SAE Aerospace
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# AEROSPACE STANDARD

SAE AS5377

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## Nut, Self-Locking, 0.7500 thru 1.5000 Thread Sizes, UNS S66286, 160,000 psi, 800 °F, UNJ Thread - Procurement Specification

RATIONALE

AS5377 has been reaffirmed to comply with the SAE five-year review policy.

1. SCOPE:

1.1 Type:

This specification establishes the requirements for self-locking wrenchable nuts with thread sizes 0.7500 thru 1.5000 inches.

The nuts are made of corrosion and heat resistant precipitation hardenable iron base alloy of the type identified under the Unified Numbering System as UNS S66286 and of 160,000 psi axial tensile strength at room temperature, with maximum conditioning temperature of parts at 800 °F.

1.2 Application:

Primarily for use in aerospace propulsion systems up to approximately 800 °F for tension height nuts made from bar, or forging. Nuts are designed to withstand an axial load of 160,000 psi at room temperature.

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/AS5377**

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

| | |
|---|---|
| AMS 2411 | Silver Plating, High Temperature Application |
| AMS 2759/3 | Heat Treatment of Precipitation Hardening Corrosion and Maraging Steel Parts |
| AMS 5663 | Nickel Alloy, Corrosion and Heat Resistant, Bars, Forgings, and Rings 52.5Ni 19Cr 3.0Mo 5.1Cb 0.90Ti 0.50Al 18Fe, Consumable Electrode or Vacuum Inducted Melted 1775°F (968°C) Solution and Precipitation Heat Treated |
| AMS 5731 | 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 |
| AMS 5732 | 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 |
| AMS 5734 | 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 |
| AMS 5737 | 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 |
| AMS 5853 | Steel Corrosion and Heat Resistant, Bars and Wire, 15Cr 25.5Ni 1.2Mo 2.1Ti 0.006B 0.30V, 1800 °F (982 °C), Consumable Electrode Melted Solution Treated and Work-Strengthened 160 ksi (1103 MPa) Tensile Strength |
| AS870 | Wrenching Configuration, Bi-Hexagonal (12-Point) Drive, Design Standard for |
| AS1310 | Fastener Torque for Threaded Applications, Definitions of |
| AIR1471 | Torque Tightening Fasteners |
| AS5054 | Areas for Calculating Stress or Load Values for Externally and Internally Threaded UNJ Fasteners |
| AS5443 | Wrenching Element, Spline Drive - Dimensions for |
| AS5447 | Nuts - Magnetic Particle, Fluorescent Penetrant, and Contrast Dye Penetrant Inspection, Acceptance Criteria for |
| AS7466 | Bolts and Screws, Nickel Alloy, UNS N07718 Tensile Strength 185 ksi Fatigue Rated, Procurement Specification |
| AS7467 | Bolts and Screws, Nickel Alloy, UNS N07718 Tensile Strength 185 ksi Stress Rupture Rated, Procurement Specification |
| AS8879 | Screw Threads - UNJ Profile, Inch |

2.1.2 U.S. Government Publications: Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

| | |
|---|---|
| GGG-W-636 | Wrenches (Box, Open End, and Combination) |
| MS 33787 | Wrenching Element, External Spline, Dimensions for |
| MIL-W-8982 | Wrenches, Splined, High Strength, Thin Wall, General Specification for |
| MIL-PFR-7808 | Lubricating Oil, Aircraft Turbine Engine, Synthetic Base |

2.1.3 ANSI Publications: Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.

| | |
|---|---|
| ANSI B4.1 | Limits and Fits for Cylindrical Parts |

2.1.4 ASTM Publications: Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

| | |
|---|---|
| ASTM E 112 | Determining Average Grain Size |
| ASTM E 140 | Standard Hardness Conversion Tables for Metals |
| ASTM E 1417 | Liquid Penetrant Examination |
| ASTM D 3951 | Commercial Packing |

2.1.5 ASME Publications: Available from ASME, 22 Law Drive, Box 2900, Fairfield, NJ 07007-2900.

| | |
|---|---|
| ASME B1.1 | Unified Inch Screw Threads (UN and UNR Thread Forms) |
| ASME B46.1 | Surface Texture (Surface Roughness, Waviness, and Lay) |

2.1.6 NAS Publications: Available from National Standards Association, Inc., 1200 Quince Orchard Boulevard, Gaithersburg, MD 20878.

| | |
|---|---|
| NASM1312-6 | Fastener Test Methods, Method 6, Hardness |
| NASM1312-8 | Fastener Test Methods, Method 8, Tensile Strength |

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.

INSPECTION LOT: Shall consist of nuts from a single production lot, of the same part number.

NON-CONFORMANCE: A departure from a specified requirement for any characteristic.

NON-CONFORMING UNIT: A unit of the product that has one or more non-conformances.

2.2 (Continued):

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 the 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, angle |
| °C | - degree Celsius |
| °F | - degree Fahrenheit |
| % | - percent (1% = 1/100) |
| HRC | - hardness, Rockwell C scale |
| lbf | - pounds force |
| lbf·in | - pounds force-inch, torque |
| psi | - pounds force per square inch |
| cpm | - cycles per minute |
| $in^2$ | - square inch |
| µin Ra | - microinch, roughness average |

3. TECHNICAL REQUIREMENTS:

3.1 Material:

Shall be a corrosion and heat resistant steel, AMS 5731, AMS 5732, AMS 5734, AMS 5737, or AMS 5853 bars or forgings, as specified on the part drawing.

3.2 Design:

Finished (completely manufactured) parts shall conform to the following requirements:

3.2.1 Dimensions: The dimensions of finished parts, after all processing, including plating, shall conform to the part drawing. Dimensions apply after plating but before coating with solid film lubricants.

3.2.1.1 Bearing Surface Perpendicularity: Shall be as specified on the part drawing when tested in accordance with Appendix A.

3.2.1.2 Geometric Tolerances: Part features shall be within the geometric tolerance specified on the part drawing when tested by conventional measuring methods, except for bearing surface perpendicularity as in 3.2.1.1.

3.2.2 Surface Texture: Surface texture of finished parts, prior to plating, shall conform to the requirements specified on the part drawing, determined in accordance with ASME B46.1.

3.2.3 Threads: Screw thread UNJ profile in accordance with AS8879.

3.2.3.1 Countersink: The entering end of the thread at the bearing surface and the end of the thread at the top of nut shall be countersunk as specified on the part drawing.

3.2.3.2 Plated Threads: Thread in plated nuts shall meet the material limits for coated threads specified in AS8879.

3.2.3.3 After Forming Self-Locking Feature: The upper threaded portion shall be formed out of round in any manner which provides self-locking nuts meeting the locking torque requirements of this specification. Tension nuts having an overall length of the threaded portion not less than 1.2 times the nominal thread diameter shall allow the GO thread plug gage to enter the plated nut a minimum of three turns before engagement of the locking element; for nuts having a shorter threaded portion the GO thread plug gage shall be allowed to enter a minimum of three quarters of a turn.

3.2.4 Construction: The nut shall be of the prevailing torque-type, self-contained, all metal unit, including the self-locking feature. The locking feature shall not operate by means of separate movement and shall not depend upon pressure on the bearing surface for the locking action. Tool marks resulting from producing the self-locking feature shall blend smoothly without abrupt change.

3.3 Heat Treatment:

The nuts shall be solution and precipitation heat treated in accordance with AMS 2759/3 requirements for UNS S66286.

3.4 Product Marking:

Each part shall be identification marked as specified on the part drawing. Depressed characters shall have a rounded root form, depressed 0.010 inches maximum depth.

3.5 Plating:

Unless otherwise specified, parts shall be silver plated on the threads only in accordance with AMS 2411. The plating thickness on the thread flanks shall be not less than 0.0002 in when measured on the pitch diameter. Microscopic measurement of a sectioned nut shall be used as the referee method. Plating is optional in the counterbore or countersink and may be incomplete but no plating shall extend onto the bearing surface or the top of the nut.

3.6 Lubrication:

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

3.7 Mechanical Properties:

3.7.1 Hardness: Unless otherwise specified on the part drawing, the core hardness after heat treatment as in 3.3 shall be no greater than 39 HRC (see 8.1), determined in accordance with NASM1312-6. The minimum limit is controlled by the axial tensile strength requirement in 3.10.1.

3.8 Metallurgical Properties:

3.8.1 Microstructure: Parts shall have microstructure of completely recrystallized material, except for cold working effects of tapping and forming operation of locking feature.

3.8.2 Grain Size: Shall be an average of ASTM No. 5 or finer with occasional grains as large as No. 2 in the base of the nut as determined by comparison of a polished and etched specimen with ASTM E 112 Plate 2. In case of disagreement on grain size by the comparison method, the intercept (Heyn) procedure shall be used.

3.9 Quality:

Parts shall be uniform in quality and condition, free from loose burrs (tight burrs are acceptable), foreign materials, and from imperfections detrimental to the usage of the part.

3.9.1 Fluorescent Penetrant Inspection: Parts shall be subject to fluorescent penetrant inspection, prior to plating or with plating removed, in accordance with ASTM E 1417, Type 1, Sensitivity Level 2. Acceptance criteria of surface discontinuities shall be in accordance with AS5447.

3.10 Product Performance Test:

Refer to Tables 4 and 5 for details of sample sizes for Acceptance Test Plan and Qualification Approval Test Plan.

3.10.1 Axial Tensile Strength: Nuts shall withstand the minimum tensile load as specified in Table 1 without rupture, stripping, or appearance of cracks when tested as follows:

3.10.1.1 As Received Condition at Room Temperature: Nuts in as received condition tested in accordance with NASM1312-8, using alloy steel test bolts hardened and tempered to 40 HRC minimum and having threads in accordance with 3.2.3, shall withstand the axial tensile load specified in Table 1, applied at room temperature at the rate specified by Equation 3 in Table 1, Note /2/.

3.10.1.2 After Bake, at Room Temperature: Prior to testing, the nut shall be assembled on a bolt as specified in 3.11 with at least two thread turns protruding through the nut and baked for 6 hours ± 0.25 hour at 800 °F ± 15 °F, and then cooled to room temperature. A new test bolt shall be used for each axial tensile test. Nuts shall be tested, after baking, at room temperature in accordance with NASM1312-8 and shall withstand the axial tensile load in Table 1, applied at the rate specified by Equation 3 in Table 1, Note /2/.

TABLE 1 - Axial Tensile Load

| Nut Thread Size | Axial Tensile Load at Room Temperature-lbf minimum /1/ | Nut Thread Size | Axial Tensile Load at Room Temperature-lbf minimum /1/ |
|---|---|---|---|
| 0.7500-16UNJF-3B | 63,240 | 1.2500-12UNJF-3B | 179,700 |
| 0.8750-14UNJF-3B | 86,280 | 1.3750-12UNJF-3B | 219,200 |
| 1.0000-12UNJF-3B | 112,400 | 1.5000-12UNJF-3B | 262,700 |
| 1.1250-12UNJF-3B | 144,100 | | |

NOTES:

/1/ Requirements above apply to the companion bolts with UNJ threads to Class 3A tolerance. Area upon which stress for axial load requirements is based is Equation 2 from AS5054 at 0.375H thread depth at basic pitch and calculated from Equation 1:

$$A = 0.7854[d - (0.750H)]^2 = 0.7854[d - (0.6495/n)]^2 \quad \text{(Eq. 1)}$$

where:

A = area at 0.375H thread depth, $in^2$
H = height of the sharp V-thread = (cos30°)/n, in
n = number of thread pitches per inch
d = major diameter, maximum, in

Load requirements for axial strength load is based on 160,000 psi stress induced on area A.

Axial tensile load is calculated from Equation 2:

$$\text{Axial Tensile Load} = 160{,}000 \times A, \text{ for load in lbf} \quad \text{(Eq. 2)}$$

For sizes not shown, axial strength load for nuts shall be based upon the respective bolt stress area using Equations 1 and 2 and 160,000 psi stress.

/2/

$$\text{Maximum Load, lbf/minute} = 78{,}000 \times d^2 \quad \text{(Eq. 3)}$$

where:

d = basic major screw thread diameter

3.10.2 Wrench Torque: Nuts with hexagon, double hexagon wrenching feature conforming to AS870, or spline drive wrenching element conforming to AS5443 shall be tested as specified in Appendix B and shall withstand the wrench torques specified in Table 2 applied through five engagement cycles without any permanent deformation which can interfere with the use of socket wrenches conforming to GGG-W-636; or for nuts with the spline drive wrenching element interfere with socket wrenches conforming to MIL-W-8982.

TABLE 2 - Wrench Torque

| Nut Thread Size | Wrench Torque lbf·in minimum | Nut Thread Size | Wrench Torque lbf·in minimum |
|---|---|---|---|
| 0.7500-16UNJF-3B | 12,800 | 1.2500-12UNJF-3B | 60,300 |
| 0.8750-14UNJF-3B | 20,300 | 1.3750-12UNJF-3B | 81,000 |
| 1.0000-12UNJF-3B | 30,300 | 1.5000-12UNJF-3B | 107,100 |
| 1.1250-12UNJF-3B | 43,500 | -- | -- |

3.10.3 Permanent Set: Nuts shall be tested as specified in Appendix C, and the maximum prevailing torque shall not exceed the values in Table 3, Column (4), or be less than the minimum breakaway torque values in Table 3, Column (1). The bolt or mandrel shall protrude through the nut a minimum of three full thread turns.

3.10.4 Reusability Test at Room Temperature, After Bake: Nuts shall be tested for three consecutive cycles as specified in Appendix D, loading initially to 90,000 psi in accordance with 3.10.4.3. The assembly shall be heated in a furnace to 800 °F ± 15 °F and held at heat for 6 hours ± 0.25 hour, removed from the furnace and cooled to room temperature.

3.10.4.1 Wrenching and Reference Recording: The nuts shall be wrenched by turning the nut relative to the fixture. The wrenchability of the tested nuts shall permit assembly of a standard wrench of the applicable size. For reference information, the assembly and unseating torques shall be recorded for each heat cycle.

3.10.4.2 Locking Feature Torque Requirements: Nuts tested as in 3.10.4 shall conform to the minimum breakaway torque in Table 3, Column (1), for each cycle. The prevailing torque shall be measured on installation, and shall not exceed the torque in Table 3, Column (4), nor shall the torque be less than the breakaway torque in Table 3, Column (1). The prevailing torque shall be measured on removal, and shall not exceed the torque in Table 3, Column (5).

3.10.4.3 Loading by Elongation: Loading shall be determined by measurement of elongation of the bolt at room temperature using bolts having a shank diameter equal to the thread pitch diameter. The bolt elongation used to load the nut-bolt assembly to induce 90,000 psi axial tensile stress in the bolted assembly is based on a modulus of elasticity of 29.5 x $10^6$ psi using Equation 4:

$$e = (s/E)[l_1((d_3/d_2)^2) + (L - l_1)] \quad \text{(Eq. 4)}$$

where:

e = total bolt elongation, inch
s = 90,000 psi bolt stress at area of maximum minor (root) diameter
E = 29.5 x $10^6$ psi modulus of elasticity
L = spacer length in loaded nut-bolt assembly; see Appendix D for configuration
$l_1$ = length of unthreaded shank
$d_1$ = diameter of full shank
$d_2$ = maximum pitch diameter of thread
$d_3$ = maximum minor diameter of thread

NOTE: Substitute $d_1$ with $d_2$ in Equation 4, when a bolt with a full shank is used.

3.10.5 Reusability Test at Room Temperature, As Received Condition: Nuts shall be tested for five cycles as specified in Appendix E, loading to the assembly torque specified in Table 3, Column (6). The nuts shall be turned relative to the fixture. Locking feature torque shall conform to the minimum breakaway torque in Table 3, Column (1), respectively, for each cycle. The prevailing torque shall be measured on installation and removal, and shall not exceed the torque in Table 3, Column (4), nor shall the torque be less than the breakaway torque in Table 3, Column (1). After testing, the nut shall assemble freely, with the fingers, up to the self-locking feature. Bolt threads shall remain serviceable and permit assembly freely of a new nut, with the fingers, up to the self-locking feature.

3.10.6 3-Cycle Test at Room Temperature: Nuts shall be tested as specified in Appendix F, loading to assembly torque specified in Table 3, Column (6). The nuts shall be turned relative to the fixture. Nuts shall conform to the minimum breakaway torque in Table 3, Column (2) for the first cycle, and Column (3) for the subsequent 2nd and 3rd cycles. The prevailing torque shall be measured on installation and removal, and shall not exceed the torque in Table 3, Column (4), nor shall the torque be less than the breakaway torque in Table 3, Column (3).

3.11 Test Bolts:

Except as specified in 3.10.1.1 and 3.10.2, test bolts shall be unplated with an axial tensile strength not less than 180,000 psi and conform to AS7466 or AS7467 with UNJ threads in accordance with AS8879.

TABLE 3 - Locking Feature Torques and Assembly Torque

| Nominal Thread Size | Minimum Torque lbf·in /1/ | Minimum Torque lbf·in /2/ | Minimum Torque lbf·in /3/ | Maximum Torque lbf·in /4/ | Maximum Torque lbf·in /5/ | Assembly Torque lbf·in /6/ |
|---|---|---|---|---|---|---|
| 0.7500-16UNJF-3B | 50 | 100 | 60 | 400 | 800 | 4,250 |
| 0.8750-14UNJF-3B | 70 | 140 | 84 | 600 | 1200 | 6,770 |
| 1.0000-12UNJF-3B | 90 | 180 | 108 | 800 | 1600 | 10,100 |
| 1.1250-12UNJF-3B | 117 | 234 | 140 | 900 | 1800 | 14,500 |
| 1.2500-12UNJF-3B | 143 | 286 | 172 | 1000 | 2000 | 20,100 |
| 1.3750-12UNJF-3B | 165 | 330 | 198 | 1100 | 2200 | 27,000 |
| 1.5000-12UNJF-3B | 195 | 390 | 234 | 1250 | 2500 | 35,700 |

NOTES:

/1/ Minimum torque values following tests at room temperature:
- 5-cycle reusability test in as-received condition, see 3.10.5
- measured on installation after exposure to 800 °F bake cycle, 3.10.4.2
- for permanent set, see 3.10.3

/2/ Minimum torque values following tests at room temperature for first cycle of 3-cycle test, see 3.10.6

/3/ Minimum torque values following tests at room temperature for second and third cycle of 3-cycle test, see 3.10.6.

/4/ Maximum torque values for tests at room temperature:
- 5-cycle reusability test in as-received condition, see 3.10.5
- measured on installation after exposure to 800 °F bake cycle, 3.10.4.2
- for permanent set, see 3.10.3

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

/5/ Maximum torque values for tests at room temperature measured on removal after exposure to 800 °F, see 3.10.4.2.

/6/ Assembly torque values equal torque to induce in the companion bolt mean stress area, (see AIR1471) a stress of 90,000 psi when the nut is silver plated and when threads and bearing surfaces are lubricated with MIL-PFR-7808 aircraft engine oil.

3.12 Test Lubrication:

Stud-mandrel or bolt threads and nut bearing surface shall be lubricated with MIL-PRF-7808 aircraft engine oil before each installation of the nut.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of parts shall supply all parts for vendor tests and shall be responsible for performing all required tests. Subsequent to qualification, there shall be no changes in the manufacturing method and operations sequence without requalification of the parts. Results of such tests shall be reported to the purchaser. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that parts conform to the requirements of this specification.

4.2 Classification of Tests:

The inspection and testing of parts shall be classified as follows:

a. Acceptance Tests
b. Qualification Tests

4.2.1 Acceptance Tests: Tests classified as acceptance or routine control tests are listed in Table 4.

4.2.2 Qualification Tests: Tests to determine conformance to all technical requirements of this specification and part drawing are listed in Table 5.

4.3 Sampling:

4.3.1 Acceptance Tests: Acceptance tests shall be performed on each inspection lot.

4.3.1.1 Nondestructive Tests, Visual and Dimensional: A random sample shall be selected from each inspection lot, the size of the sample to be as specified in Table 7. The classification of defects for nuts will be as specified in Table 6. Defects not classified in Table 6 shall be classified as Minor B defects. All dimensional characteristics are considered defective when out of tolerance.

4.3.1.2 Destructive Tests: A random sample shall be selected from each inspection lot, the size of the sample shall be as specified in Table 8. The sample nuts may be selected from those that have been subjected to and passed the nondestructive tests.

4.3.2 Qualification Tests: The qualification test samples shall consist of the applicable number of nuts for each thread size to be tested as specified in Table 5.

4.4 Reports:

4.4.1 The vendor shall furnish with, or prior to, the first shipment of parts of each part number a report of test data showing that the parts conform to all technical requirements of this specification and the part drawing.

4.4.2 The vendor of parts shall furnish with each production lot shipment a report stating that the chemical composition of the parts conform to the applicable material specification, and showing the results of tests to determine conformance to the acceptance test requirements of this specification. This report shall include the purchase order, production lot number, AS5377, contractor or direct supplier of material, part number, nominal size, and quantity.

4.5 Rejected Lots:

If a production inspection lot is rejected, the vendor of the parts shall perform corrective action by 100% screening to exclude nondestructive test anomalies or rework defective parts, and resubmit for acceptance tests inspection as in Table 4, or scrap the entire lot. Resubmitted lots shall be clearly identified as reinspected lots. Destructive test failures shall be scrapped.

Fastener lots that fail to meet requirements shall (after rework possibilities are exhausted) be scrapped. The disposal method of scrapped parts shall prevent salvage and resale of the parts as aerospace quality fasteners. Disposal method shall be subject to approval by the purchaser.

5. PREPARATION FOR DELIVERY:

5.1 Packaging and Identification:

5.1.1 Packaging shall be in accordance with ASTM D 3951.

5.1.2 Parts having different part numbers shall be packed in separate containers.

5.1.3 Each container of parts shall be marked to show not less than the following information:

NUTS, SELF-LOCKING STEEL, CORROSION AND HEAT RESISTANT
AS5377
PART NUMBER
LOT NUMBER
PURCHASE ORDER NUMBER
QUANTITY
MANUFACTURER'S IDENTIFICATION

5.1.4 Threaded fasteners shall be protected from abrasion and chafing during handling, transportation, and storage.

6. ACKNOWLEDGMENT:

A vendor shall mention AS5377 in all quotations and when acknowledging purchase orders.

7. REJECTIONS:

Parts not conforming to this specification, or to modifications authorized by purchaser, will be subject to rejection.

8. NOTES:

8.1 Hardness conversion tables for metals are presented in ASTM E 140.

8.2 Key Words:

Nuts, self-locking nuts, procurement specification

TABLE 4 - Summary of Acceptance Tests

| Characteristic | Req. Para. | Sample Size | Test Method |
|---|---|---|---|
| Non-Destructive Tests | | | |
| Dimensions | 3.2.1 | Tables 7 & 8 | Conventional measuring methods |
| Bearing Surface Perpendicularity | 3.2.1.1 | Tables 7 & 8 | Appendix A |
| Geometric Tolerances | 3.2.1.2 | Tables 7 & 8 | Conventional measuring methods |
| Surface Texture | 3.2.2 | Tables 7 & 8 | Per ASME B46.1 |
| Thread Size | 3.2.3 | Tables 7 & 8 | Inspection per AS8879 |
| Product Marking | 3.4 | Tables 7 & 8 | Visual examination |
| Quality | 3.9 | Tables 7 & 8 | Visual examination |
| Fluorescent Penetrant | 3.9.1 | Tables 7 & 8 | Inspection per ASTM E 1417 |
| Packaging & Identification | 5.1 | 100% | Visual examination |
| Destructive Tests | | | |
| Material | 3.1 | 4.3.1.2 | Certify composition |
| Axial Tensile Strength as received condition | 3.10.1.1 | Table 8 | NASM1312-8 |
| Plating | 3.5 | Table 8 | Per AMS 2411 |
| Hardness | 3.7.1 | Table 8 | NASM1312-6 |
| Microstructure | 3.8.1 | Table 8 | Microscopic examination at 100X |
| Grain Size | 3.8.2 | Table 8 | Microscopic examination with chart in ASTM E 112 |
| 3-Cycle Test | 3.10.6 | Table 8 | Appendix F |

TABLE 5 - Summary of Qualification Tests

| Characteristic | Req. Para. | Sample Size | Test Method |
|---|---|---|---|
| Non-Destructive Tests /1/ | | | |
| Dimensions | 3.2 | All | Conventional measuring methods |
| Bearing Surface Perpendicularity | 3.2.1.1 | All | Appendix A |
| Geometric Tolerances | 3.2.1.2 | All | Conventional measuring methods |
| Surface Texture | 3.2.2 | All | Per ASME B46.1 |
| Thread Size | 3.2.3 | All | Inspection per AS8879 |
| Construction | 3.2.4 | All | Visual examination |
| Product Marking | 3.4 | All | Visual examination |
| Quality | 3.9 | All | Visual examination |
| Fluorescent Penetrant | 3.9.1 | All | Inspection per ASTM E 1417 |
| Destructive Tests /2/ | | | |
| Material | 3.1 | 3 | Certify composition |
| Plating | 3.5 | 5 | Per AMS 2411 |
| Hardness | 3.7.1 | 5 | NASM1312-6 |
| Microstructure | 3.8.1 | 5 | Microscopic exam. 100X |
| Grain Size | 3.8.2 | 5 | Microscopic exam. with chart in ASTM E 112 |
| Axial Tensile Strength | 3.10.1 | | |
| As Received | 3.10.1.1 | 4 | NASM1312-8 |
| After 800 °F Bake | 3.10.1.2 | 4 | NASM1312-8 |
| Wrench Torque | 3.10.2 | 3 | Appendix B |
| Permanent Set Test | 3.10.3 | 3 | Appendix C |
| Reusability Test | | | |
| As Received | 3.10.5 | 10 | Appendix E |
| After 800 °F Bake | 3.10.4 | 10 | Appendix D |

NOTES:

/1/ Sample size includes all samples for destructive tests.
/2/ Total number of samples for destructive tests equals 80; all samples shall be subjected to the non-destructive tests prior to being subjected to the destructive tests. The same test sample may be used for more than one test provided that none of the characteristics of the samples are altered during the test procedure.

TABLE 6 - Classification of Visual and Dimensional Characteristics

| Class | Characteristic |
|---|---|
| Major A | |
| 101 | Presence of locking element |
| 102 | Surface discontinuities revealed by fluorescent penetrant inspection |
| Major B | |
| 201 | Thread size |
| 202 | Perpendicularity of bearing surface |
| 203 | Plating |
| 204 | Product marking |
| 205 | Surface texture |
| 206 | 3-cycle test |
| Minor A | |
| 301 | Wrenching size & configuration |
| 302 | Nut height |
| 303 | Bearing surface diameter |
| 304 | Burrs and sharp corners |
| 305 | Depth of counterbore |
| 306 | Flange thickness |
| Minor B | |
| 401 | Runout of wrenching form to thread |
| 402 | Runout of flange OD to thread |
| 403 | Countersink on thread end |
| 404 | Other dimensional characteristics |

NOTE: The characteristic and its class determines the size of the sample to be selected from Table 7.

TABLE 7 - Sampling Data

Non-destructive Tests - Visual and Dimensional Characteristics
for Classes Major A, Major B, Minor A, and Minor B

| Production Inspection Lot Size | Major A Sample Size | Major B Sample Size | Minor A Sample Size | Minor B Sample Size |
|---|---|---|---|---|
| 2 to 8 | All | All | 5 | 3 |
| 9 to 15 | All | 13 | 5 | 3 |
| 16 to 25 | All | 13 | 5 | 3 |
| 26 to 50 | 32 | 13 | 5 | 5 |
| 51 to 90 | 32 | 13 | 7 | 6 |
| 91 to 150 | 32 | 13 | 11 | 7 |
| 151 to 280 | 32 | 20 | 13 | 10 |
| 281 to 500 | 48 | 29 | 16 | 11 |
| 501 to 1200 | 73 | 34 | 19 | 15 |
| 1201 to 3200 | 73 | 42 | 23 | 18 |
| 3201 to 10,000 | 86 | 50 | 29 | 22 |
| 10,001 to 35,000 | 108 | 60 | 35 | 29 |
| 35,001 to 150,000 | 123 | 74 | 40 | 29 |
| 150,001 to 500,000 | 156 | 80 | 40 | 29 |
| 500,001 & over | 189 | 102 | 40 | 29 |

The acceptance number of non-conforming units is ZERO in all cases.
For classification of characteristics, see Table 6.

TABLE 8 - Sampling Data - Destructive Tests
Mechanical and Metallurgical Characteristics

| Production Inspection Lot Size | Sample Size |
|---|---|
| Up to 500 | 3 |
| 501 to 3200 | 5 |
| 3201 to 35,000 | 8 |
| 35,001 & over | 13 |
| The acceptance number of non-conforming units is ZERO in all cases. | |



PREPARED UNDER THE JURISDICTION OF
SAE COMMITTEE E-25, GENERAL STANDARDS FOR
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# APPENDIX A
# MEASUREMENT OF PERPENDICULARITY VARIATION OF THE BEARING SURFACE

## A.1 SCOPE:

This appendix is a mandatory part of this specification.

### A.1.1 Purpose of Test:

To measure the variation from perpendicularity of the nut bearing surface within dimension "A" (see Figure A1) relative to the thread. This inspection is applicable to all nuts.

### A.1.2 Floating Nuts:

This measurement applies only to the nut element of floating nuts, when the retaining plate or channel has been removed.

## A.2 APPLICABLE DOCUMENTS:

AS8879 Screw Threads, UNJ Profile, INCH
ANSI B4.1 Preferred Limits and Fits for Cylindrical Parts

## A.3 APPARATUS:

### A.3.1 Particulars:

The test fixture is illustrated in Figure A2 and includes the following elements:

a. A threaded mandrel with a threaded end in accordance with AS8879, except the pitch diameter which is modified in accordance with the dimensions specified in Appendix E, Table E1, for the maximum mandrel.

b. A collar sliding on the plain portion of the threaded mandrel whose external diameter B is at least equal to the nut bearing diameter A, see Figure A2.

c. An appropriate feeler gage.

## A.4 PROCEDURE:

A.4.1 The perpendicularity of the bearing surface relative to the thread shall be measured within the basic area "A" as defined in Figure A1.

A.4.2 Nuts may be checked for perpendicularity before or after forming the self-locking feature.

A.4.3 The maximum threaded mandrel is manually assembled into the nut a minimum of three turns if checked before forming the locking feature, or until the end of the mandrel is through the locking feature if checked after forming. The variation from perpendicularity is evaluated with a feeler gage of the required thickness.

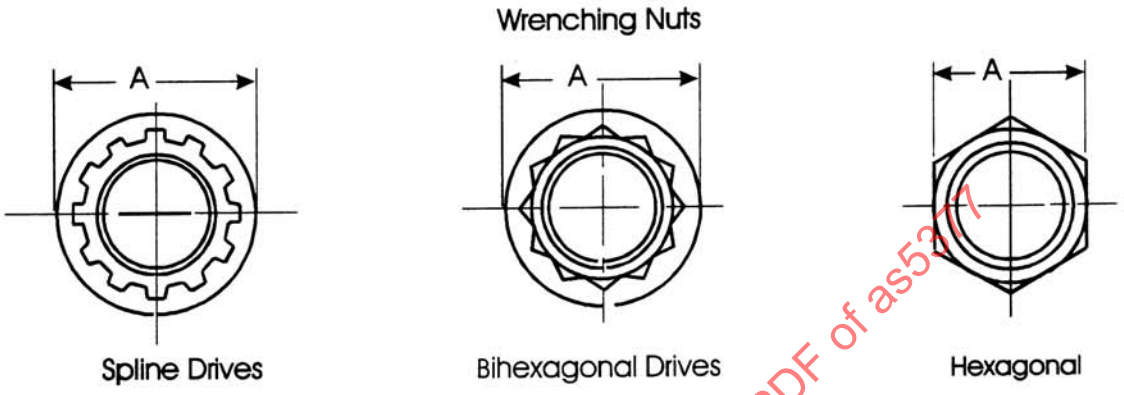
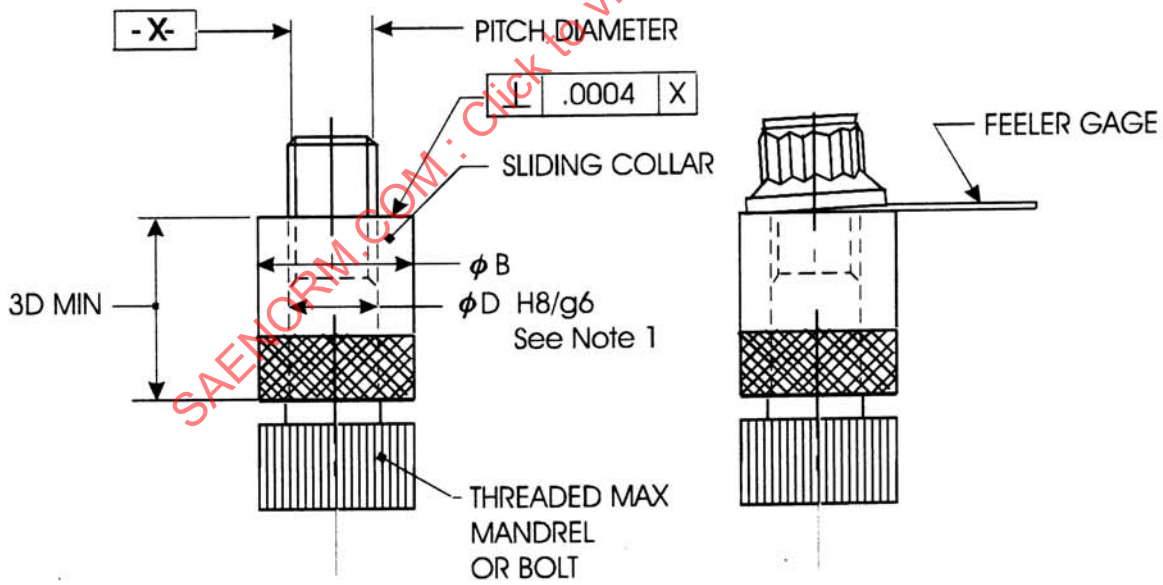



FIGURE A1 - Bearing Surface Area "A" Under Perpendicularity Control for Various Types of Nuts




D = NOMINAL THREAD DIAMETER
Note 1 - Per ANSI B4.1.

FIGURE A2 - Test Fixture

# APPENDIX B
# WRENCH TORQUE TEST

## B.1 SCOPE:

This appendix is a mandatory part of this specification.

### B.1.1 Purpose of Test:

To test that the wrenching configuration is capable of withstanding the high unseating torques encountered with nuts in hot areas of aerospace propulsion systems.

### B.1.2 Nut Types to be Tested:

This test is applied to externally wrenched nuts of spline, double hexagon, and hexagon wrenching configuration.

## B.2 APPLICABLE DOCUMENTS:

| | |
|---|---|
| AS954 | Wrenches, Hand, Twelve Points, High Strength, Thin Wall |
| AS5443 | Wrenching Element, Spline Drive - Dimensions for |
| AS8879 | Screw Threads, UNJ Profile, INCH |
| MS33787 | Wrenching Element, External Spline, Dimensions for |
| ASME B1.1 | Unified Inch Screw Threads (UN and UNR Thread Forms) |

## B.3 APPARATUS:

### B.3.1 Typical Apparatus:

The typical test apparatus is shown in Figure B1 comprises the following:

a. Stud with threads conforming to AS8879 or ASME B1.1, tolerance Class 3A.

b. Two wrenches conforming to AS954; double hexagon sockets for hexagon and double hexagon wrenching configuration nuts.

c. Two wrenches conforming to AS5443 or MS33787 spline sockets for spline drive wrenching configuration nuts.

d. Square drive adapter for socket wrenches.

B.3.1 (Continued):

NOTE: Any other test fixture preventing the rotation of the nut being tested and allowing the application of required torque is acceptable. For instance:

- Nut welded to a block of the same material, the assembly being heat treated to the correct level;

- Nuts mounted on a bolt with a strength which will permit the required torques to be applied when a spacer is placed between the nut and the bolt head.

B.4 PROCEDURE:

B.4.1 Method Using Stud and Wrenches:

B.4.1.1 Place adapter in a vise. For hexagon nuts, bottom hexagon nut is gripped in vise.

B.4.1.2 Locate first wrench socket on adapter using AS954 sockets for hexagon and double hexagon wrenching configuration nuts, and AS5443 or MS33787 sockets for spline drive wrenching configuration nuts.

B.4.1.3 Assemble nuts to be tested onto stud until bearing surfaces contact at mid-length of stud. Ensure stud engages full length of nut thread but protrusion must not prevent full location of nut wrenching configuration into wrench socket.

B.4.1.4 Locate assembly into first wrench.

B.4.1.5 Engage second wrench onto upper nut and test to the requirement of this specification.

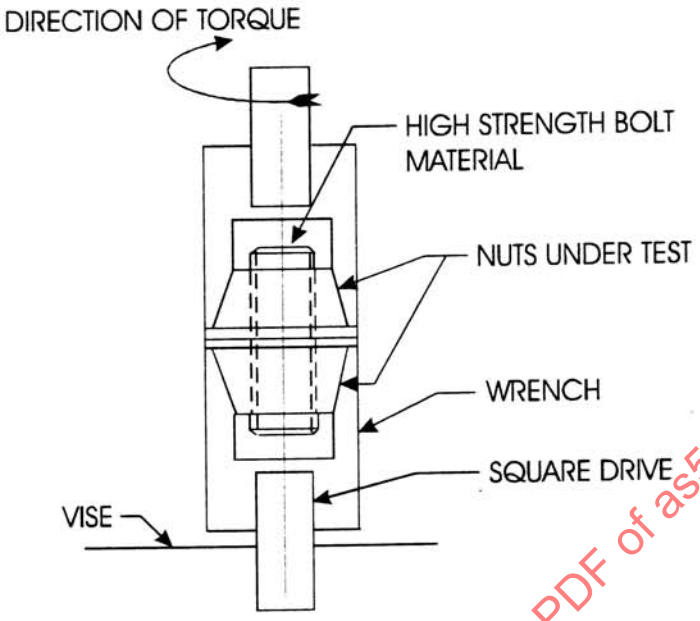



FIGURE B1 - Wrench Torque Test Apparatus

# APPENDIX C
# PERMANENT SET TEST

## C.1 SCOPE:

This appendix is a mandatory part of this specification.

### C.1.1 Purpose of Test:

This test is applicable to self-locking nuts and is to verify the ability of the nut locking feature to perform within the locking torques of this specification when assembled on a minimum threaded mandrel (or bolt) after having first been assembled onto a maximum threaded mandrel (or bolt).

## C.2 APPLICABLE DOCUMENTS:

| | |
|---|---|
| AS7466 | Bolts and Screws, Nickel Alloy, UNS N07718 Tensile Strength 185 ksi Fatigue Rated, Procurement Specification |
| AS7467 | Bolts and Screws, Nickel Alloy, UNS N07718 Tensile Strength 185 ksi Stress Rupture Rated, Procurement Specification |
| AS8879 | Screw Threads, UNJ Profile, INCH |
| ASME B46.1 | Surface Texture (Surface Roughness, Waviness, and Lay) |

## C.3 APPARATUS:

### C.3.1 Test Mandrels (or Bolts):

The apparatus (Figure C1) comprises the following:

a. Maximum mandrel or bolt; see Table C1 for pitch diameter dimensions.
b. Minimum mandrel or bolt; see Table C1 for pitch diameter dimensions.

NOTE: Bolts may be used in lieu of mandrels provided the pitch diameter tolerance meets the requirements in Table C1.

## C.4 PROCEDURE:

C.4.1 Lubricate the maximum mandrel or bolt (Figure C1) and nut in accordance with this specification.

C.4.2 Assemble nut onto the maximum mandrel or bolt until a minimum of three full thread turns protrude through the top of nut. Record the maximum prevailing torque achieved at any time during this assembly.

C.4.3 Remove the nut from the maximum mandrel or bolt.

C.4.4 Lubricate the minimum mandrel or bolt (Figure C1) and nut in accordance with this specification.