SAE The Engineering Society For Advancing Mobility Land Sea Air and Space®
INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE STANDARD

SAE AS7250

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Submitted for recognition as an American National Standard

Superseding AMS 7250E

NUTS, SELF-LOCKING, STEEL, CORROSION AND HEAT RESISTANT HIGH STRENGTH, ALL METAL 1200 °F USE, UN THREAD FORM

FSC 5310

1. SCOPE:

1.1 Type:

This document covers all metal, self-locking wrenching nuts, plate nuts, shank nuts, and gang channel nuts made from a corrosion and heat resistant steel of the type identified under the Unified Numbering System as UNS S66286 and of 160 000 psi tensile strength at room temperature, with maximum test temperature of parts at 1200 °F.

1.2 Application:

For use up to approximately 1200 °F where high strength nuts with UN thread form are required for use with 0.003 inch reduced pitch diameter threaded bolt.

2. REFERENCES:

2.1 Applicable Documents:

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other documents shall be the issue in effect on the date of the purchase order.

2.1.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 2410 Silver Plating, Nickel Strike, High Bake
AMS 2411 Silver Plating, High Temperature Application
AMS 5731 Steel Bars, Forgings, Tubing, and Rings, Corrosion and Heat Resistant, 15Cr-25.5Ni-1.3Mo-2.1Ti-0.006B-0.30V, Consumable Electrode Melted, 1800 °F (982 °C) Solution Heat Treated
AMS 5732 Steel Bars, Forgings, Tubing, and Rings, Corrosion and Heat Resistant, 15Cr-25.5Ni-1.3Mo-2.1Ti-0.006B-0.30V, Consumable Electrode Melted, 1800 °F (982 °C) Solution and Precipitation Heat Treated

2.1.1 (Continued):

AMS 5734 Steel Bars, Forgings, and Tubing, Corrosion and Heat Resistant, 15Cr-25.5Ni-1.3Mo-2.1Ti-0.006B-0.30V, Consumable Electrode Melted, 1650 °F (900 °C) Solution Heat Treated

AS954 Design Data and Standardization of Thin Wall 12-Point Sockets and Box Wrenches for Aerospace Engine Use

AS1310 Fastener Torque for Threaded Applications, Definitions of

AS7477 Bolts and Screws, Steel, Corrosion and Heat Resistant, Upset Headed, Heat Treated, Roll Threaded, 1800 °F Solution and Precipitation Heat Treated

AS7478 Bolts and Screws, Steel, Corrosion and Heat Resistant, 1800 °F Solution Heat Treated, Precipitation Heat Treated After Roll Threaded

2.1.2 U.S. Government Publications: Available from Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

GGG-W-636 Wrenches (Box, Open End, and Combinations)

MIL-S-7742 Screw Threads, Standard, Optimum Selected Series; General Specification for

MIL-L-7808 Lubricating Oil, Aircraft Turbine Engine, Synthetic Base

MIL-STD-1312 Fastener Test Methods

MIL-STD-2073-1 DOD Materiel, Procedures for Development and Application of Packaging Requirements

2.1.3 ANSI Publication: Available from American National Standards Institute, Inc., 11 West 42nd Street, 13th Floor, New York, NY 10036.

ANSI/ASME B46.1 Surface Texture (Surface Roughness, Waviness, and Lay)

2.2 Definitions:

PRODUCTION INSPECTION LOT: Shall be all finished parts of the same part number, made from a single heat of alloy, heat treated at the same time to the same specified condition, produced as one continuous run, and submitted for vendor's inspection at the same time.

ROOM TEMPERATURE: Ambient temperature (68 °F approximately).

Refer to AS1310 for definitions related to fastener torque.

2.3 Unit Symbols:

°	degree, angle
°F	degree, Fahrenheit
°C	degree, Celsius
lbf	pound-force
in^2	square inch
psi	pound-force per square inch
µin Ra	microinch, roughness average
lbf·in	pound-force inch, torque

2.3 (Continued):

HRC	hardness, Rockwell C scale
%	percent (1% - 1/100)
cpm	cycles per minute

3. TECHNICAL REQUIREMENTS:

3.1 Material:

Shall be AMS 5731 or AMS 5734, unless otherwise specified on the part drawing.

3.2 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 3.7.3 when used with external threads that meet the requirements of 3.8. Tool marks resulting from producing the locking feature shall blend smoothly without abrupt change.

3.3 Threads:

Unless otherwise specified on the part drawing, threads shall conform to MIL-S-7742 on the finished product. Except as in 3.3.2, there shall be no antiseizure allowance on the nut thread to provide a clearance fit.

3.3.1 Thread Squareness: The bearing surface shall be square with the thread pitch cylinder axis within the limits specified on the part drawing. Squareness shall be determined by a method agreed by purchaser and vendor. The squareness requirement shall apply to the complete bearing surface of the nut except that, for nonfloating plate nuts having a bearing surface exceeding 1.5 times the thread major diameter, the squareness requirement shall, unless otherwise specified on the part drawing, apply only to the portion of the bearing surface of the nut contained within a diameter equal to 1.5 times the thread major diameter. The nuts to be inspected shall permit at least three complete turns of engagement on the thread arbor of the squareness gage; plating or coating may be stripped if necessary to meet this requirement. Multipiece floating plate nuts shall have the nut element removed from the retainer for checking thread squareness.

3.3.2 Plating or Coating Allowance: Internal thread plating or coating allowance shall be as specified in MIL-S-7742, unless otherwise specified on the part drawing.

3.4 Heat Treatment:

The nuts shall be precipitation heat treated after forming to meet the hardness as in 3.4.1.

3.4.1 Hardness: Unless otherwise specified on the part drawing, the hardness after heat treatment as in 3.4 shall be within the range of 38 to 46 HRC when tested in accordance with MIL-STD-1312-6.

3.5 Plating:

Nuts shall be silver plated in accordance with AMS 2411, unless otherwise specified on the part drawing. On nuts with thread sizes 0.250 inch and larger, the plating thickness shall be not less than 0.0002 inch 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 inch and smaller shall show complete coverage on the thread. Plating on other surfaces shall be 0.0003 to 0.0006 inch thick.

3.6 Lubrication:

The nuts may be provided with a wax type coating which will prevent nut-bolt seizure at initial installation provided such treatment is applicable to all production nuts of the same part number.

3.7 Performance:

Unless otherwise specified on the part drawing, nuts shall conform to the performance requirements in 3.7.1, 3.7.2, 3.7.3, 3.7.4, 3.7.5, 3.7.6, 3.7.7, 3.7.8, and 3.7.9. 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.

3.7.1 Axial Tensile Strength: Not less than four nuts in the as-received condition and four nuts which have been heated to 1200 °F ± 15, held at heat for 6 hours ± 0.25, and cooled to room temperature shall be assembled on alloy steel bolts hardened and tempered to not lower than 40 HRC, and having threads in accordance with 3.8. Each nut-bolt assembly shall be tested at room temperature in axial tension, using a bearing plate to grip the nut. The diameter of the hole in the bearing plate shall be 0.030 to 0.034 inch 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 to 0.015 inch. Axial tensile strength of the nut shall be not lower than the load values specified in Table 1 and the nuts shall not crack during test; tests need not be run to destruction. The axial tensile load shall be applied to the nut slowly at a rate equivalent to:

$$\text{Load, lbf/minute} = 78\,000 \cdot D^2 \qquad \text{(Eq.1)}$$

where:

D = Nominal major diameter of thread

3.7.1 (Continued):

TABLE 1 - Axial Tensile Load

Nut Thread Size	Axial Tensile Load at Room Temp. lbf minimum /1/
0.112 -40UNC-3B	795
0.112 -48UNF-3B	907
0.138 -32UNC-3B	1 190
0.138 -40UNF-3B	1 400
0.164 -32UNC-3B	1 914
0.164 -36UNF-3B	2 056
0.190 -32UNF-3B	2 805
0.250 -28UNF-3B	5 210
0.3125-24UNF-3B	8 389
0.375 -24UNF-3B	12 940
0.4375-20UNF-3B	17 440
0.500 -20UNF-3B	23 780
0.5625-18UNF-3B	30 210
0.625 -18UNF-3B	38 410

/1/ Requirements above apply to companion bolts with UN threads to Class 3A tolerance. Area upon which stress for axial tensile load requirements is based on the area at 0.75H thread depth and calculated as follows:

$$A = 0.7854[D - (1.5H)]^2 = 0.7854[D - (1.2990/n)]^2$$

where:

A = Area at 0.75H thread depth, in^2

H = Height of sharp V-thread = (cos 30°)/n, inch

n = Number of thread pitches per inch

D = Major diameter, maximum, inch

Load requirements for axial strength load is based on 160 000 psi stress.

Axial tensile load = 160 000 psi x A, lbf

For sizes not shown, axial tensile strength loads for nuts shall be based upon the respective bolt stress area using the above equation and 160 000 psi stress.

3.7.1.1 Shank Nuts: Nuts with shanks designed to be flared at assembly (see Figure 1) shall be tested as in 3.7.1 except that the hole in the bearing plate shall be 0.004 to 0.008 inch 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 shank nut bearing surface-to-shank maximum fillet.

3.7.2 Wrench Torque: This test is applicable to wrenching nuts with hexagon or double hexagon wrenching feature. For this test only, all nuts shall be cleaned to remove all trace of any lubricant, wax, or antiseize coating or compound. At least three 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 3.7.1 and having hardness not lower than 40 HRC, and surface roughness of 63 μin Ra. Nuts shall withstand 12 successive applications of the torque specified in Table 2 without destroying the wrenchability of the nut. Wrenches used for this test shall be the open-end type conforming to GGG-W-636, Type IV, for hexagon nuts, and socket type conforming to AS954 for double hexagon nuts.

TABLE 2 - Wrench Torque

Nominal Thread Diameter inch	Wrench Torque Minimum lbf·in
0.112	14
0.138	30
0.164	40
0.190	82
0.250	205
0.3125	450
0.375	730
0.4375	1130
0.500	1650
0.5625	2000
0.625	2750

3.7.3 Locking Feature Torques: The locking feature torques shall be measured and recorded for not less than 10 new nuts, selected at random from the lot, for each of the tests required in 3.7.5. Loading, and conditioning for the five-cycle test of 3.7.5.2, shall be in accordance with 3.7.3.1. Test bolts shall conform to 3.8 or shall be equivalent threaded parts. Test fixtures shall conform to 3.7.3.1.2. Tests shall be conducted at room temperature. The end of the bolt shall extend within 1.5 to 3 thread turns through the top of the nut at the start of the 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 the test shall not exceed 74 °F. The maximum self-locking torque and minimum breakaway torque (see AS1310) shall not exceed the values specified in Table 3 as required by the reusability tests in 3.7.5.

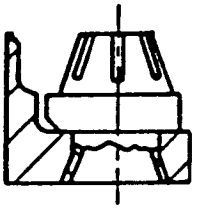
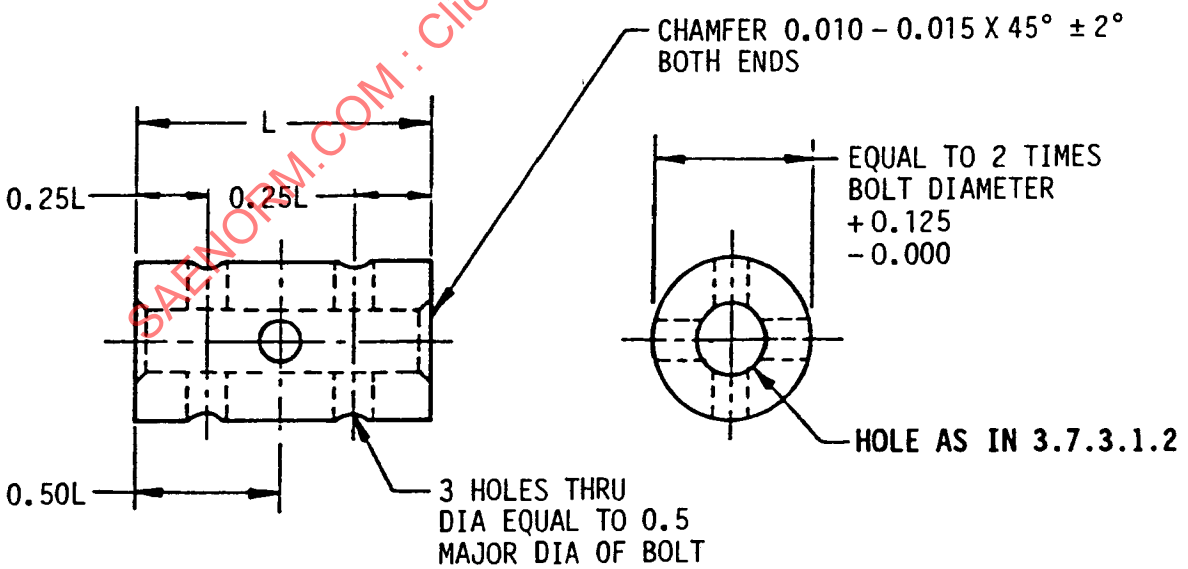


FIGURE 1 - Flange Assembly, Flared Shank Nut



DIMENSIONS IN INCHES

FIGURE 2 - Spacer-Type Fixture

3.7.3 (Continued):

TABLE 3 - Locking Feature Torques

Nominal Thread Size	Minimum Breakaway Torque lbf·in /1/	Minimum Breakaway Torque lbf·in /2/	Maximum Self-Locking Torque lbf·in /3/	Maximum Self-Locking Torque lbf·in /4/
0.112 -40	0.5	1	4	8
0.112 -48	0.5	1	4	8
0.138 -32	1	2	7	14
0.138 -40	1	2	7	14
0.164 -32	1.5	3	11	22
0.164 -36	1.5	3	11	22
0.190 -32	2	4	15	30
0.250 -28	3.5	7	30	60
0.3125-24	6.5	13	60	120
0.375 -24	9.5	19	80	160
0.4375-20	14	28	100	200
0.500 -20	18	36	150	300
0.5625-18	24	48	200	400
0.625 -18	32	64	300	600

/1/ Minimum breakaway torque for 12-cycle, room temperature, as received test; 5-cycle, loaded and conditioned test; permanent set test

/2/ Minimum breakaway torque for single-cycle, loaded, room temperature test

/3/ Maximum self-locking torque for 12-cycle, room temperature, as received test; single-cycle, loaded, room temperature test; permanent set test.

NOTE: For the permanent set test, 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 of two thread pitches, including chamfer, protrudes through the top of nut.

/4/ Maximum self-locking torque at removal for 5-cycle, loaded and conditioned test.

3.7.3.1 Loading and Conditioning: Nut-bolt assemblies shall be lubricated in accordance with 3.10 and loaded in axial tension to 75 000 psi at room temperature on a spacer-type fixture in accordance with 3.7.3.1.2. Loading shall be determined by elongation measurement of the bolt at room temperature. Bolt lengths conforming to 3.8 shall be used. Allow assembly to remain stressed at room temperature for not less than 1 hour, remeasured, and loading adjusted to 75 000 psi. The loaded assemblies shall then be heated in a furnace to 1200 °F ± 15, held at heat for 6 hours ± 0.25, removed from furnace, cooled to room temperature, and unloaded by loosening nut one-half turn and record break loose torque. Breakaway and self-locking torques shall be measured and recorded as the nut is removed from the bolt. In 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.

3.7.3.1.1 Loading: The bolt elongation used to load the nut-bolt assembly to induce 75 000 psi axial tensile stress in the bolted assembly is based on a modulus of elasticity of 29 500 000 psi and the following equations:

$$e = s/E, \text{ unit elongation, inch/inch} \quad \text{(Eq.2)}$$

$$eL = \text{bolt elongation, inch} \quad \text{(Eq.3)}$$

where:

e = unit strain of bolt loaded shank, inch/inch
s = 75 000 psi bolt stress at area of max (root) diameter
E = 29 500 000 psi modulus of elasticity
L = bushing length (see Figure 2) in loaded nut-bolt assembly, inch

The elongation of bolts for nut sizes not listed herein shall be 0.0025425L,

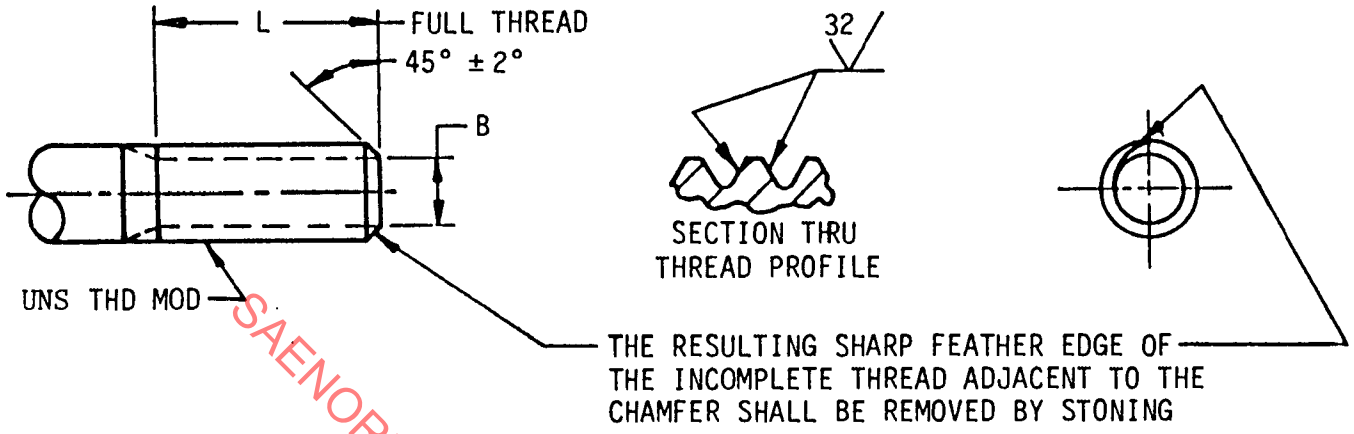
where:

L = bushing length as in Figure 2

3.7.3.1.2 Fixture: The spacer-type fixture shall be made of AMS 5732 steel. The diameter of the bolt hole in the fixture shall be 0.030 to 0.034 inch greater than the maximum major diameter of the bolt thread (see Figure 2). Fixture may be counter-bored 0.004 to 0.008 inch greater than the maximum allowable shank diameter of shank nuts to permit the spacer to seat onto the bearing surface of the nut. Length of fixture shall be as specified in Table 7.

3.7.4 Permanent Set: At least three nuts shall be assembled on a maximum mandrel (see Figure 3) so that the mandrel protrudes through the nut not less than three thread turns. Nuts shall then be removed from the maximum mandrel and assembled on a minimum mandrel (see Figure 4) in the same manner. Tests shall be conducted at room temperature with no axial stress; breakaway and self-locking torques shall be measured and recorded. The nuts shall not exceed the maximum self-locking torque of Table 3, Column /3/, during the installation or removal cycle on the maximum mandrel and shall not be less than the minimum breakaway torque of Table 3, Column /1/, at the start of the removal cycle on the minimum mandrel.

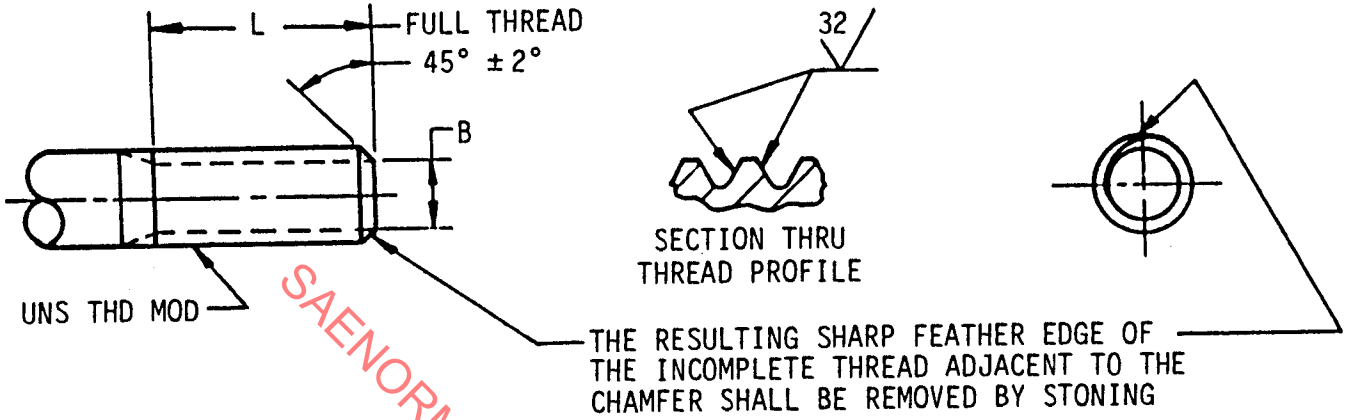
3.7.5 Reusability: Nuts shall be assembled on test bolts conforming to 3.8 and tested in accordance with 3.7.3 as modified in 3.7.5.1, 3.7.5.2, and 3.7.5.3. After testing, nut threads shall show no distortion, galling, or scratches of such depth as to prevent reassembly of nut freely, with the fingers, up to the self-locking device. Bolt threads shall remain serviceable and permit a new nut to assemble freely, with the fingers, up to the self-locking device.



Nominal Thread Size	Major Diameter Mod inch	Pitch Diameter inch	Minor Diameter inch, max	Helix Tolerance inch	Half Angle Tolerance ±	B inch	L min inch
0.112 -40	0.1061 - 0.1086	0.0941 - 0.0945	0.0801	0.0002	0°20'	0.060 - 0.080	0.224
0.112 -48	0.1068 - 0.1091	0.0970 - 0.0974	0.0854	0.0002	0°30'	0.065 - 0.085	0.224
0.138 -32	0.1312 - 0.1342	0.1159 - 0.1163	0.0983	0.0003	0°15'	0.078 - 0.098	0.276
0.138 -40	0.1321 - 0.1346	0.1201 - 0.1205	0.1061	0.0002	0°15'	0.086 - 0.106	0.276
0.164 -32	0.1571 - 0.1601	0.1418 - 0.1422	0.1242	0.0003	0°15'	0.104 - 0.124	0.328
0.164 -36	0.1577 - 0.1604	0.1443 - 0.1447	0.1287	0.0002	0°15'	0.108 - 0.128	0.328
0.190 -32	0.1810 - 0.1840	0.1657 - 0.1661	0.1481	0.0003	0°15'	0.128 - 0.148	0.380
0.250 -28	0.2405 - 0.2438	0.2227 - 0.2231	0.2025	0.0003	0°15'	0.182 - 0.202	0.500
0.3125-24	0.3023 - 0.3059	0.2813 - 0.2817	0.2576	0.0003	0°15'	0.237 - 0.257	0.625
0.375 -24	0.3648 - 0.3684	0.3437 - 0.3441	0.3200	0.0003	0°15'	0.300 - 0.320	0.750
0.4375-20	0.4264 - 0.4304	0.4008 - 0.4012	0.3723	0.0003	0°15'	0.352 - 0.372	0.875
0.500 -20	0.4889 - 0.4930	0.4633 - 0.4637	0.4348	0.0003	0°15'	0.414 - 0.434	1.000
0.5625-18	0.5508 - 0.5552	0.5221 - 0.5225	0.4904	0.0003	0°10'	0.470 - 0.490	1.125
0.625 -18	0.6133 - 0.6176	0.5846 - 0.5850	0.5529	0.0003	0°10'	0.532 - 0.552	1.250

Surface Roughness: In microinches Ra per ANSI/ASME B46.1.
Material: Steel. Hardness: 50 HRC minimum. Use of bolt or stud meeting above requirements is optional.
Screw Threads: MIL-S-7742 except as otherwise specified in above table.
Helix tolerance is the allowable axial variation in helix between any two thread pitches not farther apart than the basic length of engagement, and is the total width of tolerance zone, parallel to thread axis, within which the actual helical path (positive and negative) must lie.

FIGURE 3 - Maximum Mandrel Test Fixture



Nominal Thread Size	Major Diameter Mod inch	Pitch Diameter inch	Minor Diameter inch, max	Helix Tolerance inch	Half Angle Tolerance ±	B inch	L min inch
0.112 -40	0.1057 - 0.1061	0.0927 - 0.0931	0.0787	0.0002	0°20'	0.058 - 0.078	0.224
0.112 -48	0.1064 - 0.1068	0.0956 - 0.0960	0.0840	0.0002	0°30'	0.064 - 0.084	0.224
0.138 -32	0.1308 - 0.1312	0.1144 - 0.1148	0.0968	0.0003	0°15'	0.076 - 0.096	0.276
0.138 -40	0.1317 - 0.1321	0.1186 - 0.1190	0.1046	0.0002	0°15'	0.084 - 0.104	0.276
0.164 -32	0.1567 - 0.1571	0.1402 - 0.1406	0.1226	0.0003	0°15'	0.102 - 0.122	0.328
0.164 -36	0.1573 - 0.1577	0.1427 - 0.1431	0.1271	0.0002	0°15'	0.107 - 0.127	0.328
0.190 -32	0.1806 - 0.1810	0.1640 - 0.1644	0.1464	0.0003	0°15'	0.126 - 0.146	0.380
0.250 -28	0.2401 - 0.2405	0.2209 - 0.2213	0.2007	0.0003	0°15'	0.180 - 0.200	0.500
0.3125-24	0.3019 - 0.3023	0.2793 - 0.2797	0.2556	0.0003	0°15'	0.235 - 0.255	0.625
0.375 -24	0.3644 - 0.3648	0.3416 - 0.3420	0.3179	0.0003	0°15'	0.297 - 0.317	0.750
0.4375-20	0.4260 - 0.4264	0.3985 - 0.3989	0.3700	0.0003	0°15'	0.350 - 0.370	0.875
0.500 -20	0.4885 - 0.4889	0.4609 - 0.4613	0.4324	0.0003	0°15'	0.412 - 0.432	1.000
0.5625-18	0.5504 - 0.5508	0.5196 - 0.5200	0.4879	0.0003	0°10'	0.467 - 0.487	1.125
0.625 -18	0.6129 - 0.6133	0.5820 - 0.5824	0.5503	0.0003	0°10'	0.530 - 0.550	1.250

Surface Roughness: In microinches Ra per ANSI/ASME B46.1.
Material: Steel. Hardness: 50 HRC minimum. Use of bolt or stud meeting above requirements is optional.
Screw Threads: MIL-S-7742 except as otherwise specified in above table.
Helix tolerance is the allowable axial variation in helix between any two thread pitches not farther apart than the basic length of engagement, and is the total width of tolerance zone, parallel to thread axis, within which the actual helical path (positive and negative) must lie.

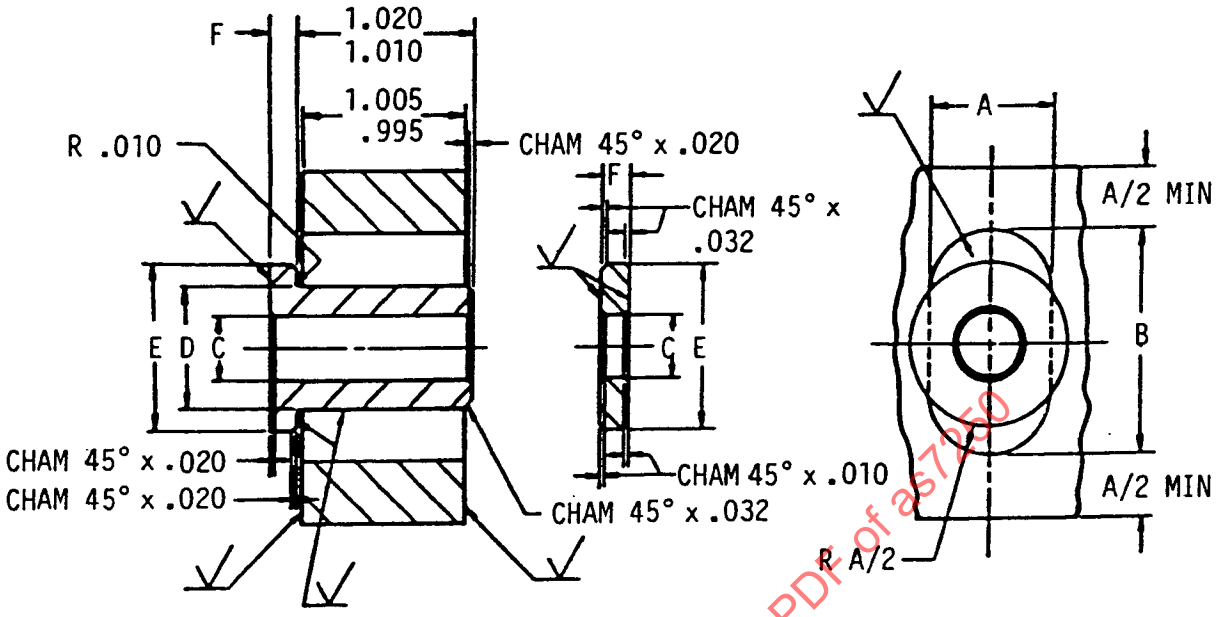
FIGURE 4 - Minimum Mandrel Test Fixture

3.7.5.1 Twelve-Cycle, Room Temperature, As Received Test: The nuts shall be installed and removed from the bolts 12 consecutive times, using the same nut and bolt; breakaway and self-locking torques shall be measured and recorded. With the exception of the first installation, the nuts shall not exceed the maximum locking torque of Table 3, Column /3/, during the installation or removal cycle and shall not be less than the minimum breakaway torque of Table 3, Column /1/.

3.7.5.2 Five-Cycle, Loaded and Conditioned Test: Conditioning cycles shall be performed in accordance with 3.7.3.1. The nuts shall be completely removed from the bolt after each cycle of conditioning. The conditioning test shall be run five consecutive cycles, using the same nut, bolt and spacer; breakaway and self-locking torques shall be measured and recorded. The maximum self-locking torque and the minimum breakaway torque for each cycle shall not exceed the limits specified in Table 3, Columns /4/ and /1/, respectively. The minimum self-locking torque on installation shall not be lower than the values in Table 3, Column /1/.

3.7.5.3 Single-Cycle, Loaded, Room Temperature Test: Nuts shall be assembled and loaded to one-half (50%) of the torques listed in Table 2. The nut shall be completely removed from the bolt; breakaway and self-locking torques shall be measured and recorded; and the nuts shall not exceed the maximum self-locking torque of Table 3, Column /3/, during the installation or removal cycle and shall not be less than the minimum breakaway torque of Table 3, Column /2/.

3.7.6 Vibration Test: Ten nuts of the type to be tested, for the sizes listed in Table 4, shall be installed on a test bolt conforming to 3.8 and on a test fixture as in 3.7.3.1.2. The assembly torque values shall be as specified in Table 4. For sizes not shown, the torque shall be as agreed upon by purchaser and vendor. Testing of nuts other than hexagon or double hexagon wrenching types shall be as agreed upon by purchaser and vendor. Five nuts shall be removed from the test bolts and reinstalled four additional times to the torque values specified for the thread size. The other five assembled nuts shall be baked at 1200 °F ± 15 for 6 hours ± 0.25 and cooled to room temperature; these nuts shall then be removed and reinstalled four additional times to the torque values specified for the thread size. The five baked nuts and five unbaked nuts shall be assembled on the vibration test fixture (see Figure 5) on test bolts and vibration tested at room temperature. The assemblies shall be vibrated 15 000 cycles at a frequency of 1750 to 1800 cpm and an amplitude of 0.435 to 0.465 inch. The assembly shall traverse the entire length of the slots in the test fixture. Reference lines shall be scribed, or other suitable markings made, to determine the amount the nut turns on the test bolt during vibration test. The relative rotation between any nut and bolt shall be not greater than 360°. The nuts shall not have developed any cracks or broken segments, as shown by examination at 10X magnification. Multipiece floating plate nuts shall have the nut element removed from the retainer for this test. Fixed anchor nuts may have the lugs removed.



Typical Assembly

Nut Size	A +0.004 −0.000	B +0.004 −0.000	C +0.004 −0.000	D +0.004 −0.000	E +0.010 −0.000	F +0.004 −0.000	Reference Bolt
0.164	0.301	1.044	0.172	0.294	0.520	0.121	MS9178-26
0.190	0.326	1.069	0.198	0.320	0.545	0.121	MS9033-27
0.250	0.498	1.243	0.263	0.493	0.745	0.161	MS9034-26
0.3125	0.623	1.368	0.326	0.618	0.870	0.161	MS9035-27
0.375	0.748	1.493	0.388	0.743	0.995	0.161	MS9036-26
0.4375	0.873	1.618	0.450	0.868	1.195	0.186	MS9037-27
0.500	0.998	1.743	0.513	0.988	1.370	0.186	MS9038-26
0.5625	1.123	1.868	0.576	1.113	1.545	0.211	MS9224-27
0.625	1.248	1.993	0.638	1.238	1.695	0.211	---

Material: Steel. Hardness: 40 - 45 HRC
Surface Roughness: Surfaces marked √ to be 32 microinches Ra per ANSI/ASME B46.1.
Dimensions in inches, unless otherwise specified.
Tolerances: Linear dimensions ± 0.010, angular dimensions ± 5°.

FIGURE 5 - Vibration Test Fixture

3.7.6 (Continued):

TABLE 4 - Assembly Torque for Vibration Test

Nominal Thread Size	Assembly Torque lbf·in
0.164 -32	22
0.164 -36	22
0.190 -32	30
0.250 -28	60
0.3125-24	120
0.375 -24	160
0.4375-20	200
0.500 -20	300
0.5625-18	400
0.625 -18	600

3.7.7 Flarability: At least three shank nuts shall be tested for flarability. The shank of shank nuts shall not crack when flared with a 60° included angle conical tool to a diameter equal to 120% of the maximum allowable shank diameter, unless otherwise specified on the part drawing.

3.7.8 Push-Out: This requirement is applicable only to gang channel nuts, floating plate nuts, and nonfloating plate nuts. At least five nuts shall be screwed or clamped to a steel plate or plates of a thickness equal to or greater than the nominal major diameter of the nut thread. The plate bolt hole at maximum material condition (MMC) shall be positioned within 0.010 inch radius relative to the nut thread minor diameter at MMC. 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 gang channel nut assemblies shall be as shown in Table 5, unless otherwise specified on the part drawing. With the push-out stud or device hemispherical end inserted against the base of the nut thread, the push-out load specified in Table 5 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 axially with the threaded element of more than 0.030 inch 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.

3.7.9 Torque-Out: This requirement is applicable only to gang channel nut assemblies, floating plate nuts, and nonfloating nuts. At least five nuts shall be prepared as in 3.7.8 and subjected to the torque-out loads in Table 6, first in the clockwise direction and then in the counterclockwise direction. The diameter of the torque stud shall have 0.010 inch maximum diametral clearance 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 retainer plate. 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.

TABLE 5 - Push-Out Load and Rivet Hole Size and Location

Nominal Thread Diameter Inch	Rivet Hole Diameter Inch	Hole Location (Distance From Nut Thread Axis) Inch	Push-Out Load, Minimum lbf
0.112	0.093 - 0.103	0.334 - 0.354	40
0.138	0.093 - 0.103	0.334 - 0.354	60
0.164	0.093 - 0.103	0.334 - 0.354	80
0.190	0.093 - 0.103	0.334 - 0.354	100
0.250	0.093 - 0.103	0.490 - 0.510	125
0.3125	0.125 - 0.135	0.490 - 0.510	125
0.375	0.125 - 0.135	0.490 - 0.510	125
0.4375	0.125 - 0.135	0.552 - 0.572	125
0.500	0.125 - 0.135	0.615 - 0.635	125
0.5625	0.125 - 0.135	0.678 - 0.698	125
0.625	0.125 - 0.135	0.740 - 0.760	125

TABLE 6 - Torque-Out Load

Nominal Thread Diameter Inch	Torque-Out Load, Minimum lbf·in
0.112	20
0.138	30
0.164	45
0.190	60
0.250	100
0.3125	160
0.375	240
0.4375	350
0.500	450
0.5625	600
0.625	900