

INCH - POUND

MIL-N-45938A
 28 March 1995
 SUPERSEDING
 MIL-N-45938
 30 September 1971

MILITARY SPECIFICATION

NUT, PLAIN, CLINCH AND NUT, SELF-LOCKING, CLINCH GENERAL SPECIFICATION FOR

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

1 SCOPE

1.1 Scope This specification covers the requirements for nuts which are permanently attached to a structure by pressing the nut shank or collar into a single hole. Anti-rotation and push-out resistance results from cold flow of the structure material into the shank or collar of the nut, or the flaring over of the nut shank.

1.2 Classification Types and sizes of clinch nuts shall be as specified on the applicable specification sheets and MS21331.

2 APPLICABLE DOCUMENTS

2.1 Government Documents

2.1.1 Specifications, standards, and handbooks The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

FEDERAL

- QQ-A-225/5 - Aluminum Alloy 2017 Bar, Rod and Wire, Rolled, Drawn or Cold Finished
- QQ-A-225/6 - Aluminum Alloy 2024 Bar, Rod and Wire, Rolled, Drawn or Cold Finished
- QQ-P-35 - Passivation Treatments for Corrosion-Resistant Steel
- QQ-P-416 - Plating, Cadmium (Electrodeposited)
- QQ-S-365 - Silver Plating, Electrodeposited, General Requirements For

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to (Defense Industrial Supply Center, 700 Robbins Avenue, DISC - EPP, Philadelphia, Pa 19111 - 5096) by using the self-addressed Standardization Document Improvement Proposal (DD Form 1456) appearing at the end of this document or by letter.

AMSC N/A

FSC 5310

DISTRIBUTION STATEMENT N/A - Approved for public release; distribution is unlimited.

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MILITARY

MIL-S-7742 - Screw Threads Standard Optimum Selected Series General Specification for
MIL-A-8625 - Anodic Coatings, for Aluminum and Aluminum Alloys
MIL-S-8879 - Screw Threads, Controlled Radius Root with Increased Minor Diameter, General
Specification for
MIL-L-23398 - Lubricant, Solid Film, Air -Cured, Corrosion Inhibiting
MIL-N-25027 - Nut, Self-Locking, 250 degrees F 450 degrees F, and 800 degrees
MIL-L-46010 - Lubricant, Solid Film, Heat Cured, Corrosion Inhibiting
MIL-C-81562 - Coatings, Cadmium, Tin-Cadmium and Zinc (Mechanically Deposited)

(See supplement 1 for list of applicable specification sheets)

STANDARDS

FEDERAL

FED - STD - H28/2 - Screw Thread Standards for Federal Services, Section 2, Unified Inch
Threads UN & UNR Thread Forms

MILITARY

MS21331 - Nut, Plain, Clinch

(Unless otherwise indicated, copies of federal military specifications and standards, are available from
DODSSP Customer Service, Standardization Document Order Desk, 700 Robbins Avenue Bldg 4D,
Philadelphia, Pa 1011-5094

2.2 Non-Government publications The following documents form a part of this document to the extent
specified herein. Unless otherwise specified, the issues of documents which are DOD adopted are those
listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of
documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2)

American National Standards Institute (ANSI)

ANSI/ASME B46.1 - Surface Texture

ASME/ANSI B18.18.2M - Inspection and Quality Assurance For High Volume Machine
Assembly Fasteners

(Application for copies should be addressed to the American National Standards Institute, 11 W 42nd
St. New York N Y 10036)

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- MIL-A-8625 - Anodic Coatings, for Aluminum and Aluminum Alloys
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- MIL-L-23398 - Lubricant, Solid Film, Air -Cured, Corrosion Inhibiting
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- MIL-L-46010 - Lubricant, Solid Film, Heat Cured, Corrosion Inhibiting
- MIL-C-81562 - Coatings, Cadmium, Tin-Cadmium and Zinc (Mechanically Deposited)

(See supplement 1 for list of applicable specification sheets)

STANDARDS

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MILITARY

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American National Standards Institute (ANSI)

ANSI/ASME B46.1 - Surface Texture

ASME/ANSI B18.18.2M - Inspection and Quality Assurance For High Volume Machine Assembly Fasteners

(Application for copies should be addressed to the American National Standards Institute, 11 W 42nd St., New York, N.Y. 10036)

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AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A322 - Standard Specification for Steel Bars, Alloy, Standard Grades

ASTM A342 - Standard Test Methods for Permeability of Feebly Magnetic Materials

ASTM A493 - Standard Specifications for Stainless and Heat-Resisting steel Wire and Wire Rods for Cold Heading and Cold Forging

ASTM B633 - Electrodeposited Coatings of Zinc on Iron and Steel, Standard Specification for

ASTM F1470 - Guide For Fastener Sampling For Specified Mechanical Properties in Performance Inspection.

ASTM D3951 - Commercial Packing, Standard Practices For

(Applications for copies should be addressed to the American Society of Testing and Materials, 1916 Race St , Phila , Pa 19103)

Society of Automotive Engineers, Inc (SAE)

AMS 5734 - Steel Bars, Forgings and Tubing, Corrosion and Heat Resistant

(Application for copies should be addressed to the Society of Automotive Engineers, Inc, 400 Commonwealth Drive, Warrendale, Pa 15096)

(Non-Government standards and other publications are normally available from the organization that prepares the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence In the event of a conflict between the text of this specification and the references cited herein (except for the related associated MS standards), the text of this specification shall take precedence. Nothing in this specification, however, supersedes 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 sheets.

3.2 Material Clinch nuts shall be made from the following materials, as specified in the applicable specification sheet and MS21331.

3.2.1 Carbon and alloy steel Carbon steel shall conform to any of the grades 1010 thru 1095 (UNS G10100 thru G10950). Alloy steel shall be 4130 (UNS G41300) in accordance with ASTM A322.

3.2.2 Corrosion-resistant steel Corrosion-resistant steel shall be AISI 303 (UNS S30300) in accordance with AMS 5640 or 302 HQ (UNS S30430) in accordance with ASTM A493. When specified in the applicable cable specification sheet, corrosion-resistant steel shall be Type A 286 in accordance with AMS 5734.

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3 2 2 1 Magnetic permeability Corrosion-resistant steel shall have a magnetic permeability of 2 0 max (air = 1 0) for a field strength of $H = 200$ oersteds when tested using an indicator in accordance with ASTM A342 Corrosion - resistant steel nuts that cannot meet the minimum required physical size for testing in accordance with ASTM A342 shall be exempt from this requirement, however, raw material stock used to manufacture these unmeasurable parts shall meet magnetic permeability requirements specified herein

3 2 3 Aluminum alloy Aluminum alloy shall be 2017-T4 in accordance with QQ-A-225/5 or 2024-T4 in accordance with QQ-A-225/6

3 2 4 Non-metallic insert The non-metallic insert used in self-locking nuts shall be nylon

3 3 Protective finish

3 3 1 Cadmium plating Carbon and alloy steel nuts shall be cadmium plated in accordance with QQ-P-416, Type II, Class 3

3 3 1 1 Hydrogen embrittlement Cadmium plated alloy or carbon steel nuts heat treated to 39 HRC or higher shall be subjected to an embrittlement relief treatment within 4 hours after plating, conducted in accordance with QQ-P-416

3 3 2 Passivation Corrosion-resistant steel (303) nuts shall be passivated in accordance with QQ-P-35 Type II and (302) nuts in accordance with QQ-P-35, Type VI

3 3 3 Silver plating Corrosion-resisting steel (A-286) nuts shall be silver plated in accordance with QQ-S-365, Type II, Grade B, .0002" thick

3 3 4 Zinc plating When specified, nuts shall be zinc coated in accordance with MIL-C-81542, Type II, class 2 or in accordance with ASTM B633, Fe/Zn 13, Type II for mechanical or electrodeposition, respectively

3 3 5 Lubricant When specified on the applicable specification sheet, alloy steel nuts shall have a supplementary solid film lubricant coating in accordance with MIL-L-46010 Type 1 or MIL-L-23398 When specified on the applicable specification sheet, corrosion-resistant steel nuts shall have a supplementary solid film lubricant coating in accordance with MIL-L-46010 or MIL-L-23398 Lubricant shall be optional on nuts with non-metallic inserts

3 4 Design and construction Clinch nuts shall be of one-piece construction (Nuts with permanently attached non-metallic inserts are considered as one-piece construction For the purpose of this specification, floating clinch nuts shall be considered as one-piece construction) Clinch nuts shall have a countersunk entry on both sides, except for deformed thread lock nuts and nuts with non-metallic inserts, which shall only be required to have the countersink on the entry side When properly installed in a predrilled or punched hole in sheet material, the clinch portion of the nut shall provide a positive, permanent attachment to the sheet without damaging or affecting the threads, The locking device shall not operate by means of separate movement from the installation and shall not depend upon pressure on the bearing surface for locking action

3 4 1 Dimensions Dimensions and tolerances shall be as specified on the applicable specification sheet and MS21331 and shall apply after plating and prior to supplemental lubrication

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3 4 2 Threads Unless otherwise specified, threads shall be in accordance with FED-STD- H28/2. When specified on the applicable specification sheet, threads shall be in accordance with MIL-S-7742 or MIL-S-8879.

3 4 2 1 Thread start Self-locking nuts with locking feature incorporated and without lubricant, shall allow a "Go" plug gage to enter the nut a minimum of 3/4 turn before engagement of the locking feature.

When lubricant prevents use of standard gages, the nut shall permit free rotational (finger torqued) bolt engagement of at least 3/4 turn.

3 5 Mechanical requirements

3 5 1 Push-out Push-out values for installed clinch nuts shall not be less than the values specified in the applicable specification sheet.

3 5 2 Torque-out Torque-out values for installed clinch nuts shall not be less than the values specified in the applicable specification sheet.

3 5 3 Locking-torque Self-locking clinch nuts shall meet the locking-torque requirements specified in MIL-N-25027, Table III, for ambient temperature only.

3 5 4 Surface roughness The surface roughness of all external surfaces, except knurling, shall not exceed 125 microinches RA as specified in ANSI /ASME B46.1.

3 6 Installation Clinch nuts shall be installed as specified in the applicable specification sheet. Installation forces shall be exerted between parallel faces so that the nut will be installed squarely and the proper embedment of knurled surfaces will result in proper displacement of structure material. Sufficient support shall be provided the structure material during clinching to prevent its collapse.

Self-clinching nuts shall be attached to the structure by pressing and imbedding a knurled or hexagonal configuration into the structure to provide anti-rotation, thereby displacing structure material into the shank undercut to provide push-out resistance. Self-clinching nuts must always be harder than the structure material to obtain proper displacement.

Swage-clinching nuts shall be installed by pressing the nut in a hole sized to produce an interference fit and thereby cause the knurl to broach into the structure to provide anti-rotation. Push-out resistance is developed by flaring the shank into a countersink on the opposite structure side or rolling the shank over on the opposite side.

3 7 Metallurgical properties

3 7 1 Discontinuities Clinch nuts shall not contain discontinuities such as laps, seams and inclusions which equal or exceed the limitations specified herein. Care must be exercised not to confuse cracks with discontinuities. When visual inspection discloses discontinuities which show cause for further examination, inspection shall be as specified in 4 4.

3 7 1 1 Laps and seams Clinch nuts may possess laps and seams. The depth shall not exceed the values specified in Table 1.

3 7 1 2 Inclusions Small inclusions in parts of the clinch nuts which are not indicative of unsatisfactory quality shall not be cause for rejection. The depth shall not exceed the values specified in Table I.

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TABLE I DISCONTINUITY LIMITS

NOM SIZE	DEPTH LIMIT (INCH)	
	SHEET METAL	BAR STOCK
060	004	008
086	004	008
112	004	008
138	005	010
164	005	010
190	005	010
250	005	010
312	005	010
375	006	011
500	008	012

3 7 2 Cracks Clinch nuts shall be free from cracks in any direction or location.

3 8 Workmanship Clinch nuts shall be free of burrs, flaws and other similar defects, and shall be free of corrosion and surface contamination.

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 inspection 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 Quality Conformance Inspection

4 2 1 Inspection of product for delivery Inspection of product for delivery shall be in accordance with the requirements of ASME/ANSI B18 18 2M. Final inspection shall consist of the inspections listed in Table II.

4 2 1 1 Inspection lot An inspection lot shall consist of all clinch nuts covered by a single part number, produced by the same manufacturer under essentially the same conditions and submitted at any one time.

4 2 1 2 Subgroup inspection Subgroup inspection shall consist of the inspections specified in Table II.

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TABLE II Subgroup Inspection

INSPECTION	REQUIREMENT PARAGRAPH	TEST METHOD PARAGRAPH	SAMPLING PROCEDURE
<u>Subgroup 1</u> Protective coating and surface treatment Dimensions Surface roughness	3 1 thru 3 3 3 3 4 1 3 5 4	4 4 3 4 4 1 4 4 1	As specified per ASTM F1470
<u>Subgroup 2</u> Cracks Discontinuities Magnetic Permeability	3 7 2 3 7 1 3.2 2 1	4 4 4 4 4 4	

4 2 1 2 1 Sampling plan. Statistical sampling and inspection for Subgroup 1 shall be in accordance with the criteria called out in ASTM F1470. Sampling and inspection for Subgroup 2 shall be in accordance with the criteria called out in ASTM F1470, and shall be performed on inspection lots that have passed Subgroup 1 inspection requirements.

4 2 1 2 1 1 Rejected lots (Subgroup 1) Rejected inspection may be resubmitted for Government acceptance only if the manufacturer performs 100 percent inspection on the clinch nuts of that lot which was rejected, removes all defective units and resubmits the lot for conformance inspection. Resubmitted lots shall be kept separate from new lots and shall be clearly identified as resubmitted lots. Resubmitted lots shall be inspected using the reinspection criteria specified in ASTM F1470, paragraph 7 3 and shall not thereafter be tested for acceptance unless the former rejection or requirement of correction is disclosed.

4 2 1 2 1 2 Rejected lots (Subgroup 2) If an inspection lot is rejected, the manufacturer may rework it to screen out the defective units, and resubmit for reinspection. Resubmitted lots shall be inspected using the reinspection criteria specified in ASTM F1470, paragraph 7 3 and shall not thereafter be tendered for acceptance unless the former rejection or requirement of correction is disclosed. Such lots shall be separate from new lots and shall be clearly identified as reinspected lots.

4 2 1 2 2 Disposition of sample units. Sample units which have passed all subgroup inspections may be delivered on the contract or purchase order.

4 2 1 3 Noncompliance. If a sample fails to pass the specified inspection plan, the manufacturer shall notify the procuring activity and the cognizant inspection activity of the failure. The manufacturer will take corrective action on the materials or process, or both, as warranted, and on all units of product which can be corrected and which have been manufactured under essentially the same materials and processes and which are subject to the same inspection plan. After the corrective action has been taken, inspection will be repeated on additional sample units (all tests and examinations, or the test which the original sample failed) at the option of the procuring activity.

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4.3 Inspection of packaging The sampling and inspection of the preservation - packaging, packing and container marking shall be in accordance with the requirements of ASTM D3951

4.4 Methods of Inspection

4.4.1 Visual and dimensional The clinch nuts will be examined to verify that physical dimensions, surface roughness and workmanship are in accordance with the applicable requirements of 3.4.1, 3.5.6 and 3.8

4.4.2 Material inspection Material inspection shall consist of certification supporting verifying data that the materials used in fabricating the clinch nut are in accordance with the applicable requirements of 3.2 thru 3.3.4, as called out on the applicable slash sheet

4.4.3 Protective finish inspection Samples taken as specified in ASTM F1470 shall be inspected for adequacy of plating in accordance with paragraph 3.3 and the applicable slash sheets

4.4.4 Cracks Inspection When visual inspection discloses discontinuities which show cause for further examination, the inspection will be performed using 10X magnification per para 3.7.1

4.5 Tests

4.5.1 Sampling for tests Sampling for tests (installation, push - out or torque - out) shall be in accordance with ASTM F1470, Sample level B Sampling for test of locking torque shall be in accordance with ASTM F1470, Sample level C

4.5.2 Test panels Test panels shall be of suitable thickness and hardness for the nut being tested, as specified in the applicable specification sheet

4.5.3 Installation test Samples taken as specified in 4.5.1 shall be installed in test panels specified in the applicable specification sheet Installation shall be in accordance with 3.6 Properly installed samples shall be visually inspected under 10 diameters magnification Evidence of cocking, looseness, splits or cracks shall be cause for rejection When applicable, depth of embedment shall be measured using standard inspection equipment

4.5.4 Push-out test Samples taken as specified in 4.5.1 shall be installed in test panels specified in the applicable specification sheet Installation shall be in accordance with 3.6 A mating test screw or bolt shall be engaged in the nut The push-out load shall be steadily applied to the test screw or bolt directly in line with the axis of the nut thread (see figure 1) Sufficient support shall be provided for the test panel to prevent its collapse Failure of the clinch nuts to withstand the push-out loads specified on the applicable specification sheet without loosening, cracking or thread damage shall be cause for rejection

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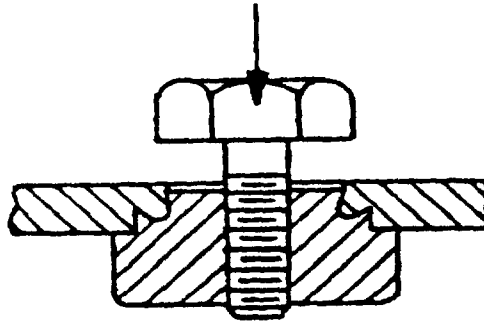
APPLIED LOAD

FIGURE 1
Push out test

4 5 5 Torque-out test Samples taken as specified in 4 5 1 shall be installed in test panels specified in the applicable specification sheet. Installation shall be in accordance with 3 6. A mating test screw, bolt or torque stud shall be engaged in the nut and shall be provided with a shoulder, whose diameter is less than the diameter of the mounting hole, to seat against the base of the nut. The threads of the test screw, bolt or torque stud shall extend through the nut sufficiently to accept a check nut. The check nut shall be torqued against the top of the nut being tested to resist the torque-out test. Torque shall be applied with a torque measuring device to the engaged screw, bolt or torque stud in a clockwise direction. Failure of the clinch nuts to withstand the torque-out loads specified on the applicable specification sheet without loosening, turning or thread damage shall be cause for rejection.

4 5 6 Locking-torque test Samples taken as specified in 4 5 1 shall be subjected to a locking torque test (self-locking clinch nuts only). The test shall be conducted as specified in MIL-N-25027 to determine conformance to 3 5 3.

4 5 7 Protective and Finish Examination and test of protective finish shall be in accordance with the applicable specification 3 3.

4 5 8 Magnetic Permeability Corrosion-resistant steel shall have a magnetic permeability of 2 0 maximum (using air = 1 0 as a reference point) for a field strength of $N = 200$ oersteds when tested using an indicator in accordance with ASTM A345, Test Method 5.

5 PACKAGING

5 1 Packaging Requirements The requirements for packaging shall be in accordance with ASTM D3951 or as specified in contract or purchase order.

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6 NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory)

6 1 Intended use Clinch nuts covered by this specification are intended as permanent or captive type nuts installed into the parent structure by compression, swaging or flaring. Clinch nuts are intended to provide a more durable thread for disassembly and assembly in secondary and non-structural applications.

6 1 1 Clinch nuts should not be used in magnesium parent material.

6 2 Acquisition requirements Acquisition documents should specify the following:

- a Title, number and date of this general specification
- b Issue of DODISS to be cited in the solicitation, and if required, the specific issue of the individual documents referenced (see 2 1 1 & 2 2)
- c Title, number and date of applicable specification sheet or Military Standard
- d Applicable part number
- e Selection of applicable levels of packaging and packing (5 1)

6 3 Definitions

6 3 1 Crack A crack is a clean crystalline break passing through the grain or grain boundary without the inclusion of foreign elements.

6 3 2 Lap A lap is a surface defect appearing as a seam, caused by folding over of metal fins or sharp corners and then rolling or forging them into the surface, but not welding them.

6 3 3 Seam A seam is an unwelded fold or lap which appears as an opening in the raw material as received from the source.

6 3 4 Inclusions Inclusions are non-metallic materials in a solid metallic matrix.

6 4 Subject term (keyword) listing

- nut, plain, clinch
- nut, self-locking, clinch
- lubricant, solid film
- insert, non-metallic
- insert, nylon

6 5 Changes from previous issues Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

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Custodians

Army - AR

Navy - OS

Preparing activity

DLA - IS

Project No 5310 - 1982

Reviewer activities

Army - AV, AT, GL, ME

Navy - AS, MC, SH

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