing surface diameter is greater than 1.5 times the Ø thread major diameter, at a diameter equal to 1.5 times the thread major diameter. The nuts to be inspected shall permit at least 3 complete turns of engagement on the thread arbor of the gage; plating or other coating may be stripped if necessary to meet this requirement. Multi-piece floating plate nuts shall have the nut element removed from the retainer for checking thread squareness.

4.1.2.2 Plating or Coating Allowance: Unless otherwise specified, internal threads to be plated or coated may be overcut as follows: Increase the maximum pitch diameter by not more than Ø 0.001 in. if the pitch diameter tolerance does not exceed 0.0035 in.; by not more than 0.3 times the pitch diameter tolerance but not more than 0.0015 in. if the pitch diameter tolerance is greater than 0.0035 inch. All thread elements shall be within tolerances as modified above before coating and shall conform to tabulated material limits after coating.

4.1.3 Finish: Unless otherwise specified on the drawing, nuts shall be silver plated in accordance with the latest issue of AMS 2411. On nuts with thread sizes 0.250 in. and larger, the plating thickness Ø shall be not less than 0.0002 in. when measured on the thread pitch diameter. Microscopic measurement on a sectioned nut shall be used as a referee method. Nuts with thread sizes 0.190 in. and smaller shall show complete plate coverage on the threads. Plating on other surfaces shall be 0.0003 - 0.0006 in. thick.

4.1.4 Lubrication: The nuts may be provided with a wax-type coating which will prevent nut-bolt seizure provided such treatment is applicable to all production nuts.

4.2 Performance: Nuts shall conform to the following requirements. The tests of 4.2.3 as-received, ø 4.2.5 as-received, and 4.2.7 will be the only tests required for routine inspection. Unless otherwise specified, all tests shall be conducted on representative nuts assembled on bolts of any convenient length and on which the nuts will assemble freely, with the fingers, up to the self-locking device.

4.2.1 Axial Strength: Not less than 4 nuts in the as-received condition and 4 nuts which have been heated to 1200 F ± 15 (648.9 C ± 8.3), held at heat for 6 hr, and cooled shall be assembled on alloy steel bolts hardened and tempered to not lower than Rockwell C 40 or equivalent and having threads in accordance with 4.3. Each nut-bolt assembly shall be pulled, at room temperature, in tension, axially, using a ø bearing plate to grip the nut. The diameter of the hole in the bearing plate shall be 0.032 in. ± 0.002 greater than the basic major diameter of the bolt thread and the bearing plate thickness shall be not less than the major diameter of the bolt thread. Edges of the hole in the bearing plate shall be broken 0.010 - 0.015 inch. Axial strength of the nut shall be not lower than the values specified below and the nuts shall not crack during test; tests need not be run to destruction.

Thread Size	Axial Strength lb
0.112 -40	795
0.112 -48	906
0.138 -32	1,190
0.138 -40	1,400
0.164 -32	1,915
0.164 -36	2,060
0.190 -32	2,800
0.250 -28	5,220
0.3125-24	8,380
0.375 -24	12,940
0.4375-20	17,440
0.500 -20	23,780
0.5625-18	30,210
0.625 -18	38,400

4.2.1.1 The axial strength requirement for thread sizes not shown may be calculated from the following formula:

$$S = 0.7854 (D - 2h_b)^2 \times 160,000$$

where, S = Axial strength requirement
D = Max major diameter of thread
h_b = Twice the external thread addendum

4.2.1.2 Clinch Nuts: Nuts with shanks designed to be flared at assembly (See Fig. 1) shall be tested as in 4.2.1 except that the hole in the bearing plate shall be 0.006 in. ± 0.002 greater than the maximum allowable shank diameter. It is not necessary to flare the shank for this test. The bearing plate hole shall be chamfered sufficiently to clear the clinch nut bearing surface-to-shank maximum fillet.

4.2.2 Wrench Torque: At least 3 nuts shall be tested at room temperature for wrench torque by assembling a nut on a bolt having sufficient strength. The nut shall be tightened against a bushing with a hole diameter as in 4.2.1 and having hardness not lower than Rockwell C 40 or equivalent and surface roughness on the bearing surface of 63 micro-inches or less. Nuts shall withstand 12 successive applications of the torque specified below without destroying the wrenchability of the nut. Wrenches used for this test shall be open end type conforming to Federal Specification GGG-W-636, Type IV for hexagon nuts and socket type conforming to AS 954 for double hexagon nuts. This test shall be applicable only to nuts which have provisions for use of a wrench. For this test only, all nuts shall be cleaned to remove all trace of any lubricant, wax, or anti-seize coating.

Thread Size	Wrench Torque lb-in.
0.112 -40	14
0.112 -48	14
0.138 -32	30
0.138 -40	30
0.164 -32	40
0.164 -36	40
0.190 -32	82
0.250 -28	205
0.3125-24	450
0.375 -24	750
0.4375-20	1130
0.500 -20	1650
0.5625-18	2000
0.625 -18	2750

4.2.3 Starting Torque: The torque necessary to start a nut turning on or off a bolt shall be measured for not less than 10 nuts as received and 10 nuts after conditioning as in 4.2.3.1. Test bolts as in 4.3 shall be used. Test shall be conducted at room temperature with no axial stress and with nuts assembled on bolts so that the bolts project through the nuts not less than 3 turns at start of test. Test shall be run in such a manner that a dependable measure of torque will be obtained. The increase in temperature of the nuts during test shall not exceed 75 F (42 C) degrees. Torque shall be as specified below:

Thread Size	Starting Torque min	max(1)	max (2)
0.112 -40	8 oz-in.	4 lb-in.	8 lb-in.
0.112 -48	8 oz-in.	4 lb-in.	8 lb-in.
0.138 -32	16 oz-in.	7 lb-in.	14 lb-in.
0.138 -40	16 oz-in.	7 lb-in.	14 lb-in.
0.164 -32	24 oz-in.	11 lb-in.	22 lb-in.
0.164 -36	24 oz-in.	11 lb-in.	22 lb-in.
0.190 -32	32 oz-in.	15 lb-in.	30 lb-in.
0.250 -28	3.5 lb-in.	30 lb-in.	60 lb-in.
0.3125-24	6.5 lb-in.	60 lb-in.	120 lb-in.
0.375 -24	9.5 lb-in.	80 lb-in.	160 lb-in.
0.4375-20	14.0 lb-in.	100 lb-in.	200 lb-in.
0.500 -20	18.0 lb-in.	150 lb-in.	300 lb-in.
0.5625-18	24.0 lb-in.	200 lb-in.	400 lb-in.
0.625 -18	32.0 lb-in.	300 lb-in.	600 lb-in.

(1) At initial installation, values may be exceeded for 20% of the parts tested when bolt first enters locking feature provided all parts are within the specified limits after a minimum length of two pitches, including chamfer, protrudes through the nut.

(2) Maximum for removal after conditioning only.

4.2.3.1 Conditioning: Nut-bolt assemblies shall be axially loaded initially to 75,000 psi at room temperature in a spacer-type fixture in accordance with 4.2.3.1.2. Loading shall be determined by elongation measurement of the bolt at room temperature. Bolt and fixture lengths conforming to 4.3 shall be used. Allow assembly to remain stressed at room temperature for at least 1 hr, remeasure, and adjust loading to agree with the required stress. The assemblies shall then be placed in a furnace which is at 1200 F ± 15 (648.9 C ± 8.3) for 6 hr, removed, cooled to room temperature, and unloaded by backing off nut 1/2 turn. Starting torque shall be measured at this point. In the case of wrenchable nuts, the nut shall be turned relative to the fixture; in the case of anchor or channel nuts, the bolt head shall be turned. The wrenchability of the tested nuts shall not be destroyed by the test.

4.2.3.1.1 Loading: The correct elongation for bolts to load the nuts to 75,000 psi shall be determined by using a modulus of elasticity of 29,500,000 psi. Stress area of the bolt shall be based on the basic (maximum) minor diameter of the thread. The elongation of bolts for nut sizes not listed herein shall be 0.0025425L, where L = bushing length as in Fig. 2.

4.2.3.1.2 Fixture: The spacer-type fixture shall be made of AMS 5735 steel. The diameter of the bolt hole in the fixture shall be 0.032 in. ± 0.002 greater than the basic major diameter of the bolt thread (See Fig. 2). Fixture may be counter-bored 0.006 in. ± 0.002 greater than the maximum allowable shank diameter of clinch nuts to permit the spacer to seat onto the bearing surface of the nut.

4.2.4 Permanent Set: At least three nuts shall be assembled on a maximum mandrel (See Fig. 3) so that the mandrel projects through the nut not less than three turns. Nuts shall then be removed from the maximum mandrel and assembled on a minimum mandrel (See Fig. 4) in the same manner. Tests shall be conducted at room temperature with no axial stress. The starting torque of the nuts when assembled on either mandrel shall not exceed the maximum values or be less than the minimum values listed in 4.2.3.

4.2.5 Reusability: Nuts shall be assembled on test bolts as in 4.3 and tested in accordance with 4.2.3 as modified below. After testing, nut threads shall show no distortion, galling, or scratches of such depth as to prevent reassembly of nut freely, with the fingers, up to the self-locking device. Bolt threads shall remain servicable and permit assembly of a new nut freely, with the fingers, up to the self-locking device.

4.2.5.1 As Received: Nuts shall be installed and completely removed from the bolt 12 consecutive times. Except for the first installation, the starting torque shall be not greater than the maximum value specified in 4.2.3; at no time shall the removal torque be less than the minimum value specified therein.

4.2.5.2 Conditioned: Conditioning cycles shall be performed in accordance with 4.2.3.1. The nuts shall be completely removed from the bolt after each cycle of conditioning. Conditioning cycle shall be run 5 consecutive times and the starting torque for each installation and removal shall be as specified in 4.2.3.

4.2.6 Vibration: Nuts shall be capable of withstanding vibration as agreed upon by purchaser and vendor.

4.2.7 Flarability: Unless otherwise specified on the drawing, the clinch nut shank shall be capable of being flared without cracking when flared with a 60 deg included angle conical tool to a diameter equal to 120% of the maximum allowable shank diameter.

4.2.8 Push Out: This requirement is applicable only to gang channel nuts, floating plate nuts, and non-floating plate nuts. The nuts shall be screwed or clamped to a steel plate of a thickness equal to or greater than the basic major diameter of the nut thread. The bolt hole in the plate shall be located within 0.010 in. radius of true position in relation to the nut minor diameter when the nut is at basic position. The screw or clamping head diameter shall not exceed 1.5 times the rivet hole diameter and shall employ the rivet holes or be centered over same. The rivet hole size and its location from the thread axis of the nut in Ø gang channel nut assemblies shall be as shown below, unless otherwise specified on the drawing. With the push out stud or device hemispherical end inserted against the base of the nut thread, the push out load specified below shall be applied evenly to the nut on a line perpendicular to the mounting plane of the nut. When subjected to the push out load, the nut shall not be pushed out of the retainer of any type of plate nut or gang channel nut or effect a permanent deformation axial with the threaded element of more than 0.030 in. when measured at the thread centerline between the steel plate and the base of the nut retainer. Any deformation that will prevent a bolt from being assembled freely with the fingers is not permitted.

Thread Major Diameter Inch	Rivet Hole Diameter Inch, ±0.005	Hole Location (Distance From Nut Thread Axis) Inch, ±0.010	Push Out Load lb, min
0.112	0.098	0.344	40
0.138	0.098	0.344	60
0.164	0.098	0.344	80
0.190	0.098	0.344	100
0.250	0.098	0.500	125
0.3125	0.130	0.500	125
0.375	0.130	0.500	125
0.4375	0.130	0.562	125
0.500	0.130	0.625	125
0.5625	0.130	0.688	125
0.625	0.130	0.750	125

4.2.9 Torque Out: This requirement is applicable only to gang channel nut assemblies, floating plate nuts, and non-floating plate nuts. The nuts shall be prepared as in 4.2.8 and subjected to the torque out values below, first in the clockwise direction and then in the counterclockwise direction. The diameter of the torque stud shall have a maximum diametral clearance of 0.010 in. in the test plate. The torque stud shall be provided with a shoulder to seat against the base of the nut element and may incorporate a suitable bushing. Reverse loading may be accomplished by use of a check nut assembled onto the stud threads that protrude through the top of the nut. This test shall be performed with no axial load on the bearing surface of the nut. The nut assembly shall withstand the applied torque without cracking, rupture, or being deformed sufficiently to prevent normal use of the nut. Nuts used in push out test shall be used for this test.

Thread Size	Torque Out Load lb-in., min
0.112 -40	20
0.112 -48	20
0.138 -32	30
Ø 0.138 -40	30
0.164 -32	45
0.164 -36	45
0.190 -32	60
0.250 -28	100
0.3125-24	160
0.375 -24	240
0.4375-20	350
0.500 -20	450
0.5625-18	600
0.625 -18	900

4.3 Test Bolts: Except as specified in 4.2.1, test bolts shall conform to AMS 7477 or AMS 7478. All test bolts 0.190 in. and larger in diameter shall have threads reduced 0.003 in. from Class 3A limits of MIL-S-7742 or Part I of the 1957 National Bureau of Standards Handbook H28, on the major, minor, and pitch diameters. All test bolts smaller than 0.190 in. in diameter shall have Class 2A tolerances. All test bolts, including those specified in 4.2.1 and 4.2.3.1, shall have lengths as shown below:

Thread Size	Nominal Bolt Length Inches	Fixture Length Inches ± 0.015	Required Bolt Elongation Inch	Reference Part No.
0.112 -40	1.000	0.750	0.0019	---
Ø 0.112 -48	1.000	0.750	0.0019	---
0.138 -32	1.500	1.124	0.0029	---
0.138 -40	1.500	1.124	0.0029	MS9177-22
0.164 -32	2.000	1.584	0.0040	---
0.164 -36	2.000	1.584	0.0040	MS9178-28
0.190 -32	2.500	2.025	0.0052	MS9033-32
0.250 -28	2.500	1.956	0.0050	MS9034-32
0.3125-24	2.500	1.860	0.0047	MS9035-30
0.375 -24	2.500	1.838	0.0046	MS9036-28
0.4375-20	2.500	1.733	0.0044	MS9037-27
0.500 -20	2.500	1.636	0.0042	MS9038-25
0.5625-18	2.500	1.533	0.0039	MS9224-24
0.625 -18	2.500	1.448	0.0037	---

4.4 Ø Uncoated Nuts: Uncoated nuts that have threads overcut for coating at assembly shall be plated for test purposes as in 4.1.3. Uncoated nuts permanently attached to brackets or other similar parts shall be checked with bolts plated in accordance with AMS 2410 or AMS 2411 and having plate thickness of 0.0003 - 0.0006 inch. Plated bolts shall meet the requirements of 4.3 before plating.

Ø4.5 Test Lubrication: Bolt threads shall be lubricated with MIL-L-7808 oil before each installation of the nut.

5. QUALITY: Nuts shall be uniform in quality and condition, clean, sound, and free from fins, burrs, cracks, tool marks, and other imperfections detrimental to their performance.

6. REPORTS:

6.1 Ø Unless otherwise specified, the vendor shall furnish with, or prior to, the first shipment of parts of each type and material three copies of a report of test data showing that the parts conform to all requirements of this specification.

6.2 Unless otherwise specified, the vendor of parts shall furnish with each shipment three copies of a report stating that the chemical composition of the parts conforms to the requirements of the applicable material Ø specification and showing the results of tests to determine conformance to the starting torque, reusability as received, and flarability requirements of this specification. This report shall include the purchase order number, specification number and its revision letter, contractor or other direct supplier of material, part number, and quantity.

7. REJECTIONS: Parts not conforming to this specification or to authorized modifications will be subject to rejection.

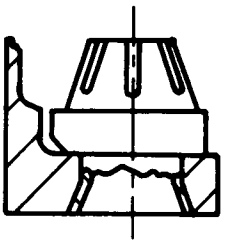
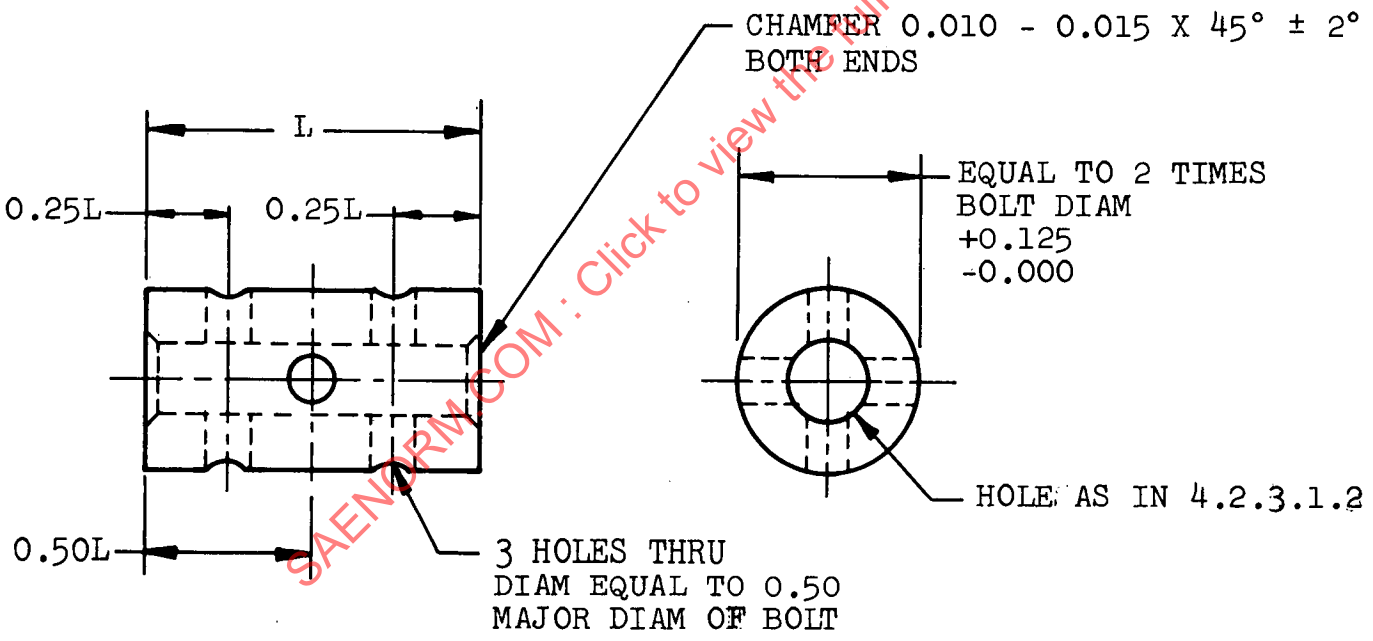


Figure 1



DIMENSIONS ARE IN INCHES

Figure 2