SAE Aerospace
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AEROSPACE STANDARD

SAE AS7250C

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Superseding AS7250B

Nuts, Self-Locking, Steel, Corrosion and Heat Resistant High Strength, All Metal 1200 °F Use, UN Thread Form

FSC 5310

RATIONALE

TO CORRECT FIGURES 3 AND 4 FOR PERMANENT SET PITCH DIAMETERS APPLICABLE TO THE .003 INCH REDUCTION REQUIRED PER SECTION 3.8 AND GENERAL SAE FORMATING REQUIREMENTS.

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 ksi 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 publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

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http://www.sae.org/technical/standards/AS7250C

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org

AMS2410 Plating, Silver Nickel Strike, High Bake

AMS2411 Plating, Silver for High Temperature Applications

AMS5731 Steel, Corrosion and Heat-Resistant, Bars, Wire, Forgings, Tubing, and Rings 15Cr - 25.5Ni - 1.2Mo - 2.1Ti - 0.006B - 0.30V Consumable Electrode Melted, 1800 °F (982 °C) Solution Heat Treated

AMS5732 Steel, Corrosion and Heat-Resistant, Bars, Wire, Forgings, Tubing, and Rings 15Cr - 25.5Ni - 1.2Mo - 2.1Ti - 0.006B - 0.30V, Consumable Electrode Melted 1800 °F (982 °C) Solution and Precipitation Heat Treated

AMS5734 Steel, Corrosion and Heat-Resistant, Bars, Wire, Forgings, and Tubing 15Cr - 25.5Ni - 1.2Mo - 2.1Ti - 0.006B - 0.30V Consumable Electrode Melted, 1650 °F (899 °C) Solution Heat Treated

AMS5737 Steel, Corrosion and Heat-Resistant, Bars, Wire, Forgings, and Tubing 15Cr - 25.5Ni - 1.2Mo - 2.1Ti - 0.006B - 0.30V Consumable Electrode Melted 1650 °F (899 °C) Solution and Precipitation Heat Treated

AMS5853 Steel, Corrosion and Heat-Resistant, Bars and Wire 15Cr - 25.5Ni - 1.2Mo - 2.1Ti - 0.006B - 0.30V Consumable Electrode Melted 1800 °F (982 °C) Solution Treated and Work-Strengthened 160 ksi (1103 MPa) Tensile Strength

AS954 Wrenches, Hand Twelve Point High Strength, Thin Wall

AS1310 Fastener Torque for Threaded Applications, Definitions of

AS3067 Nut, Self-Locking, Double Hexagon, Reduced Envelope, AS7251

AS7477 Bolts and Screws, Steel, UNS S66286 Tensile Strength 130 ksi, Procurement Specification

AS7478 Bolts and Screws, Steel, UNS S66286 Classification: 130 ksi/1200 °F 1800 °F Solution Heat Treated, Aged After Roll Threaded

AS7481 Studs, Steel, UNS S66286 Aged After Roll Threaded Procurement Specification for

AS7482 Studs, Corrosion and Heat Resistant Steel, UNS S66286 Tensile Strength 130 ksi 1800 °F Solution Heat Treated, Aged Before Roll Threading Procurement Specification

2.1.2 U.S. Government Publications

Available from the Document Automation and Production Service (DAPS), Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-6257, http://assist.daps.dla.mil/quicksearch/

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

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

2.1.3 ASME Publications

Available from American Society of Mechanical Engineers, 22 Law Drive, P.O. Box 2900, Fairfield, NJ 07007-2900, Tel: 973-882-1170, www.asme.org

ASME B1.1 Unified Inch Screw Threads, (UN and UNR Thread Form)

ASME B46.1 Surface Texture, Surface Roughness, Waviness, and Lay

2.1.4 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org

ASTM E 140 Standard Hardness Conversion Tables for Metals Relationship Among Brinell Hardness, Vickers Hardness, Rockwell Hardness, Superficial Hardness, Knoop Hardness, and Scleroscope Hardness

ASTM D 3951 Commercial Packaging Standard Practice for

2.1.5 NAS Publications

Available from Aerospace Industries Association, 1000 Wilson Boulevard, Suite 1700, Arlington, VA 22209-3928, Tel: 703-358-1000, www.aia-aerospace.org

NASM 1312-6 Fastener Test Methods - Method 6 Hardness

2.2 Definitions

Refer to AS1310 for definitions related to fastener torque.

BURR: A rough edge or ridge left on the metal due to a cutting, grinding, piercing or blanking operation.

DEFECT: Any nonconformance of the unit of product with specified requirements.

DEFECTIVE: A unit of product which contains one or more defects.

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).

TIGHT BURR: A burr closely compacted and binding in the periphery of a part without any loose ends and is within the dimensional limits of the part.

2.3 Unit Symbols

°	degree, angular
°C	degree Celsius
°F	degree Fahrenheit
%	percent (1% = 1/100)
HRC	hardness, Rockwell C scale
lbf	pound-force
lbf-in	pound-force inch, torque
psi	pound-force per square inch
ksi	kips (1000 pounds) per square inch
cpm	cycles per minute
in^2	square inch
µin Ra	microinch, roughness average

3. TECHNICAL REQUIREMENTS

3.1 Material

Shall be AMS5731, AMS5734, or AMS5853.

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 Bearing Surface Squareness

The bearing surface shall be square with the thread pitch cylinder axis within the limits specified on the part drawing. Bearing surface shall not be convex. Bearing surface squareness shall be tested using a table squareness gage and feeler gage. 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 core hardness after heat treatment as in 3.4 shall be no greater than 46 HRC (see 8.1), determined in accordance with MIL-STD-1312-6 (in accordance with NASM 1312-6). The minimum limit is controlled by the axial tensile strength requirement in 3.7.1.

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 (cetyl alcohol) 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 °F, held at heat for 6 hours ± 0.25 hour 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 bearing plate hole diameter shall be 0.010 to 0.034 inch greater than the bolt thread basic major diameter. Bearing plate hole edges 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 the test; tests need not be run to failure. The axial tensile load shall be applied to the nut slowly at a maximum rate equivalent to:

$$\text{Load, lfb/minute} = 778\,000 \times D^2 \qquad \text{(Eq. 1)}$$

where:

D = nominal major diameter of thread

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 bearing plate hole 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.

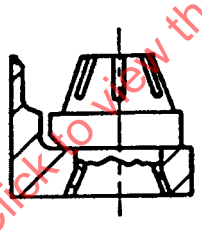


FIGURE 1 - FLANGE ASSEMBLY, FLARED SHANK NUT

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 an alloy steel 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 for hexagon nuts, and socket type conforming to AS954 for double hexagon nuts.

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 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 a minimum of 1.5 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 prevailing 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.

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	1190
0.138 -40UNF-3B	1400
0.164 -32UNC-3B	1914
0.164 -36UNF-3B	2056
0.190 -32UNF-3B	2805
0.250 -28UNF-3B	5210
0.3125-24UNF-3B	8389
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:

$$A = 0.7854[D - (1.5H)]^2 = 0.7854[D - (1.2990/n)]^2 \quad \text{(Eq. 2)}$$

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.

$$\text{Axial tensile load} = 160\,000 \text{ psi} \times A, \text{ lbf} \quad \text{(Eq. 3)}$$

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.

TABLE 2 - WRENCH TORQUE

Nominal Dimension Across Flats inch	Nut Wrenching Feature Double Hexagon Wrench Torque min lbf-in	Nut Wrenching Feature Hexagon Wrench Torque min lbf-in
0.188	--	30
0.218	40	40
0.250	82	60
0.281	145	90
0.312	205	125
0.375	450	250
0.438	730	370
0.500	930	495
0.562	1130	690
0.625	1565	990
0.688	2000	1235
0.750	2375	1485
0.781	2750	1730
0.812	3180	1980

TABLE 3 - LOCKING FEATURE TOPICS

Nominal Thread Size	Minimum Breakaway Torque lbf·in /1/	Minimum Breakaway Torque lbf·in /2/	Maximum Prevailing Torque lbf·in /3/	Maximum Prevailing Torque lbf·in /4/	Assembly Torque lbf-in /5/
0.112 -40	0.5	1	4	8	7
0.112 -48	0.5	1	4	8	7
0.138 -32	1	2	7	14	15
0.138 -40	1	2	7	14	16
0.164 -32	1.5	3	11	22	25
0.164 -36	1.5	3	11	22	26
0.190 -32	2	4	15	30	42
0.250 -28	3.5	7	30	60	95
0.3125-24	6.5	13	60	120	185
0.375 -24	9.5	19	80	160	330
0.4375-20	14	28	100	200	530
0.500 -20	18	36	150	300	800
0.5625-18	24	48	200	400	1150
0.625 -18	32	64	300	600	1580

/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 prevailing torque for 12-cycle, room temperature, as received test; single-cycle, loaded, room temperature test; permanent set test

NOTE: At initial installation, values may be exceeded when bolt first enters locking feature, provided all parts are within the specified limits after a minimum of 1.5 thread pitches, including chamfer, protrudes through the top of nut.

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

/5/ Assembly torque for single-cycle, loaded, room temperature 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 ksi at room temperature on a spacer-type fixture in accordance with 3.7.3.1.2, measuring and recording maximum prevailing torque. Loading shall be determined by elongation measurement of the bolt at room temperature. For reference, minimum bolt lengths are given in 3.8. Allow assembly to remain stressed at room temperature for not less than 1 hour, remeasured, and loading adjusted to 75 ksi. The loaded assemblies shall then be heated in a furnace to 1200 °F ± 15 °F, held at heat for 6 hours ± 0.25 hour, removed from furnace, cooled to room temperature, and unloaded by loosening nut one-half turn and record unseating torque. Breakaway and prevailing 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:

$$e = s/E, \text{unit elongation, inch/inch} \quad \text{(Eq. 4)}$$

$$eL = \text{bolt elongation, inch} \quad \text{(Eq. 5)}$$

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

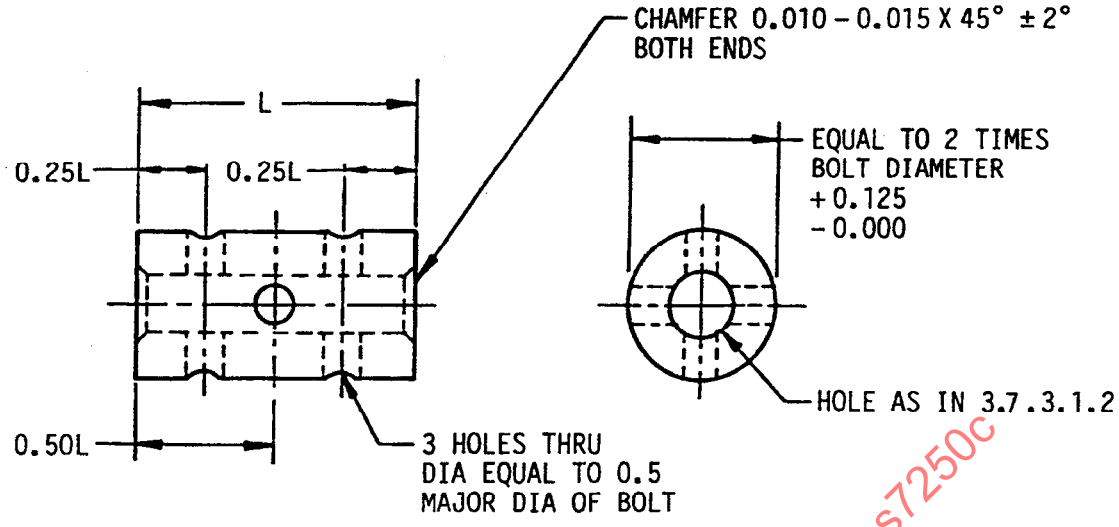


FIGURE 2 - SPACER-TYPE FIXTURE

3.7.3.1.2 Fixture

The spacer-type fixture shall be made of AMS5732 or AMS5737 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

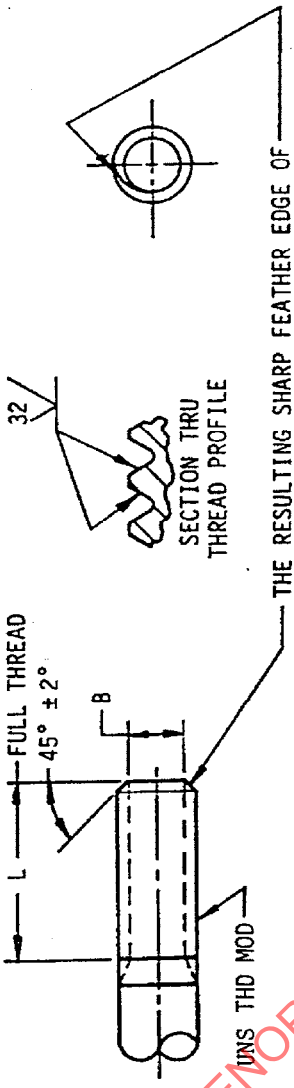
At least three nuts shall be assembled on a maximum material bolt or stud (see Figure 3) so that the bolt or stud protrudes through the nut not less than three thread turns. Nuts shall then be removed from the maximum material bolt or stud and assembled on a minimum material bolt or stud (see Figure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

3.7.5.1 Twelve-Cycle, Room Temperature, As Received Test

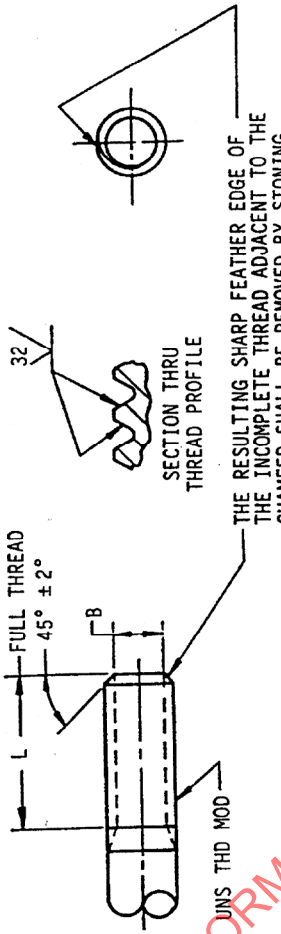
The nuts shall be installed and removed from the bolts 12 consecutive times, using the same nut and bolt; breakaway and prevailing torques shall be measured and recorded. The nuts shall not exceed the maximum prevailing torque of Table 3, Column /3/, during the installation or removal cycle and shall not be less than the minimum breakaway torque of Table 3, Column /1/.



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	0.0940 - 0.0950	0.0801	0.0002	0°20'	0.060 - 0.080	0.224
0.112 -48	0.1068 - 0.1091	0.0968 - 0.0978	0.0854	0.0002	0°30'	0.065 - 0.085	0.224
0.138 -32	0.1312 - 0.1342	0.1158 - 0.1169	0.0983	0.0003	0°15'	0.078 - 0.098	0.276
0.138 -40	0.1321 - 0.1346	0.1200 - 0.1210	0.1061	0.0002	0°15'	0.086 - 0.106	0.276
0.164 -32	0.1571 - 0.1601	0.1416 - 0.1428	0.1242	0.0003	0°15'	0.104 - 0.124	0.328
0.164 -36	0.1577 - 0.1604	0.1441 - 0.1452	0.1287	0.0002	0°15'	0.108 - 0.128	0.328
0.190 -32	0.1810 - 0.1840	0.1658 - 0.1667	0.1481	0.0003	0°15'	0.128 - 0.148	0.380
0.250 -28	0.2405 - 0.2438	0.2228 - 0.2238	0.2025	0.0003	0°15'	0.182 - 0.202	0.500
0.3125-24	0.3023 - 0.3059	0.2813 - 0.2824	0.2576	0.0003	0°15'	0.237 - 0.257	0.625
0.375 -24	0.3648 - 0.3684	0.3437 - 0.3449	0.3200	0.0003	0°15'	0.300 - 0.320	0.750
0.4375-20	0.4264 - 0.4304	0.4008 - 0.4020	0.3723	0.0003	0°15'	0.352 - 0.372	0.875
0.500 -20	0.4889 - 0.4930	0.4632 - 0.4645	0.4348	0.0003	0°15'	0.414 - 0.434	1.000
0.5625-18	0.5508 - 0.5552	0.5220 - 0.5234	0.4904	0.0003	0°10'	0.470 - 0.490	1.125
0.625 -18	0.6133 - 0.6176	0.5845 - 0.5859	0.5529	0.0003	0°10'	0.532 - 0.552	1.250

Surface Roughness: In microinches Ra per ASME B46.1.
Bolts or studs shall conform to AS7477, AS7478, AS7481, or AS7482 except threads may be formed by any method provided above dimensional and surface finish requirements are met.
Screw Threads: ASME B1.1 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.
Maximum pitch equals maximum Class 2A for diameters less than 0.190 inch nominal and maximum Class 3A minus 0.003 inch for 0.190 and greater.
Minimum pitch equals maximum minus (0.4) (applicable pitch diameter tolerance).

FIGURE 3 - MAXIMUM MATERIAL BOLT OR STUD



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	0.0925 - 0.0931	0.0787	0.0002	0°20'	0.058 - 0.078	0.224
0.112 -48	0.1064 - 0.1068	0.0954 - 0.0960	0.0840	0.0002	0°30'	0.064 - 0.084	0.224
0.138 -32	0.1308 - 0.1312	0.1141 - 0.1148	0.0968	0.0003	0°15'	0.076 - 0.096	0.276
0.138 -40	0.1317 - 0.1321	0.1184 - 0.1190	0.1046	0.0002	0°15'	0.084 - 0.104	0.276
0.164 -32	0.1567 - 0.1571	0.1344 - 0.1406	0.1226	0.0003	0°15'	0.102 - 0.122	0.328
0.164 -36	0.1573 - 0.1577	0.1424 - 0.1431	0.1271	0.0002	0°15'	0.107 - 0.127	0.328
0.190 -32	0.1806 - 0.1810	0.1644 - 0.1650	0.1464	0.0003	0°15'	0.126 - 0.146	0.380
0.250 -28	0.2401 - 0.2405	0.2213 - 0.2219	0.2007	0.0003	0°15'	0.180 - 0.200	0.500
0.3125-24	0.3019 - 0.3023	0.2797 - 0.2804	0.2556	0.0003	0°15'	0.235 - 0.255	0.625
0.375 -24	0.3644 - 0.3648	0.3420 - 0.3427	0.3179	0.0003	0°15'	0.297 - 0.317	0.750
0.4375-20	0.4260 - 0.4264	0.3989 - 0.3997	0.3700	0.0003	0°15'	0.350 - 0.370	0.875
0.500 -20	0.4885 - 0.4889	0.4613 - 0.4621	0.4324	0.0003	0°15'	0.412 - 0.432	1.000
0.5625-18	0.5504 - 0.5508	0.5200 - 0.5209	0.4879	0.0003	0°10'	0.467 - 0.487	1.125
0.625 -18	0.6129 - 0.6133	0.5824 - 0.5833	0.5503	0.0003	0°10'	0.530 - 0.550	1.250

Surface Roughness: In microinches Ra per ASME B46.1.
Bolts or studs shall conform to AS7477, AS7478, AS7481, or AS7482 except threads may be formed by any method provided above dimensional and surface finish requirements are met.
Screw Threads: ASME B1.1 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.
Minimum pitch equals minimum Class 2A for diameters less than 0.190 inch nominal and minimum Class 3A minus 0.003 inch for 0.190 and greater.
Maximum pitch equals minimum plus 1/4 applicable pitch diameter tolerance.

FIGURE 4 - MINIMUM MATERIAL BOLT OR STUD

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 prevailing torques shall be measured and recorded. The maximum prevailing torque and the minimum breakaway torque for each cycle shall not exceed the limits specified in Table 3, Columns /4/ and /1/, respectively.

3.7.5.3 Single-Cycle, Loaded, Room Temperature Test

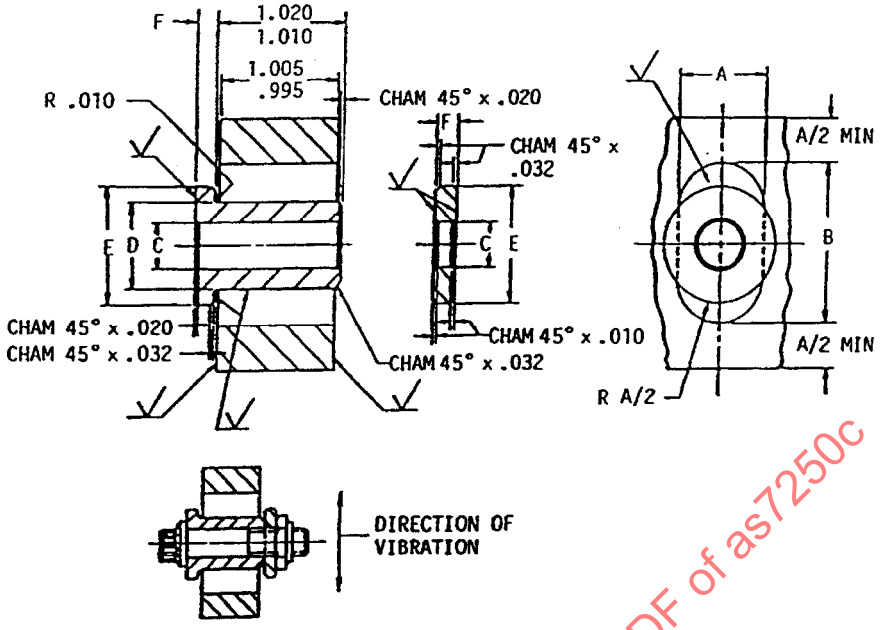
Nuts shall be assembled and loaded to the assembly torque specified in Table 3, Column /5/. The nut shall be completely removed from the bolt; breakaway and prevailing torques shall be measured and recorded; and the nuts shall not exceed the maximum prevailing torque of Table 3, Column /3/, during the 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 °F for 6 hours ± 0.25 hour 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. Assemblies of nuts having Class 3B threads 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. Vibration testing is not required for nuts of nominal thread diameter less than 0.164 inch.

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



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	Ref. Bolt Length min (1)
0.164	0.301	1.044	0.172	0.294	0.520	0.121	1.625
0.190	0.326	1:069	0.198	0.320	0.545	0.121	1.625
0.250	0.498	1.243	0.263	0.493	0.745	0.161	1.781
0.3125	0.623	1.368	0.326	0.618	0.870	0.161	1.844
0.375	0.748	1.493	0.388	0.743	0.995	0.161	1.938
0.4375	0.873	1.618	0.450	0.868	1.195	0.186	2.031
0.500	0.998	1.743	0.513	0.988	1.370	0.186	2.125
0.5625	1.123	1.868	0.576	1.113	1.545	0.211	2.250
0.625	1.248	1.993	0.638	1.238	1.695	0.211	2.312

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

(1) Min bolt length calculated to provide 3 pitches protruding thru AS3067 nut for max grip of test fixture bushing and spacer and then rounded to .031 increment.

FIGURE 5 - VIBRATION TEST FIXTURE

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.

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