AEROSPACE STANDARD

AS5878™ REV. B

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Superseding AS5878A

Nut, Self-Locking, Nickel Alloy, UNS N07001, 1400 °F, 180000 psi, UNJ Thread Procurement Specification

RATIONALE

Correct paragraph 3.1 material to change from A286 (AMS5525) to alloy per AMS5544.

1. SCOPE

1.1 Type

This specification establishes the requirements for the following types of self-locking nuts in thread diameter sizes 0.1380 through 0.6250 inch:

a. Wrenching Nuts: i.e., hexagon, double hexagon, and spline nuts.

b. Anchor Nuts: i.e., plate nuts, gang channel nuts, and shank nuts.

The wrenching nuts, shank nuts, and nut elements of plate and gang channel nuts are made of a corrosion- and heat-resistant nickel-base alloy of the type identified under the Unified Numbering System as UNS N07001 and of 180000 psi axial tensile strength at room temperature, with maximum conditioning of parts at 1400 °F prior to room temperature testing.

1.2 Application

Primarily for use in aerospace propulsion systems up to approximately 1400 °F for tension height nuts made from bar, forging, or sheet. Nuts are designed for use with bolts capable of developing 180000 psi tensile strength at room temperature and having UNJ profile threads.

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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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 +1 724-776-4970 (outside USA), www.sae.org.

AMS5544 Nickel Alloy, Corrosion and Heat-Resistant, Sheet, Strip, and Plate, 57Ni - 19.5Cr - 13.5Co - 4.2Mo - 3.0Ti - 1.4Al - 0.05Zr - 0.006B, Consumable Electrode or Vacuum Induction Melted, Annealed

AMS5708 Nickel Alloy, Corrosion- and Heat-Resistant, Bars, Wire, Forgings, Rings, Forging, Flash-Welded Rings and Heading Stock, 58Ni - 19.5Cr - 13.5Co - 4.3Mo - 3.0Ti - 1.4Al - 0.05Zr - 0.006B (Waspaloy), Consumable Electrode or Vacuum Induction Melted, 1975 °F (1079 °C) Solution Heat Treated

AMS5709 Nickel Alloy, Corrosion and Heat-Resistant, Bars and Forgings, 58Ni - 19.5Cr - 13.5Co - 4.3Mo - 3.0Ti - 1.4Al - 0.05Zr - 0.006B, Consumable Electrode or Vacuum Induction Melted, 1975 °F (1079 °C) Solution, Stabilization, and Precipitation Heat Treated

AS870 Wrenching Configuration, Bi-Hexagonal (12 Point) Drive, Design Standard For

AS954 Wrenches, Hand, Twelve Point, High Strength, Thin Wall

AS1310 Fastener Torque for Threaded Applications, Definitions Of

AS1701 Lubricant, Solid Film

AS5447 Acceptance Criteria for Nuts - Magnetic Particle, Fluorescent Penetrant, and Visible Penetrant Examination

AS7471 Bolts and Screws, Nickel Alloy, UNS N07001, Tensile Strength 165 ksi, Corrosion- and Heat-Resistant Procurement Specification

AS8879 Screw Threads - UNJ Profile, Inch, Controlled Radius Root with Increased Minor Diameter

2.1.2 U.S. Government Publications

Copies of these documents are available online at https://quicksearch.dla.mil.

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

2.1.3 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM D3951 Commercial Packaging

ASTM E140 Standard Hardness Conversion Tables for Metals

ASTM E1417 Liquid Penetrant Examination

2.1.4 ASME Publications

Available from ASME, P.O. Box 2900, 22 Law Drive, Fairfield, NJ 07007-2900, Tel: 800-843-2763 (U.S./Canada), 001-800-843-2763 (Mexico), 973-882-1170 (outside North America), www.asme.org.

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

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.

NAS3353 Fixture - Bearing Surface Squareness Test Self-Locking Nuts

NASM1312-6 Fastener Test Methods, Method 6, Hardness

NASM1312-7 Fastener Test Methods, Method 7, Vibration

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.

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

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

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

PRODUCTION INSPECTION LOT: Shall be all furnished 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

°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
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, nickel-based alloy, AMS5708, AMS5709, or as specified on the part drawing for wrenching nuts, shank nuts, and nut elements for plate and gang channel nuts. When specified on the part drawing, wrenching nuts, shank nuts, and nut elements for plate and gang channel nuts may be formed from AMS5544 sheet. Material for the retaining plate for plate nuts and channel for gang channel nuts shall be capable of meeting the requirements of this specification and shall be 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, shall conform to the part drawing. Dimensions apply before coating with dry 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 coating, shall conform to the requirements as 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 the nut shall be countersunk as specified on the part drawing.

3.2.3.2 Coated Threads

Threads in coated 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 that provides self-locking nuts meeting the locking torque requirements of this specification. The coated nut shall allow the GO thread plug gauge to enter a minimum of three turns before engagement of the locking element for tension nuts having overall length of threaded portion not less than 1.2X the nominal thread diameter; nuts having shorter threaded portion shall allow the GO thread plug gauge 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 formed and machined nuts shall be solution, stabilization, and precipitation heat treated in accordance with the heat-treating procedure specified in the material specification, except that the time for stabilization heat treatment may be extended up to 24 hours.

3.4 Product Marking

Each part shall be identification marked as specified on the part drawing. Depressed characters shall have a rounded root form with a depth of 0.010 inch maximum.

3.5 Coating

Nuts shall be coated with dry film lubrication in accordance with AS1701, Class IV, unless otherwise specified on the part drawing. On nuts with nominal thread sizes 0.2500 inch and larger, the coating thickness shall be not less than 0.0002 inch when measured on the thread pitch diameter and bearing surface. Microscopic measurement on a sectioned nut shall be used as a referee method. Nuts with thread sizes smaller than 0.2500 inch shall show complete coating coverage on the threads and bearing surface. Coating on other surfaces shall be optional and may be incomplete.

3.6 Mechanical Properties

3.6.1 Hardness

Unless otherwise specified on the part drawing, the core hardness after heat treatment as in 3.3 shall be no greater than 44 HRC (see 8.1), determined in accordance with NASM1312-6. The minimum limit is controlled by the axial tensile strength requirement in 3.9.1.

3.7 Metallurgical Properties

3.7.1 Microstructure

Wrenching nuts and nut elements of anchor nuts shall have microstructure of completely recrystallized material, except for cold-working effects of tapping and forming operation of locking feature.

3.8 Quality

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

3.8.1 Fluorescent Penetrant Inspection

Parts shall be subject to fluorescent penetrant inspection, prior to coating or with coating removed, in accordance with ASTM E1417, Type 1, Sensitivity Level 2. Acceptance criteria of surface discontinuities shall be in accordance with AS5447.

3.9 Product Performance Test

See Tables 7 and 8 for details of sample sizes for Acceptance Test Plan and Qualification Approval Test Plan.

3.9.1 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:

3.9.1.1 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 AS8879, shall withstand the axial tensile load specified in Table 1 applied at room temperature at the rate specified in Note (2).

3.9.1.2 After Bake, at Room Temperature

Prior to testing, the nut shall be assembled on a bolt as specified in 3.10 with at least two thread turns protruding through the nut and baked for 6 hours ± 0.25 hour at 1400 °F ± 15 °F and then cooled to room temperature. A new test bolt shall be used for each axial tensile test. Nuts, after baking, tested in accordance with NASM1312-8, using alloy steel bolts hardened and tempered to 40 HRC minimum and having threads in accordance with AS8879, shall withstand the axial tensile load in Table 1 applied at room temperature at the rate specified in Note (2).

Table 1 - Axial tensile load

Nut Thread Size	Axial Tensile Load at Room Temp lbf minimum(1)
0.1380-32 UNJC-3B	1960
0.1380-40 UNJF-3B	2100
0.1640-32 UNJC-3B	2920
0.1640-36 UNJF-3B	3010
0.1900-32 UNJF-3B	4070
0.2500-28 UNJF-3B	7270
0.3125-24 UNJF-3B	11520
0.3750-24 UNJF-3B	17120
0.4375-20 UNJF-3B	23190
0.5000-20 UNJF-3B	30900
0.5625-18 UNJF-3B	39180
0.6250-18 UNJF-3B	49030

(1) Requirements above apply to companion bolts with UNJ threads to Class 3A tolerance. Area upon which stress for axial strength load requirements is based on the UNJ basic pitch diameter (max PD) at 0.375H thread depth and calculated from Equation 1:

$$A = 0.7854[d - (0.750\,H)]^2 = 0.7854[d - (.6495/n)]^2 = 0.7854[d - (6495p)]^2 \quad \text{(Eq. 1)}$$

where:

A = Area at the UNJ basic pitch diameter at 0.375H thread depth, in^2
d = Maximum major diameter, inch
H = Height of the sharp V-thread = (cos 30) / n, inch
n = Number of threads per inch
p = Pitch (1 / n), inch

Load requirements for axial strength load is based on 180000 psi stress induced on area A. Axial tensile load is calculated from Equation 2:

$$Axial\ Tensile\ Load = 180000 \times A, for\ in\ lbf \quad \text{(Eq. 2)}$$

For sizes not shown, axial tensile strength load for nuts shall be based upon the respective bolt stress area using Equations 1 and 2 and 180000 psi stress.

(2)

$$Maximum\ Load, lbf/minute = 78000 \times D^2 \quad \text{(Eq. 3)}$$

where:

D = nominal major diameter of thread

3.9.1.3 Shank Nuts

Nuts with shanks designed to be flared at assembly (see Figure 1) shall be tested as in 3.9.1 except that the bearing plate hole shall be 0.004 to 0.008 inch greater than the maximum 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.

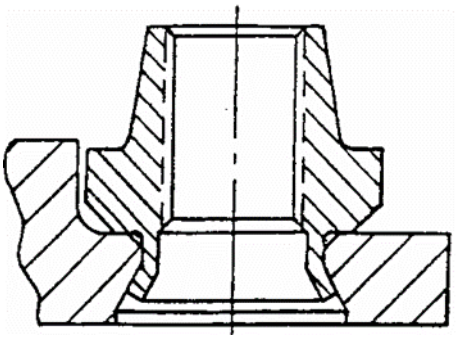

Figure 1 - Flange assembly, flared shank nut

3.9.2 Wrench Torque

Wrenching nuts with hexagon or double hexagon wrenching feature conforming to AS870 shall be tested as specified in Appendix B and shall withstand the wrench torques specified in Table 2 applied through 15 engagement cycles without any permanent deformation, which can interfere with the use of socket wrenches conforming to AS954.

Table 2 - Wrench torque

Nominal Dimension Across Flats Inches	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

3.9.3 Push Out Load

Anchor nuts shall be tested as specified in Appendix C and shall withstand the push out load specified in Table 3 without separating from the plate or channel. Nuts shall be serviceable after this test.

Table 3 - Push out load

Nominal Thread Diameter Inches	Push Out Load Minimum lbf
0.1380	60
0.1640	80
0.1900	100
0.2500	125
0.3125	125
0.3750	125
0.4375	125
0.5000	125
0.5625	125
0.6250	125

3.9.3.1 The push out test in 3.9.3 is applicable to gang channel nuts and plate nuts (floating and non-floating except side by side, corner, and side-mounted types). See Appendix A for definition of types.

3.9.4 Torque Out

Anchor nuts of the types in 3.9.3.1 shall be tested as specified in Appendix D and shall withstand the torque out loads in Table 4 without cracking, rupture, or being deformed to a degree that will prevent normal use. This test shall be performed with no axial load on the bearing surface of the nut retainer plate or channel.

Table 4 - Torque out load

Nominal Thread Diameter Inches	Torque Out Load Minimum lbf-in
0.1380	30
0.1640	45
0.1900	60
0.2500	100
0.3125	160
0.3750	240
0.4375	350
0.5000	450
0.5625	600
0.6250	900

3.9.5 Permanent Set

Nuts shall be tested as specified in Appendix E and shall not exceed the maximum permissible prevailing torque or be less than the minimum breakaway torque values specified in Table 5. The bolt or stud shall protrude through the nut a minimum of three full thread turns.

3.9.6 Reusability Test at Room Temperature After Baking

Nuts shall be tested for three consecutive cycles as specified in Appendix F, loading initially to 85000 psi in accordance with 3.9.6.3. The assembly shall be heated in a furnace to 1400 °F ± 15 °F and held at heat for 6 hours ± 0.25 hour, removed from the furnace, and cooled to room temperature.

3.9.6.1 Wrenching and Reference Recording

Wrenchable nuts shall be wrenched by turning the nut relative to the fixture. The wrenchability of the tested nuts shall permit assembly of standard wrench. For reference information, the installation and unseating torques shall be recorded for each heat cycle.

3.9.6.2 Locking Feature Torque Requirements

Nuts tested as in 3.9.6 shall conform to the minimum breakaway torque in Table 5, Column (1), for each cycle. The prevailing torque shall be measured on installation and removal, and shall not exceed the torque in Table 5, Column (4), nor shall be less than the breakaway torque in Table 5, Column (1).

3.9.6.3 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 85000 psi axial tensile stress in the bolted assembly is based on a modulus of elasticity of 31000000 psi and Equations 4 and 5:

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

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

where:

e = unit strain of bolt loaded shank, inch/inch

s = 85000 psi bolt stress at area of maximum minor (root) diameter

E = 31000000 psi modulus of elasticity

L = bushing length (see Appendix F) in loaded nut-bolt assembly

The elongation of bolts for nut sizes not listed herein shall be 0.002742L, where L = bushing length as in Appendix F.

3.9.7 Reusability Test at Room Temperature, As Received Condition

Nuts shall be tested for five cycles as specified in Appendix G, loading to installation torque specified in Table 5, Column (5). Wrenchable nuts shall be turned relative to the fixture. For non-wrenchable nuts, the bolt head shall be turned. Locking feature torque shall conform to the minimum breakaway torque and maximum prevailing torque in Table 5, Columns (1) and (3), respectively, for each cycle. The prevailing torque shall be measured on installation and removal and shall not exceed the torque in Table 5, Column (3), nor shall be less than the breakaway torque in Table 5, 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 of a new nut freely, with the fingers, up to the self-locking feature.

3.9.8 Single-Cycle Test at Room Temperature

Nuts shall be tested as specified in Appendix H, loading to assembly torque specified in Table 5, Column (5). Wrenchable nuts shall be turned relative to the fixture. For non-wrenchable nuts, the bolt head shall be turned. Nuts shall conform to the minimum breakaway torque in Table 5, Column (2). The prevailing torque shall be measured on installation and removal and shall not exceed the torque in Table 5, Column (3), nor be less than the breakaway torque in Table 5, Column (2).

Table 5 - Locking feature torque and assembly torque

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)
0.1380-32	1	2	7	14	15
0.1380-40	1	2	7	14	16
0.1640-32	1.5	3	11	22	25
0.1640-36	1.5	3	11	22	26
0.1900-32	2	4	15	30	42
0.2500-28	3.5	7	30	60	95
0.3125-24	6.5	13	60	120	185
0.3750-24	9.5	19	80	160	330
0.4375-20	14	28	100	200	530
0.5000-20	18	36	150	300	800
0.5625-18	24	48	200	400	1150
0.6250-18	32	64	300	600	1580

(1) Minimum breakaway torque for 5-cycle, room temperature, as received test; 3-cycle, loaded and conditioned test; permanent set test.

(2) Minimum breakaway torque for single-cycle, loaded, room temperature test.

(3) Maximum prevailing torque for 5-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 3-cycle, loaded, and conditioned test.

(5) Assembly torque for 5-cycle, loaded, room temperature test and single-cycle, loaded, room temperature test.

3.9.9 Accelerated Vibration Test

Nuts shall be tested in accordance with NASM1312-7 and shall be loaded to assembly torques specified in Table 6. The loaded nut assembly shall withstand 30000 cycles continuous vibration at 30 cycles per second and an amplitude (total travel) of 0.435 to 0.465 inch without relative rotation exceeding 360 degrees, without cracking of the nut, and without being capable of turning nut by hand. Nut sizes to be tested shall be as shown in Table 6; testing of other nuts sizes shall be as agreed upon by the purchaser and vendor.

3.9.9.1 At Room Temperature, As Received Condition

Nut shall be loaded as specified in 3.9.9 on spacer then removed and reinstalled four additional times on the same bolt to the assembly torques in Table 6. The final assembly shall be with the block ready for the vibration test. The loaded nut assembly shall then be vibrated at room temperature in accordance with 3.9.9 requirements, and nuts shall conform to the requirements of 3.9.9 after the vibration test.

3.9.9.2 At Room Temperature After Baking

Nuts shall be loaded as specified in 3.9.9 on spacer as specified in Appendix F, and the loaded nut assembly shall be heated in a furnace to 1400 °F ± 15 °F, held at heat for 6 hours ± 0.25 hour, and cooled to room temperature. Nut shall then be removed from the assembly and reinstalled two additional times on the same bolt to the assembly torques in Table 6. The final assembly shall be on the test fixture in the block ready for the vibration test. The loaded nut assembly shall then be vibrated at room temperature in accordance with 3.9.9 requirements, and nuts shall conform to the requirements of 3.9.9 after the vibration test.

3.9.10 Flareability

Unless otherwise specified on the part drawing, the shank of shank nuts shall be capable of being flared with a 60-degree included angle conical tool to a diameter equal to 120% of the maximum shank diameter without cracking.

Table 6 - Assembly torque for accelerated vibration test

Nominal Thread Size	Assembly Torque lbf-in
0.1640-32	22
0.1640-36	22
0.1900-32	30
0.2500-28	60
0.3125-24	120
0.3750-24	160
0.4375-20	200
0.5000-20	300
0.5625-18	400
0.6250-18	600

3.10 Test Bolts

Except as specified in 3.9.1, 3.9.2, 3.9.3, and 3.9.4, test bolts shall be unplated and conform to AS7471 with threads in accordance with AS8879.

3.11 Test Lubrication

Stud-mandrel or bolt threads and nut bearing surface, and for non-wrenchable nut tests, the bolt bearing surface shall be lubricated with aircraft engine oil MIL-PRF-7808 or equivalent before each installation and removal 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. The 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 7.

4.2.2 Qualification Tests

Tests to determine conformance to all technical requirements of this specification and part drawing are listed in Table 8.

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 shall be as specified in Table 10. The classification of defects for nuts will be as specified in Table 9. Defects not classified in Table 9 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 11. 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 8.

Table 7 - Summary of acceptance tests

Characteristic	Req Para	Sample Size	Test Method
Nondestructive Tests			
Dimensions	3.2.1	Tables 9 & 10	Conventional measuring methods
Bearing Surface Perpendicularity	3.2.1.1	Tables 9 & 10	Appendix A
Geometric tolerances	3.2.1.2	Tables 9 & 10	Conventional measuring methods
Surface Texture	3.2.2	Tables 9 & 10	Per ASME B46.1
Thread Size	3.2.3	Tables 9 & 10	Inspection per AS8879
Product Marking	3.4	Tables 9 & 10	Visual examination
Quality	3.8	Tables 9 & 10	Visual examination
Fluorescent Penetrant Inspection	3.8.1	Tables 9 & 10	Inspection per ASTM E1417 Criteria per AS5447
Packaging & Identification	5.1	100%	Visual examination
Destructive Tests			
Coating	3.5	Table 11	Per AS1701
Hardness	3.6.1	Table 11	NASM1312-6
Microstructure	3.7.1	Table 11	Microscopic examination 100X
Axial Tensile Strength as received condition	3.9.1.1	Table 11	NASM1312-8
Single-Cycle Test	3.9.8	Table 11	Appendix H
Flareability	3.9.10	Table 11	Conventional flaring tool

Table 8 - Summary of qualification tests

Characteristic	Req Para	Sample Size	Test Method
Destructive tests[1]			
Material	3.1	3	Certify composition
Coating	3.5	5	Per AS1701
Hardness	3.6.1	5	NASM1312-6
Microstructure	3.7.1	5	Microscopic examination 100X
Axial Tensile Strength	3.9.1		
As Received	3.9.1.1	4	NASM1312-8
After 1400 °F Bake	3.9.1.2	4	NASM1312-8
Wrench Torque	3.9.2	3	Appendix B
Push Out Load	3.9.3	5	Appendix C
Torque Out	3.9.4	5	Appendix D
Permanent Set Test	3.9.5	3	Appendix E
Reusability Test			
After 1400 °F Bake	3.9.6	10	Appendix F
As Received	3.9.7	10	Appendix G
Accelerated Vibration Test	3.9.9		
As Received	3.9.9.1	5	NASM1312-7
After 1400 °F Bake	3.9.9.2	5	NASM1312-7
Flareability	3.9.10	3	Conventional flaring tool
Nondestructive Tests[2]			
Dimensions	3.2.1	All	Conventional measuring method
Bearing Surface Squareness	3.2.1.1	All	Appendix A
Geometric Tolerances	3.2.1.2	All	Conventional measuring method
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	3.8	All	Visual examination
Fluorescent Penetrant	3.8.1	All	Inspection per ASTM E1417, criteria per AS5447

(1) Total number of samples for destructive tests equals 75; all samples shall be subjected to the nondestructive 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.

(2) Sample size includes all samples for destructive tests.

Table 9 - 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	Product marking
204	Shank diameter
205	Shank length
206	Rivet hole size
207	Rivet hole location
208	Surface texture
209	Single-cycle test
Minor A	
301	Wrenching size and configuration
302	Nut height
303	Bearing surface diameter
304	Float of nut element
305	Burrs and tool marks
306	Depth of counterbore
307	Flange thickness
Minor B	
401	Runout of wrenching form to thread
402	Runout of shank OD to thread
403	Runout of flange OD to thread
404	Countersink on thread end
404	Other characteristics not listed

Note: The characteristic and its class determine the size of the sample to be selected from Table 10.

Table 10 - Sampling data;
nondestructive 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 10000	86	50	29	22
10001 to 35000	188	60	35	29
35000 to 150000	123	74	40	29
150001 to 500000	156	90	40	29
500001 & over	189	102	40	29

Notes:
1. The acceptance number of defectives is ZERO in all cases.
2. For classification of characteristics, see Table 9.

Table 11 - Sampling data;
destructive tests;
mechanical and metallurgical characteristics

Production Inspection Lot	Sample Size
Up to 500	3
501 to 3200	5
3201 to 35000	8
35001 & over	13

Note: The acceptance number of defectives is ZERO in all cases.

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 qualification 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 conforms to the applicable material specification and showing the results of tests to determine conformance to the acceptance tests. This report shall include the purchase order number, production lot number, AS5878, 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 parts shall perform corrective action to screen out or rework the defective parts, resubmit for acceptance tests inspection as in Table 7, or scrap the entire lot. Resubmitted lots shall be clearly identified as reinspected lots.

5. PREPARATION FOR DELIVERY

5.1 Packaging and Identification

5.1.1 Packaging shall be in accordance with ASTM D3951.

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 NICKEL ALLOY, CORROSION AND HEAT RESISTANT
AS5878
PART NUMBER
LOT NUMBER
PURCHASE ORDER NUMBER
QUANTITY
MANUFACTURER'S IDENTIFICATION

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

6. ACKNOWLEDGMENT

A vendor shall mention AS5878 in all quotations and when acknowledging purchase orders.

7. REJECTIONS

Parts not conforming to this specification, or to modifications of this specification documented on part drawing/standard, will be subject to rejection.

8. NOTES

8.1 Hardness conversion tables for metals are presented in ASTM E140.

8.2 Revision Indicator

A change bar (I) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this document. An (R) symbol to the left of the document title indicates a complete revision of the document, including technical revisions. Change bars and (R) are not used in original publications, nor in documents that contain editorial changes only.

PREPARED BY SAE E-25 GENERAL STANDARDS FOR AEROSPACE AND PROPULSION SYSTEMS

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 “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 APPARATUS

A.2.1 Particulars

Particulars of the fixture are given in NAS3353; the bolts or studs shall be in accordance with the maximum material bolt or stud in Appendix E, Figure E1.

A.3 PROCEDURE

A.3.1 The perpendicularity of the bearing surface relative to the thread shall be measured within the basic area “A” as defined in Figure A1.

A.3.2 Nuts may be checked for perpendicularity before or after forming the self-locking feature.

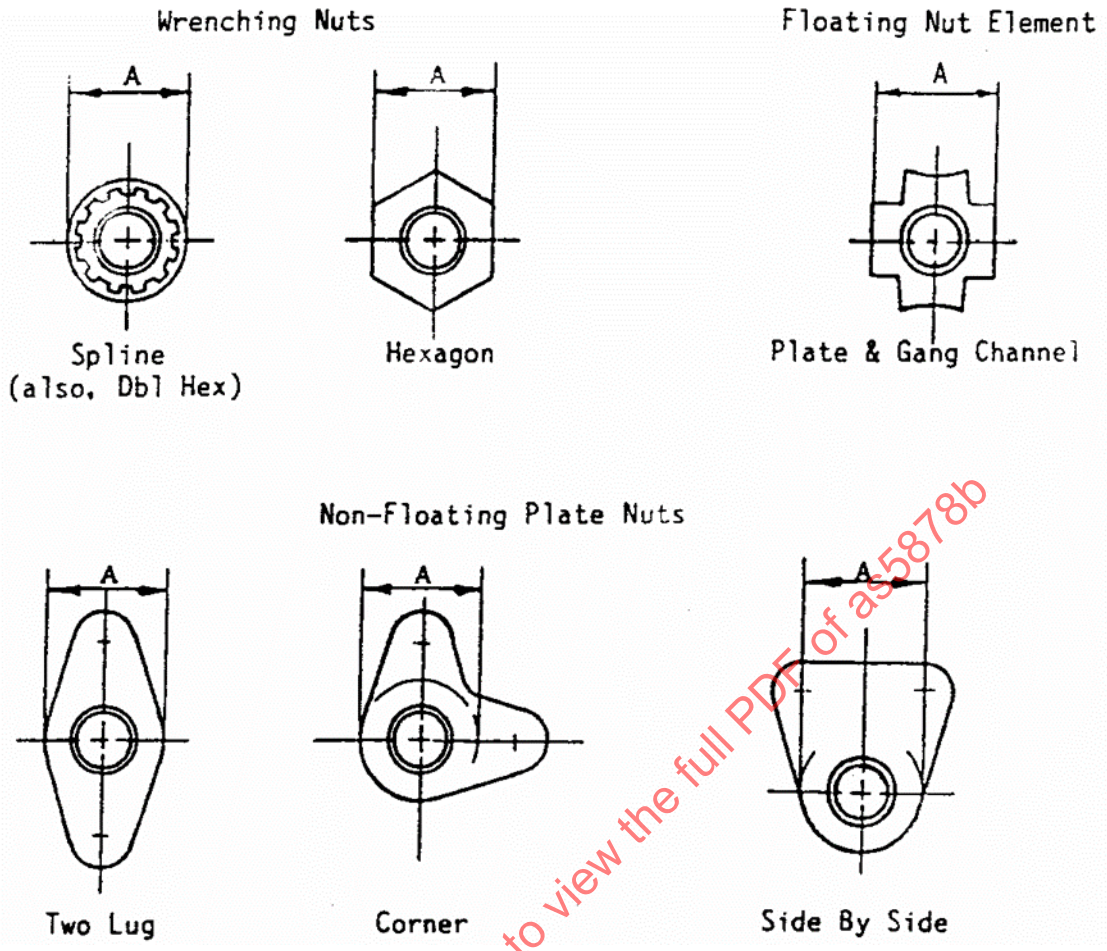

Figure A1 - Bearing surface area "A" under perpendicularity control for various types of nuts

A.3.3 The maximum threaded bolt or stud is manually assembled into the nut a minimum of three turns if checked before forming the locking feature, or until the end of the bolt or stud is through the locking feature if checked after forming. The variation from perpendicularity is evaluated with a shim of the required thickness.

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 APPARATUS

B.2.1 Typical Apparatus

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

a. Alloy steel stud with threads conforming to AS8879.

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

c. Square drive adapter for socket wrenches.

B.3 PROCEDURE

B.3.1 Method Using Stud and Wrenches

B.3.1.1 Place adapter in vise. For hexagon nuts, bottom hexagon nut is gripped in vise.

B.3.1.2 Locate first wrench socket on adapter.

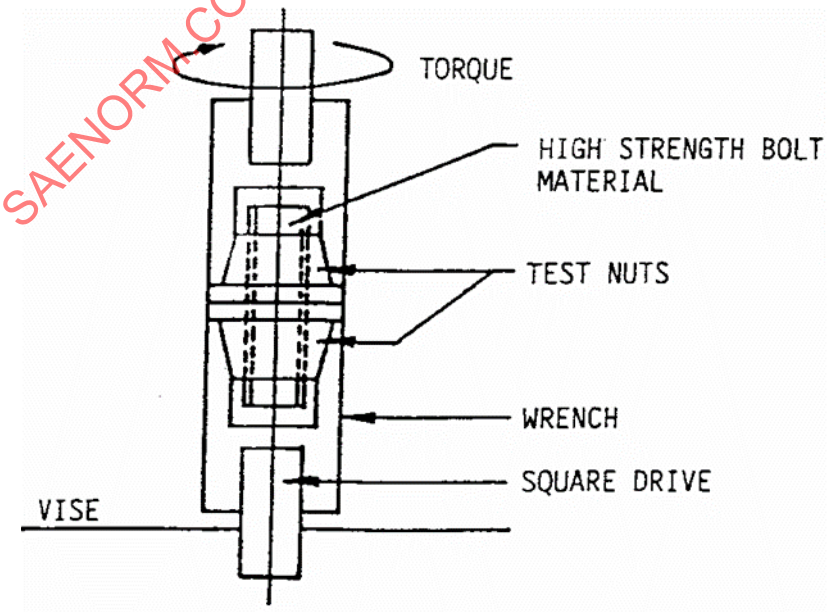

Figure B1 - Wrench torque test apparatus

B.3.1.3 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.3.1.4 Locate assembly into first wrench.

B.3.1.5 Engage second wrench onto upper nut and test to the requirement of this specification.

APPENDIX C - PUSH OUT TEST

C.1 SCOPE

This appendix is a mandatory part of this specification.

C.1.1 Purpose of Test

This test is to determine whether the nut retainer plate or channel is capable of withstanding the axial push out load specified in this specification after the nut is installed.

C.1.2 Types of Nuts to be Tested

This test is applicable to floating plate nuts and gang channel nuts. It is not applicable to non-floating plate nuts that are side by side mounting and also to floating angle plate nuts (see Figure C1).

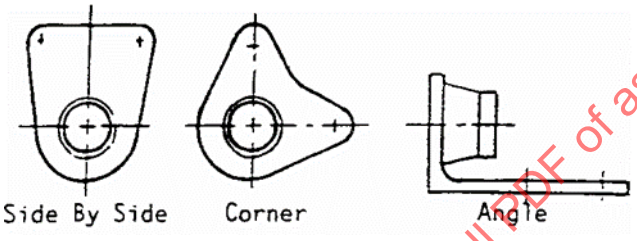

Figure C1 - Types of nuts not applicable to push out test

C.2 APPARATUS

C.2.1 Parts Contained

The test apparatus is shown in Figure C2 and comprises the following:

a. The retention plate.

b. Rivets or bolts to attach test nut to plate.

c. A push out mandrel with spherical end.

d. Alloy steel bolt with threads conforming to AS8879.

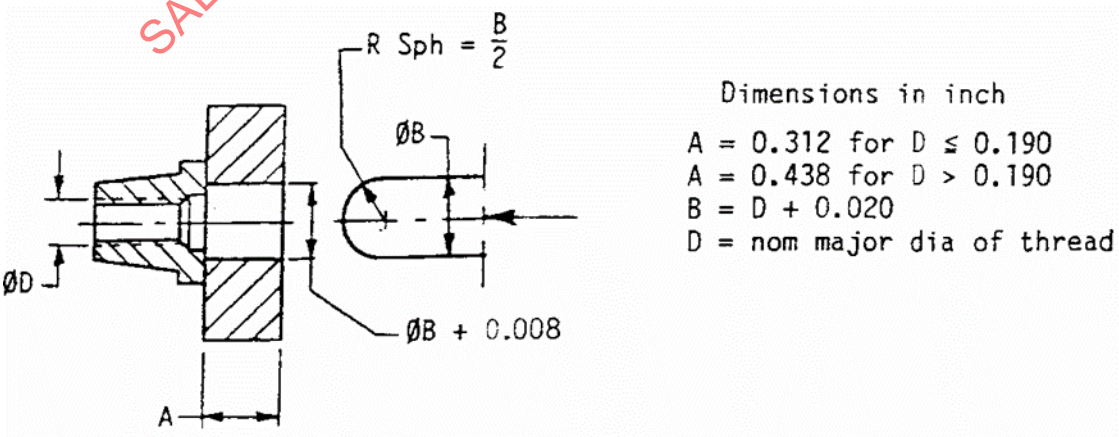

Figure C2 - Push out test apparatus

C.3 PROCEDURE

C.3.1 Attach the plate nut or section of gang channel to be tested to the plate by riveting or with bolts.

C.3.2 Apply the push out load given in this specification to the spherically ended bolt or stud as shown in Figure C2.

C.3.3 Install a standard bolt with the fingers up to the locking feature using no supporting pressure on the nut.

C.3.4 Remove bolt and detach nut from retention plate or channel.

C.3.5 Submit the nut for visual examination and, if necessary, to an examination at low magnification after sectioning.

APPENDIX D - TORQUE OUT TEST

D.1 SCOPE

This appendix is a mandatory part of this specification.

D.1.1 Purpose of Test

This test is to determine that the retention device is capable of holding the nut element against rotation when tightening or untightening the mating bolt.

D.1.2 Types of Nuts to be Tested

This test is applicable to the following types of nuts produced as multipiece nuts:

a. Floating plate nuts or gang channel nuts.

b. Fixed plate nuts that have the nut body assembled on a plate by brazing or swaging.

D.2 APPARATUS

D.2.1 Typical Apparatus

A typical test apparatus is shown in Figure D1 and comprises the following:

a. A retention plate.

b. Rivets or bolts to attach test nut to plate.

c. Alloy steel bolt with threads conforming to AS8879.

d. A hardened steel sleeve that bears the axial load against the base of nut element and bolt bearing surface, with no axial load on the retention plate during the test.

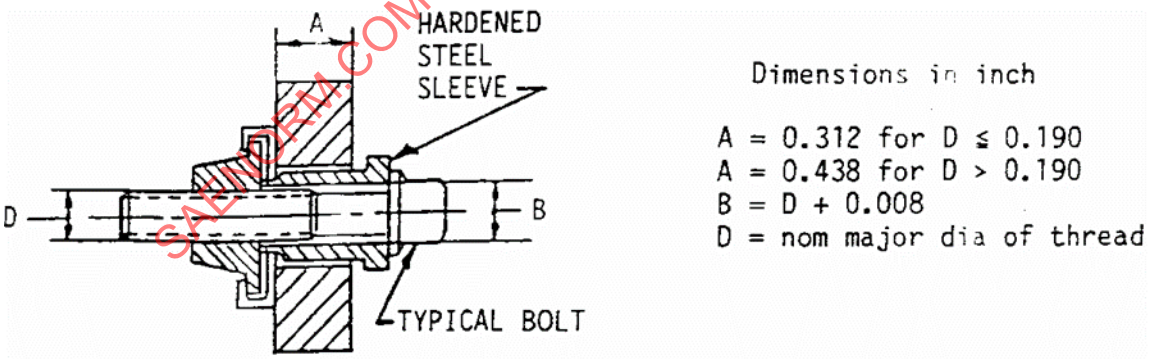

Figure D1 - Torque out test apparatus

D.3 PROCEDURE

D.3.1 Attach the nut or section of gang channel to be tested to the plate by riveting or with bolts.

D.3.2 Apply the torque-out torque given in this specification in a clockwise direction.

D.3.3 Remove the bolt and detach nut from retention plate or channel.

D.3.4 Submit the nut for visual examination and, if necessary, to an examination at low magnification after sectioning.

APPENDIX E - PERMANENT SET TEST

E.1 SCOPE

This appendix is a mandatory part of this specification.

E.1.1 Purpose of Test

This test is applicable to all self-locking nuts (wrenching nuts and anchor 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 bolt or stud after having first been assembled onto a maximum threaded bolt or stud.

E.2 APPARATUS

E.2.1 Test Bolts or Studs

The apparatus shown in Figures E1 and E2 comprises the following:

a. Maximum material bolt or stud conforming to Table E1 and Figure E1.

b. Minimum material bolt or stud conforming to Table E2 and Figure E2.

Table E1 - Maximum material bolt or stud thread dimensions

Nominal Thread Size	Pitch Dia Inches
0.1380-32	0.1167-0.1177
0.1380-40	0.1210-0.1218
0.1640-32	0.1427-0.1437
0.1640-36	0.1452-0.1460
0.1900-32	0.1687-0.1697
0.2500-28	0.2257-0.2268
0.3125-24	0.2843-0.2854
0.3750-24	0.3467-0.3479
0.4375-20	0.4038-0.4050
0.5000-20	0.4662-0.4675
0.5625-18	0.5250-0.5264
0.6250-18	0.5875-0.5889

Notes:
1. Maximum material bolt or stud.
2. Bolts or studs shall conform to AS7471 except threads may be formed by any method provided dimensional and surface finish requirements are met.
3. Surface roughness: Thread flanks to be 32 µin Ra in accordance with ASME B46.1
4. Threads: AS8879 except pitch diameter shall be as specified in Table E1.

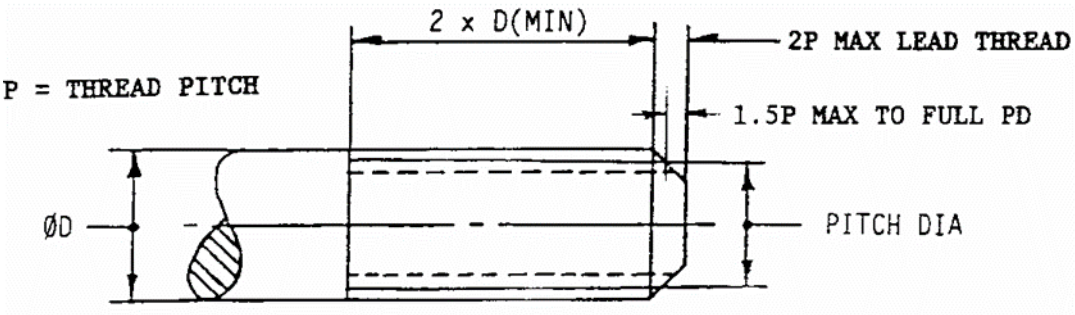

Figure E1 - Maximum material bolt or stud