

INCH-POUND

MIL-N-8922B
 14 SEPTEMBER 1994
 SUPERSEDING
 MIL-N-8922A
 23 MAY 1988

MILITARY SPECIFICATION

NUT, SELF-LOCKING, ALLOY STEEL, 220 ksi Ft_u, 450°F.
 GENERAL SPECIFICATION FOR

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the requirements for alloy steel nuts for use with MIL-B-8906 Bolts.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specification and standards. Unless otherwise specified, issues of referenced documents are those in effect at the time of solicitation. Information regarding the latest issue of government documents and adopted non-government documents can be obtained from the Department of Defense Index of Specification and Standards.

SPECIFICATIONS

FEDERAL

QQ-P-416 Plating, Cadmium (Electrodeposited)

MILITARY

| | |
|--------------|---|
| MIL-H-6875 | Heat Treatment of Steel (Aircraft Practice) Process for |
| MIL-C-8837 | Coating, Cadmium (Vacuum Deposited) |
| MIL-S-8879 | Screw Threads, Controlled Radius Root with Increased Minor Diameter, General Specification for |
| MIL-N-8922/1 | Nut, Self-locking, Assembled Washer, Alloy Steel, 220 Ksi, Ft _u 450°F, (12 - Spline Wrenching Element) |

Beneficial comments (recommendations, additions, deletions) any pertinent data which may be of use in improving this document should be addressed to: Defense Industrial Supply Center, DISC-EPP, 700 Robbins Avenue, Philadelphia, PA 19111-5096 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

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SPECIFICATIONS (continued)

| | |
|-------------|---|
| MIL-W-8982 | Wrenches, Splined, High Strength, Thin Wall, general Specification for |
| MIL-L-46010 | Lubricant, Solid Film, Heat Cured, Corrosion Inhibiting |
| MS14164 | Nut, Wheel, Self-locking, Flanged, Steel, 220 Ksi, Ft _u 450°, Spline Drive |
| MS21084 | Nut, Self-locking, Steel, 220 Ksi, Ft _u 450°, Flanged, MS33787 Wrenching element |
| MS33588 | Nut, Self-locking, Aircraft, Design and Usage |
| MS33787 | Wrenching Element, External Spline, Dimensions for |

STANDARDS

MILITARY

| | |
|-----------------|--|
| MIL-STD-129 | Marking for Shipment and Storage |
| MIL-STD-410 | Non-destructive Testing Personnel Qualification and Certification |
| MIL-STD-1312 | Fastener, Test Methods |
| MIL-STD-1312-6 | Fastener, Test Method, Hardness |
| MIL-STD-1312-7 | Fastener, Test Method, Vibration |
| MIL-STD-1312-8 | Fastener, Test Method, Tensile Strength |
| MIL-STD-1312-9 | Fastener, Test Method, Stress Corrosion |
| MIL-STD-1312-14 | Fastener, Test Method, Stress Durability Internal Threaded Fasteners |

(Copies of specifications, standards, handbooks, drawings, publications, and other Government documents required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

2.2 Other publications. Unless otherwise specified, issues of referenced documents are those in effect at the time of solicitation. Information regarding the latest issue of non-government documents not adopted by the government can be obtained from the organization responsible for their publication.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME/ANSI)

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

(Application for copies should be addressed to the American Society of Mechanical Engineers, 345 E. 47th Street, New York, NY 10017)

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SOCIETY of AUTOMOTIVE ENGINEERS (AEROSPACE MATERIAL SPECIFICATIONS)

AMS 6485 Steel Bars and Forgings
AMS 6487 Steel Bars and Forgings

(Copies of SAE publications may be obtained from the Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15068-0001.)

AMERICAN SOCIETY for TESTING and MATERIALS (ASTM)

ASTM E1444 Standard Practice for Magnetic Particle Examination
ASTM D3951 Standard Practice for Commercial Packaging

(Application for copies should be addressed to the American Society for Testing and Materials 1916 Race St. Philadelphia, Pa. 19103.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein (except for associated detail specifications, specification sheets or MS standards), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheet or standard. In the event of any conflict between the requirements of this specification and the specification sheet, the latter shall govern.

3.2 Qualification. The nut furnished under this specification shall be products which are authorized by the qualifying activity for listing on the applicable Qualified Products List at the time of contract award. (see 4.3 and 6.3).

3.3 Retention of qualification. To maintain status on a Qualified Products List, certification shall be submitted at two year intervals to indicate continued compliance with the requirements of this specification (see 4.3.4)

3.4 Definitions. For definitions of terms used in this specification (see 6.4).

3.5 Materials.

3.5.1 Nut. Shall be fabricated from alloy steel as specified in the applicable specification sheet or standard.

3.6 Design. Nut design shall conform to the applicable specification sheet or standard.

3.7 Construction. Nuts shall be of the prevailing torque type. The locking device shall not operate by means of separate movement as a result of installation and shall not depend upon pressure on the bearing surface for locking action.

3.7.1 Wrenching element. Spline wrenching element shall be in accordance with MS33787.

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3.7.2 Bearing surface perpendicularity. The bearing surface shall be normal to the axis of the pitch diameter of the threads within the values specified on the applicable specification sheet or standard. (see 4.5.1.1)

3.7.3 Threads. Unless otherwise specified, threads shall be class 3B in accordance with MIL-S-8879 prior to incorporation of the locking feature. Threads used on the locking device may be displaced or deformed in any manner which will provide self-locking nuts conforming to this specification. The nut, without lubricant, shall allow the go-gage to enter not less than .750 turn before engagement of the locking element. When lubricant prevents use of standard gages, the nut shall permit a minimum free rotational bolt thread engagement of at least .750 turn before engagement of the locking element.

3.8 Surface treatment. The nut shall be cadmium coated in accordance with MIL-C-8837 or as specified on the applicable specification sheet or standard.

3.9 Lubricant. The nut shall be lubricated with dry film lubricant conforming to MIL-L-46010, Type I.

3.10 Axial strength. The nuts shall withstand the minimum axial tensile load specified in table I without rupture, stripping of threads, or appearance of cracks.(see 4.5.2).

3.11 Torque.

3.11.1 Wrench torque. The nuts shall withstand the wrench torque values specified in table I, when tested as specified in 4.5.3.1. Upon completion of the test, the nut shall show no indications of permanent deformation which may prevent its proper application and removal with a socket-type wrench conforming to MIL-W-8982. The nuts shall show no evidence of cracking (see 4.5.7).

3.11.2 Torque effectivity, room temperature. The nuts shall not exceed the room temperature maximum locking torque nor produce less than the minimum breakaway torque specified in table III (see 4.5.3.2)

3.11.2.1 Torque effectivity, 450°F. The nuts shall not exceed the room temperature after bake maximum locking torque nor produce less than the minimum breakaway torque specified in table III (see 4.5.3.2.1).

3.11.3 Locking torque. The nuts shall not exceed the room temperature maximum locking torque nor produce less than the minimum breakaway torque specified in table III (see 4.5.3.3).

3.11.4 Permanent set. The nuts shall not exceed the maximum locking torque nor produce less than the minimum breakaway torque specified in table III, when tested as specified in 4.5.3.4.

3.12 Accelerated vibration. The nuts shall withstand the vibration test specified in 4.5.4.

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3.13 Stress durability. The nuts shall show no evidence of cracking, when tested as specified in 4.5.5.

TABLE I Axial Strength and Wrench Torque

| Nominal Size | Cross Sectional Area (Sq-In.) | Axial Strength Minimum (lbs.) | Wrench Torque Minimum (In-Lbs.) |
|--------------|-------------------------------|-------------------------------|---------------------------------|
| .1900-32 | .0226 | 4,970 | 85 |
| .2500-28 | .0404 | 8,870 | 210 |
| .3125-24 | .0640 | 14,100 | 450 |
| .3750-24 | .0951 | 20,900 | 730 |
| .4375-20 | .1288 | 28,300 | 1,100 |
| .5000-20 | .1717 | 37,800 | 1,400 |
| .5625-18 | .2176 | 47,900 | 2,000 |
| .6250-18 | .2724 | 59,900 | 2,600 |
| .7500-16 | .3952 | 86,900 | 4,400 |
| .8750-14 | .5392 | 119,000 | 7,200 |
| 1.0000-12 | .7027 | 155,000 | 10,300 |
| 1.1250-12 | .9007 | 198,000 | 13,000 |
| 1.2500-12 | 1.1232 | 247,000 | 16,000 |
| 1.3750-12 | 1.3703 | 301,000 | 19,000 |
| 1.5000-12 | 1.6420 | 361,000 | 22,000 |

Axial Strength Values determined from Formula $W_a = F_t u A$;

Where A = Cross sectional area (Sq-In.) as tabulated
Area based on maximum pitch diameter of bolt thread.

$F_t u = 220$ KSI

W_a = Axial Strength (lbs.)

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TABLE II. Stress Durability and Stress Corrosion

| Nominal Size | Nominal Grip Length of Bolt (In.) | Bolt Elongation (In.) |
|--------------|-----------------------------------|-----------------------|
| .1900-32 | 2.00 | .0070 |
| .2500-28 | 2.00 | .0073 |
| .3125-24 | 2.00 | .0076 |
| .3750-24 | 2.00 | .0080 |
| .4375-20 | 2.50 | .0096 |
| .5000-20 | 2.50 | .0101 |
| .5625-18 | 2.50 | .0103 |
| .6250-18 | 2.75 | .0114 |
| .7500-16 | 2.75 | .0122 |
| .8750-14 | 2.75 | .0126 |
| 1.0000-12 | 3.00 | .0138 |
| 1.1250-12 | 3.00 | .0144 |
| 1.2500-12 | 3.00 | .0149 |
| 1.3750-12 | 3.00 | .0154 |
| 1.5000-12 | 3.00 | .0159 |

- (a) Test bolt shall be stressed by torquing the nut until elongation is within 0.0005 of value specified. This elongation will indicate a stress of 50% of the minimum axial strength.
- (b) Bolt elongations are calculated using bushing assembly lengths "A" (dimensions "L" per table VIII).
- (c) Other bolt grip lengths permissible. Calculate elongation per MIL-STD-1312-14, using values for "A" equal to nominal grip length plus three times the thread pitch.

TABLE III Torque Values

| Nominal Size | Seating Torque For Torque Effectivity Test (In-Lbs.) | Maximum Locking Torque 1/ | | Minimum Breakaway Torque (In-Lbs.) | Assembly Torque Vibration (In-Lbs.) |
|--------------|--|----------------------------|---------------------------------------|------------------------------------|-------------------------------------|
| | | Room Temperature (In-Lbs.) | Room Temperature After Bake (In-Lbs.) | | |
| .1900-32 | 76 | 18 | 36 | 2.0 | 36 |
| .2500-28 | 190 | 30 | 60 | 3.5 | 60 |
| .3125-24 | 400 | 60 | 120 | 6.5 | 120 |
| .3750-24 | 655 | 80 | 160 | 9.5 | 160 |
| .4375-20 | 1,000 | 100 | 200 | 14.0 | 200 |
| .5000-20 | 1,260 | 150 | 300 | 18.0 | 300 |
| .5625-18 | 1,800 | 200 | 400 | 24.0 | 400 |
| .6250-18 | 2,350 | 300 | 600 | 32.0 | 600 |
| .7500-16 | 4,000 | 400 | 800 | 50.0 | |
| .8750-14 | 6,500 | 600 | 1,200 | 70.0 | |
| 1.0000-12 | 9,300 | 800 | 1,600 | 90.0 | |
| 1.1250-12 | 11,700 | 900 | 1,800 | 117.0 | |
| 1.2500-12 | 14,400 | 1,000 | 2,000 | 143.0 | |
| 1.3750-12 | 17,000 | 1,100 | 2,200 | 165.0 | |
| 1.5000-12 | 19,800 | 1,250 | 2,500 | 195.0 | |

1/ Values apply to nuts as lubricated by manufacturer.

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3.14 Stress corrosion. The nuts shall show no evidence of cracking when tested as specified in 4.5.6. Cracks are not permitted in any location.

3.15 Discontinuities. Shall not exceed the depth limitations shown in table IV when examined as specified in 4.5.7. Care shall be exercised not to confuse cracks with discontinuities (see 6.4.3)

TABLE IV Discontinuity depth limits, maximum, inch 1/

| Nominal Size | Limits | Rejectable Criteria |
|--------------|--------|---|
| .1900-32 | .005 | Any crack, regardless of location. Discontinuities in excess of specified limits. |
| .2500-28 | .005 | |
| .3125-24 | .005 | |
| .3750-24 | .006 | |
| .4375-20 | .007 | |
| .5000-20 | .008 | |
| .5625-18 | .009 | |
| .6250-18 | .010 | |
| .7500-16 | .010 | |
| .8750-14 | .010 | |
| 1.0000-12 | .011 | |
| 1.1250-12 | .011 | |
| 1.2500-12 | .012 | |
| 1.3750-12 | .012 | |
| 1.5000-12 | .012 | |

1/ Samples of nuts having indications may be sectioned and micro-examined to determine whether the indications are due to tool or die marks, or due to discontinuities, and to determine conformance of discontinuities to the depth limits specified in table IV (see 6.4.6).

3.16 Hardness. Shall be as specified on the applicable specification sheet or standard. (see 4.5.2.1).

3.17 Workmanship. Shall be consistent with the type or product, finish, and the class of thread fit specified. Sharp edges shall be broken; hanging burrs and slivers shall be removed.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspections requirements as specified herein. Except as otherwise specified in the contract or order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Classification of inspections and tests. The inspection and tests requirements specified herein are classified as follows:

- a. Qualification Tests (4.3)
- b. Quality Conformance (Acceptance) Inspection and Tests (4.4)

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4.3 Qualification inspections.

4.3.1 Sampling instructions. Qualification test samples (see table V) shall consist of 50 nuts for each size upon which qualification is desired. All bolts, screws, and mandrels necessary for test specified herein shall be furnished by the manufacturer. Complete description and name of lubricating material used on the nuts shall be furnished. Samples shall be identified as required and forwarded to the activity responsible for qualification designated in the letter of authorization from that activity, see 6.3.

TABLE V Qualification test plan

| Test | Paragraph | Nuts Required | Bolts or Studs Required |
|--|-----------|---------------|-------------------------|
| Examination of Product | 4.5.1 | All | 0 |
| Thread Fit | 4.5.1 | All | 0 |
| Bearing Surface Squareness | 4.5.1.1 | 3 | 0 |
| Axial Strength | 4.5.2 | 5 | 5 |
| Hardness | 4.5.2.1 | 5 | 0 |
| Wrench Torque | 4.5.3.1 | 5 | 5 |
| Torque Effectivity, Room Temp. (Locking Element) | 4.5.3.2 | 5 | 5 |
| Torque Effectivity, 450°F (Locking Element) | 4.5.3.2.1 | 5 | 5 |
| Locking Torque | 4.5.3.3 | 3 | 3 |
| Permanent Set | 4.5.3.4 | 3 | 3 |
| Accelerated Vibration | 4.5.4 | 5 | 5 |
| Stress Durability | 4.5.5 | 6 | 6 |
| Stress Corrosion | 4.5.6 | 6 | 6 |
| Discontinuities | 4.5.7 | ALL | 0 |

4.3.2 Inspections. The qualification inspections shall consist of all the tests and examinations specified in 4.5, and shall be performed prior to the first shipment of production parts.

4.3.3 Certified test report. The manufacturer shall furnish a certified test report showing that the manufacturer's product satisfactorily conforms to this specification. The test report shall include, as a minimum, actual results of the test specified herein. When this report is submitted, it shall be accompanied by a dated drawing which describes the manufacturer's product by specifying pertinent dimensions and tolerances, compositions of material selected, coating and the heat treat. The manufacturer's part number for each size shall be included on the above drawing.

4.3.4 Retention of qualification. Certification shall be requested by the Defense Industrial Supply Center, (Code DISC EPP), 700 Robbins Avenue, Philadelphia, PA 19111-5096. Certification shall be at the time of the two year review and shall be signed by a responsible official of management, attesting that the listed product(s) is still available from the listed plant, can be produced under the same conditions as originally qualified; (i.e., same process, materials, construction, design, manufacturer's part number, or designation); and meets the requirements of the current issue of the specification. Failure to provide the certification will be cause for removal from the QPL. After completion of the certification review, the QPL will be reprinted to show the date of certification. (DD Form 1718, Certification of Qualified Products, shall be used for obtaining certification.)

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4.4 Quality conformance inspections. The quality conformance (acceptance) inspections shall consist of those examinations and tests listed in 4.4.2 on samples selected in accordance with sampling plans A, B, and C. Acceptance tests shall be performed on each inspection lot.

4.4.1 Selection of samples. Sample nuts shall be selected at random from each inspection lot as specified herein.

4.4.1.1 Production Lot: Shall consist of finished nuts of the same type and diameter fabricated by the same process 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.

4.4.1.2 Inspection Lot: Shall consist of nuts from a single production lot, of the same part number.

4.4.1.3 Sampling Plan A. Sample sizes for examination of production characteristics shall be in accordance with 4.4.1.3.1 and Table VI below:

4.4.1.3.1 Product Characteristics. The following characteristics shall be inspected:

Critical

Discontinuities identified as cracks
Visual presence of locking feature

Major

Bearing surface perpendicularity
Thread fit
Surface plating
Height of wrenchable portion
Overall height
Diameter of bearing surface
Loose or hanging burrs
Concentricity of threads to base diameter
Part identification per applicable specification, standard or drawing

Minor

Dimensions not covered above

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Table VI Inspection Sampling Plan A (Zero-based Acceptance Plan)

| Lot Size | SAMPLE SIZE (Acceptance number in all cases is zero.) "A" indicates the entire lot must be inspected | | |
|-----------------|---|-------|-------|
| | Critical | Major | Minor |
| 1-8 | A | A | 3 |
| 9-15 | A | 13 | 3 |
| 16-25 | A | 13 | 3 |
| 26-50 | A | 13 | 5 |
| 51-90 | A | 13 | 6 |
| 91-150 | A | 13 | 7 |
| 151-280 | A | 20 | 10 |
| 281-500 | A | 29 | 11 |
| 500-1200 | A | 34 | 15 |
| 1201-3200 | 1250 | 42 | 18 |
| 3201-10,000 | 1250 | 50 | 22 |
| 10,001-35,000 | 1250 | 60 | 29 |
| 35,001-150,000 | 1250 | 74 | 29 |
| 150,001-500,000 | 1250 | 90 | 29 |
| 500,001 & OVER | 1250 | 102 | 29 |

4.4.1.4 Sampling Plan B. For the axial strength test (4.5.2), hardness test (4.5.2.1), and locking torque test (4.5.3.3) the samples shall be selected in accordance with table VII.

TABLE VII Sampling Plan B

| Lot Size | Sample Size | Accept | Reject |
|-------------------|-------------|--------|--------|
| Under 10,000 | 5 | 0 | 1 |
| 10,000 to 50,000 | 10 | 0 | 1 |
| 50,001 to 100,000 | 15 | 0 | 1 |
| Over 100,000 | 27 | 0 | 1 |

4.4.1.5 Sampling Plan C. For Stress Durability (4.5.5), sample size shall be 5 for each lot and the acceptance number zero.

4.4.2 Tests. The quality conformance tests shall consist of:

- a. Examination of Product (4.5.1 and 4.5.1.1)
- b. Axial Strength (4.5.2)
- c. Hardness (4.5.2.1)
- d. Locking Torque (4.5.3.3)
- e. Discontinuities (4.5.7)

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4.5 Test methods.

4.5.1 Examination of product. The nuts shall be examined for conformance to this specification and the applicable standards with respect to dimensions, design and construction, and finish.

4.5.1.1 Bearing surface squareness. Prior to incorporation of the locking feature, bearing surface squareness shall be tested on an expanding type thread plug gage that positions on the nut thread pitch cylinder (thus, establishing the datum axis of nut thread) with a dial indicator stylus positioned on the nut bearing surface near the minimum bearing diameter. Indicator readings are taken during circular and radial stylus movements over the bearing surface. The squareness requirement shall apply to the complete bearing surface of the nut. The nuts to be inspected shall permit at least three full threads of engagement on the thread gage of the test fixture; coating shall be stripped to meet this requirement.

4.5.2 Axial strength. The nuts shall be assembled on the test bolts as specified in table VII, having minimum grip length equal to three times the bolt diameter, and subjected to the axial strength load specified in table I. Test method and fixtures shall be in accordance with MIL-STD-1312-8. The nuts shall support the axial strength load without rupture, stripping of threads, or appearance of cracks. For qualification, apply load until nut or bolt failure. For quality conformance, tests may be discontinued after minimum load has been achieved. Bolt failure below the rated axial strength of the nut due to defective bolt is not cause for rejection, but in the event of such bolt failure, the test shall be repeated.

4.5.2.1 Hardness. The nuts shall be tested for hardness in accordance with MIL-STD-1312-6.

4.5.3 Torque.

4.5.3.1 Wrench torque. The nuts shall be installed on test bolts as specified in table VII with a steel fixture in accordance with figure 2, and torqued to the wrench torque test values specified in table I. The nut shall then be removed and reinstalled to this torque fourteen additional times. Nuts shall be magnetic particle inspected per ASTM E1444 for cracks upon completion of testing. Wrenches shall be of the socket type conforming to MIL-W-8982. Deformation which interferes with the proper application and removal of the nut with the wrench is sufficient cause for rejection.

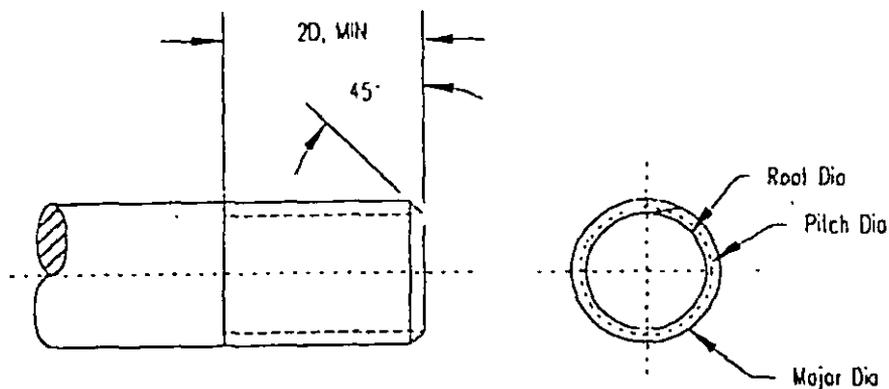
TABLE VIII Type of test bolt or stud.

| Type | Test | Paragraph Number |
|------|--|------------------|
| I | Stress Durability | 4.5.5 |
| I | Torque Effectivity, Room Temperature (Locking Element) | 4.5.3.2 |
| I | Wrench Torque | 4.5.3.1 |
| I | Locking Torque | 4.5.3.3 |
| II | Permanent Set | 4.5.3.4 |
| I | Torque Effectivity, 450°F (Locking Element) | 4.5.3.2.1 |
| I | Stress Corrosion | 4.5.6 |
| I | Accelerated Vibration | 4.5.4 |

NOTE: Test bolts specified in this table are for referee purposes. Bolts or threaded studs may be used for routine testing. Threads may be rolled before or after heat treatment and shall be cadmium plated.

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- Type I Rolled threads in accordance with MIL-S-8879 thread form, having 220 KSI (minimum) strength level. If bolts are used, head configuration is optional.
- II A. Maximum Stud - Cadmium plated 160 KSI (minimum) strength level with rolled threads in accordance with MIL-S-8879, except that the pitch diameter shall be established at 75% $+0.0000 - 0.0004$ of the tolerance range of class JA, above the minimum pitch diameter subject to check with pitch diameter tri-roll gages, see table XI.
- B. Minimum Mandrel - In accordance with figure 1. Threads shall conform to table XI. It shall be checked with pitch diameter tri-roll gages.



First Thread

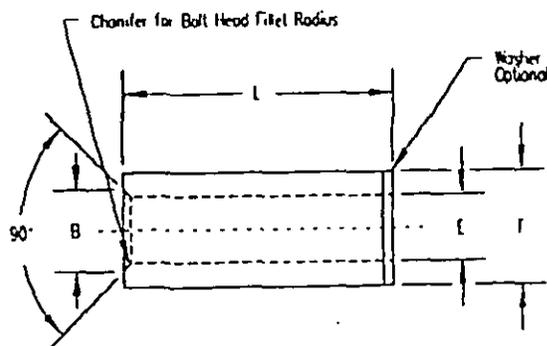
Details:

- Material: Steel
- Hardness: Heat treated to ROCKWELL C60 to 64.
- Threads: The thread form shall conform to that shown in MIL-S-8879.
The threads shall be right hand. The thread dimensions shall be as shown in table X.
- Surface Roughness: 20 microinches maximum in accordance with ANSI/ASME B46.1

The mandrel end shall have a 45 degree chamfer extending below the root diameter. The resulting sharp feather edge of the incomplete thread shall be removed by stoning.

Figure 1. Mandrel.

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Test Fixture for Torque Effectivity and Wrench Torque.
Material: Alloy Steel per AMS 6485 or AMS 6487.
Hardness: Rockwell C40-45

Ends of bushing and bushing plus washer to be flat and parallel within
.002 Surface texture of ends: 32 microinches per ANSI/ASME B46.1.

Figure 2 Test fixture.

Table IX Dimensions for torque test bushing assembly.

| Nut Nominal Thread Size (ref) | B Diameter +.005 -.005 | E Diameter +.000 -.010 | F Diameter Minimum | L +.010 -.010 (a) |
|-------------------------------------|---------------------------------|---------------------------------|---|----------------------------|
| .1900-32 | .285 | .205 | Diameter of Nut base or Twice the Diameter of the Bolt Whichever is Greater | 2.125 |
| .2500-28 | .345 | .265 | | 2.125 |
| .3125-24 | .407 | .327 | | 2.125 |
| .3750-24 | .502 | .390 | | 2.125 |
| .4375-20 | .564 | .452 | | 2.625 |
| .5000-20 | .627 | .515 | | 2.625 |
| .5625-18 | .689 | .577 | | 2.625 |
| .6250-18 | .783 | .640 | | 2.875 |
| .7500-16 | .908 | .765 | | 2.938 |
| .8750-14 | 1.033 | .890 | | 2.938 |
| 1.0000-12 | 1.158 | 1.015 | | 3.188 |
| 1.1250-12 | 1.283 | 1.140 | | 3.188 |
| 1.2500-12 | 1.440 | 1.265 | | 3.188 |
| 1.3750-12 | 1.565 | 1.390 | | 3.188 |
| 1.5000-12 | 1.690 | 1.565 | | 3.188 |

(a) Length "L" may include one washer of equal material and hardness
Length "L" may vary to accommodate other bolts lengths - see table II. note c.

4.5.3.2 **Torque effectivity-room temperature.** The nuts shall be installed on test bolts as specified in table VII with a test fixture in accordance with figure 2, and torqued to the seating torque test values specified in table III. The nut shall then be removed and reinstalled (seated) fourteen additional times. The maximum locking torque and minimum breakaway torque for the 1st, 7th and 15th cycles shall be recorded. The minimum breakaway torque shall be that torque required to start relative motion, between the nut and bolt, after the nut has been unseated and backed off one-half turn.

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4.5.3.2.1 Torque effectivity after 450°F bake. The nuts shall be installed on test bolts as specified in table VII with a test fixture in accordance with figure 2, and torqued to the seating torque test values specified in table III. The assemblies shall then be baked for one hour at 450°F (-0 +25°) and cooled to room temperature. The nuts shall then be removed and reinstalled (seated and baked) four additional times. The maximum locking torque and minimum breakaway torques for the 1st, and 5th cycles shall be recorded. The minimum breakaway torque shall be that torque required to start relative motion, between the nut and bolt, after the nut has been unseated and backed off one-half turn.

4.5.3.3 Locking torque. The nuts shall be installed and removed on test bolts, as specified in table VII, one time, recording maximum locking torque and minimum breakaway torque during the one cycle.

4.5.3.4 Permanent set. Subject the nut at room temperature, to one complete installation and removal cycle on a maximum stud in accordance with table VIII. Repeat the test cycle with the same clean nut on a minimum pitch mandrel, in accordance with table VIII.

4.5.4 Vibration. Sample nuts with bolts of the size and quantities specified in tables VII and IX shall be vibrated in accordance with MIL-STD-1312-7. Vibration life, for each lot of five specimens tested in accordance with MIL-STD-1312-7, of less than 45,000 cycles shall be cause for rejection.

TABLE X Vibration requirements

| Nominal Nut Size | Bolt Grip (Inch) | MIL-STD-1312-7 Bolts and Nuts Required (min. of each) |
|------------------|------------------|---|
| .1900-32 | 1.125 | 10 |
| .2500-28 | 1.188 | 10 |
| .3125-24 | 1.188 | 10 |
| .3750-24 | 1.188 | 10 |
| .4375-20 | 1.188 | 10 |
| .5000-20 | 1.188 | 10 |
| .5625-18 | 1.188 | 10 |
| .6250-18 | 1.188 | 10 |

4.5.4.1 Vibration tests on nuts larger than 5/8 inch size are waived, provided that 5/8 inch nuts and smaller of the same type and design of locking device have passed the vibration test.

4.5.4.2 Preparation for Vibration test to MIL-STD-1312-7.

4.5.4.3 Accelerated vibration. The nuts shall be assembled in accordance with figure 2 of MIL-STD-1312-7, with bolts and torque values specified in table III. The nuts shall then be removed and reinstalled to this torque four additional times before being vibrated.

4.5.4.4 Baking of test specimens. Five nuts shall be assembled on the appropriate bolts and baked for six hours at 450°F. The baked specimens shall be allowed to cool slowly in air to room temperature. The nuts shall then be removed and reinstalled to torque values specified in table III for four additional times before being vibrated.

4.5.4.5 Method. Use procedure of MIL-STD-1312-7.

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4.5.4.5.1 Determination shall be made throughout the test to guarantee that assembly is traversing the entire length of the slots in the test fixture. The test shall be run for 45,000 cycles except that it shall be stopped prior to the completion of the 45,000 cycles in the event a nut becomes disassembled from the bolt. The nut samples shall be examined under 10X magnification for cracks.

4.5.4.5.2 The nuts shall be considered to have failed the vibration test under the following conditions:

a. If any structural failure occurs, such as broken segments, locking inserts falling out, or cracks occur in the nuts during the test, provided failure is not the result of failure of the bolt.

b. If any nut comes completely off the bolt or can be turned completely on or off the bolt with the fingers during or after completion of 45,000 cycles.

c. If relative rotation between any nut and bolt exceeds 360 degrees.

4.5.5 Stress durability. Test in accordance with MIL-STD-1312-14, with test bolts as specified in table VIII and torque, using the extension method of loading until the bolt elongates the amount specified in table II. The assemblies shall then be baked for 96 hours at 450°F (-0° +25°) and cooled to room temperature. After removing nuts, polish bearing surface of nuts and examine at 10X to 50X magnification for cracks.

4.5.6 Stress corrosion. Test in accordance with MIL-STD-1312-9. The nuts shall be installed on test bolts as specified in table VIII and torqued until the bolt elongates the amount specified in table II. After 500 hours of alternate immersion, the parts shall be disassembled and the nut bearing surface shall be polished and examined at 10X to 50X magnification for cracks.

4.5.7 Cracks and discontinuities. Magnetic particle inspection shall be used to determine the presence of cracks and discontinuities such as laps, seams and inclusions. Magnetic particle indications of themselves shall not be cause for rejection. If indications are considered cause for rejection, representative samples shall be taken from these nuts showing indications and these samples shall be further examined by microexamination to determine whether the indicated discontinuities exceed the limits specified herein.

4.5.7.1 Magnetic particle inspection. Magnetic particle inspection shall be performed in accordance with ASTM E1444. Personnel conducting magnetic particle inspection shall be qualified in accordance with MIL-STD-410.

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TABLE XI Thread dimensions for maximum stud and minimum mandrel for permanent set test.

| Nominal Size | Maximum 3A Stud | | Minimum 3A Mandrel | | | |
|--------------|-----------------|--------|-----------------------|-----------------------|------------------------------|---|
| | Pitch Diameter | | + .0000 | + .0000 | Tolerance in lead (per inch) | Tolerance half angle of thread in minutes |
| | Max. | Min. | -.0004 Major Diameter | -.0004 Pitch Diameter | | |
| .19XX-32 | .1691 | .1687 | .1840 | .1674 | $\pm .0003$ | ± 15 |
| .2500-28 | .2261 | .2257 | .2435 | .2243 | $\pm .0003$ | ± 15 |
| .3125-24 | .2847 | .2843 | .3053 | .2827 | $\pm .0003$ | ± 15 |
| .3750-24 | .3471 | .3467 | .3678 | .3450 | $\pm .0003$ | ± 15 |
| .4375-20 | .4042 | .4038 | .4294 | .4019 | $\pm .0003$ | ± 15 |
| .50XX-20 | .4667 | .4663 | .4919 | .4643 | $\pm .0003$ | ± 15 |
| .5625-18 | .5255 | .5251 | .5538 | .5230 | $\pm .0003$ | ± 10 |
| .6250-18 | .5880 | .5876 | .6163 | .5854 | $\pm .0003$ | ± 10 |
| .75XX-16 | .7084 | .7080 | .7406 | .7056 | $\pm .0003$ | ± 10 |
| .8750-14 | .8275 | .8271 | .8647 | .8245 | $\pm .0003$ | ± 10 |
| 1.0000-12 | .9448 | .9444 | .9886 | .9415 | $\pm .0003$ | ± 10 |
| 1.1250-12 | 1.0697 | 1.0693 | 1.1136 | 1.0664 | $\pm .0003$ | ± 10 |
| 1.2500-12 | 1.1947 | 1.1943 | 1.2386 | 1.1913 | $\pm .0003$ | ± 10 |
| 1.3750-12 | 1.3197 | 1.3193 | 1.3636 | 1.3162 | $\pm .0003$ | ± 10 |
| 1.5000-12 | 1.4447 | 1.4443 | 1.4886 | 1.4411 | $\pm .0003$ | ± 10 |

5. PACKAGING

5.1 Self-locking nuts shall be packaged for shipment in accordance with ASTM D3951, or as specified in the contract or purchase order.

5.2 Marking of shipments. In addition to any special requirements of the contract or order, shipments shall be marked in accordance with MIL-STD-129

6. NOTES

6.1 Intended use. The nuts are intended for use in airframes and airborne mechanical systems in combination with high fatigue 220 KSI bolt applications where the maximum temperatures do not exceed 450°F.

6.2 Ordering data. Procurement documents should specify:

6.2.1 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Military part number, see 3.1.
- c. Applicable levels of packaging and packing.

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6.3 Qualification. With respect to products requiring qualification, awards will be made only for such products which are, at the time set for opening of bids, qualified for inclusion in the Qualified Products Lists (QPL-8922) whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or purchase orders for the products covered by this specification. The activity responsible for the Qualified Products Lists is the Naval Air Systems Command, Navy Department, Washington, DC 20361, and information pertaining to qualification of products may be obtained from the Naval Air Warfare Center, Code 6013, Warminster, PA 18974-0521.

6.3.1 Qualification tests will be authorized only upon presentation of certified test reports indicating that the nuts conform to this specification (see 4.3.3) and the applicable military specification sheet or standard approved by the activity responsible for qualification.

6.4 Definitions applicable to the tests under this specification.

6.4.1 Installed. A nut is considered installed when a minimum of two thread pitches including the chamfer of the male threads extend beyond the top of the nut.

6.4.2 Removal cycle. The removal cycle is considered complete when the locking device is disengaged.

6.4.3 Crack. A crack is a clean break passing through the grain or grain boundary without inclusion of foreign elements.

6.4.4 Minimum breakaway torque. The minimum breakaway torque is that torque required to start nut rotation from a fixed position during a removal cycle with no load on the base of the nut.

6.4.5 Maximum locking torque. The maximum locking torque is the highest self-locking torque encountered in any installation or removal cycle with no load on the base of the nut.

6.4.6 Discontinuity. Discontinuities are any type of indication detected during magnetic particle inspection including laps, seams, folds, scratches or toolmarks.

6.5 Subject term (key word) listing.

NUT
SELF-LOCKING
220 KSI Ft_u
450°F

6.6 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes..

Custodians:
Navy - AS
Air Force - 99
Army - AV

Preparing activity
DLA-IS

(Project 5310-1906)

Reviewer Activity:
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