

FED. SUPPLY CLASS

5320

1. SCOPE

1.1 Scope. This specification establishes the requirements for installation formed high strength, alloy steel blind fasteners.

1.2 Classification. Fasteners furnished under this specification shall be of the following types:

Type I Pull Type – Positive Mechanically Locked (see 6.4)

Type II Threaded – Self Locking (see 6.4)

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in Sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in Sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 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

Department of Defense

MIL-L-46010 — Lubricant, Solid Film, Heat Cured, Corrosion Inhibiting

MIL-L-87132 — Lubricant, Cetyl Alcohol, 1 Hexadecanol, Application to Fasteners

(See Supplement 1 for applicable specification sheets.)

STANDARDS

Federal

FED-STD-66 — Steel: Chemical Composition and Hardenability

Department of Defense

MIL-STD-129 Military Marking for Shipment and Storage

MIL-STD-889 Dissimilar Metals

② MIL-STD-2073-1 Standard Practice for Military Packaging

(See Supplement 1 for applicable military standards.)

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Defense Automated Printing Service, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094

② <http://quicksearch.dla.mil>

THE INITIAL RELEASE OF THIS DOCUMENT SUPERSEDES MIL-F-81177, REVISION E, AMENDMENT 3.

THIRD ANGLE PROJECTION	CUSTODIAN NATIONAL AEROSPACE STANDARDS COMMITTEE	REVISION 2
PROCUREMENT SPECIFICATION NONE	TITLE FASTENERS, BLIND, HIGH STRENGTH, INSTALLATION FORMED, ALLOY STEEL, GENERAL SPECIFICATION FOR	CLASSIFICATION SPECIFICATION NASM81177 SHEET 1 OF 23

- 2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the 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 those of the documents cited in the solicitation (see 6.2).

SAE International

AIR4127	Steel: Chemical Composition and Hardenability
AMS-QQ-P-416	Plating, Cadmium (Electrodeposited)
AMS2700	Passivation Treatments for Corrosion-resisting Steel
AMS2759	Heat Treatment of Steel Parts, General Requirements
AMS5690	Steel Wire, Corrosion and Heat Resistant, 17Cr - 12Ni - 2.5Mo (SAE 30316)
AMS5737	Bars, Forgings, and Tubing - 15Cr - 25.5Ni - 1.2Mo - 2.1 Ti
AS5272	Lubricant, Solid Film, Heat Cured, Corrosion Inhibiting
AS87132	Lubricant, Cetyl Alcohol, 1 Hexadecanol, Application to Fasteners

Copies can be obtained from SAE International, 400 Commonwealth Dr., Warrendale, PA 15096-0001 www.sae.org

ASTM International

ASTM A108	Steel Bar, Carbon and Alloy, Cold-Finished
ASTM A331	~~Steel Bars, Alloy, Cold Finished~~
ASTM E1417/E1417M	Standard Practice for Liquid Penetrant Examination (2)
(2) ASTM E1444/E1444M	Standard Practice for Magnetic Particle Inspection
ASTM D3951	Standard Practice for Commercial Packaging

Copies can be obtained from ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA, 19428-2959 USA www.astm.org

ASME

ASME B46.1	Surface Texture (Surface Roughness, Waviness and Lay)
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Copies can be obtained from ASME, Three Park Ave., New York, NY 10016-5990 www.asme.org

American Society for Quality

ASQ Z1.4	Sampling Procedures and Tables for Inspection by Attributes
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Copies can be obtained from the American Society for Quality, 600 North Plankinton Ave., Milwaukee, WI 53203 www.asq.org

Aerospace Industries Association

NAS672	Plating, High Strength Steels, Cadmium
NASM1312	Fastener Test Methods

Copies can be obtained from the Aerospace Industries Association, 1000 Wilson Blvd., Suite 1700, Arlington, VA 22209 www.aia-aerospace.org

(Industry association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal Agencies.)

- 2.4 Order of precedence. In the event of a conflict between the text of this document and the 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.

3. REQUIREMENTS

- 3.1 Specification sheets and standards. 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 or standard, the latter shall govern.
- 3.2 Verification of compliance. Manufacturers shall verify that fasteners furnished under this specification meet specified requirements (see 4.3).
- 3.2.1 Retention of verification of compliance. Manufacturers shall maintain on file certified test reports (see 4.3.1) available for inspection by the procuring activity.
- 3.3 Design and construction. Type I.
- 3.3.1 Design. The fastener shall be of multiple-piece construction. It shall be an integral assembly and shall include a means, other than friction, of mechanically locking the serrated pin to the fastener body.
- 3.3.2 Construction. The fasteners shall consist primarily of a sleeve and a serrated pin with additional parts to lock the pin to the sleeve.
- 3.3.2.1 Locking feature. The locking feature shall be a secured component of the fastener assembly and shall not become disassembled during assembly or normal handling. Locking collars may be slotted for ease of assembly. Slot width shall not exceed .020 inch after assembly.
- 3.3.3 Installation. Installation of the fastener shall be accomplished by the action of the serrated pin being pulled into the sleeve, forming a blind head on the back side of the assembly, and removing the pulling portion of the pin after the locking feature has been installed. The pin protrusion of the driven fastener shall be within limits shown on Figure 1 and Table I. The fastener shall meet the performance requirements of this specification when installed with the tools listed in Appendix "A". No additional lubricant shall be used on the fastener. A means of visual inspection for proper installation shall be provided. Pin and collar position shall be as specified in Table I and Figure 1.
- 3.3.4 Blind head diameters (installed). When driven in minimum grip, the blind head of the installed fastener shall have a minimum diameter as specified in Table I.
- 3.3.5 Grip lengths increments. Grip lengths for all fastener diameters shall be in 0.0625-inch increments and conform to the applicable NAS specification sheet or standard.
- 3.3.6 Dimensions. After plating and finishing, fastener dimensions shall conform to the applicable NAS standards (see 4.5.1).
- 3.3.7 Roundness and concentricity of heads. Fastener heads shall be round and concentric within the limits specified in Table II (see 4.5.1).
- 3.3.8 Materials. The materials used in the manufacture of the high strength, blind fastener shall be as follows:
- Sleeves and serrated pins shall be alloy steel in accordance with ~~ASTM A331~~ ASTM A108. The mechanical lock collar shall be of carbon steel or alloy steel conforming to the chemical composition of 1010, 1020, 1144, 4037 or 4130 of ~~FED-STD-66~~ AIR4127 or A286 conforming to the chemical requirements of AMS5737, or Type 316 CRES conforming to the chemical requirements of AMS5690.
- 3.3.8.1 Dissimilar metals. The use of dissimilar metals in fabrication of fasteners shall conform to MIL-STD-889.
- 3.3.9 Heat treatment. Heat treatment of alloy steel components shall be in accordance with AMS2759.
- 3.3.9.1 Hardness. All alloy steel sleeves shall be within Knoop 326 to 466 employing a 1000 gram load when tested in the core of the head at the center of head cross section (see 4.5.5). Alloy steel serrated pins shall be within 48-53 HRC (see 4.5.3).

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- 3.3.9.2 Carburization and decarburization. Alloy steel serrated pins shall meet the requirements of AMS2759 for carburization and decarburization. Alloy steel sleeves shall show no more than .020 inch total decarburization (complete plus partial) (see 4.5.5).
- 3.3.10 Passivation. All corrosion and heat-resistant steel components shall be passivated in accordance with AMS2700, Method 1, Class 4.
- 3.3.11 Protective treatment. Alloy steel sleeves, alloy steel mechanical lock collars, and carbon steel mechanical lock collars shall be cadmium plated in accordance with AMS-QQ-P-416, Type II, Class 2. Alloy steel serrated pins shall be cadmium plated in accordance with AMS-QQ-P-416, Type I or Type II, Class 3.
- 3.3.11.1 Hydrogen embrittlement relief. The alloy steel serrated pins shall be heated to 375 ± 25 °F within 4 hours after plating, and held at this temperature for not less than 23 hours.
- 3.4 Discontinuities, Type I (see 4.5.2).
- 3.4.1 Seam and tool marks. Except as specified in 3.4.1.1 and 3.4.2, fasteners may possess seams and tool marks that do not exceed the limits of Table III on any of the components of the fastener.
- 3.4.1.1 Fastener head. The fastener head shall not have more than three openings, seams, inclusions, nicks, or gouges in the following areas:
- On the top of the fastener head exceeding twice the depth limits shown in Table III.
 - On the periphery of the fastener head exceeding four times the depth limits shown in Table III for protruding and flush head fasteners.
 - On the bearing surface of the head to depths exceeding Table III values.
- The bearing surface shall not be mutilated to the degree that it will prevent firm seating.
- 3.4.2 Head shank junction. Only longitudinal seams not exceeding the limits of Table III shall be permitted. Slight tool marks or undercuts of depth not exceeding the limits of Table III will be permitted, provided they fair into the shank with no sharp scratches, gouges, or corners.
- 3.5 Mechanical properties, Type I.
- 3.5.1 Ultimate single shear strength. The ultimate single shear strength of the driven fastener shall be as specified in Table IV (see 4.6.2).
- 3.5.2 Ultimate tensile strength. The ultimate tensile strength of the driven fastener shall be as specified in Table IV (see 4.5.4).
- 3.5.3 Tensile preload. The driven fastener shall be capable of a tensile preload as specified in Table IV (see 4.5.4).
- 3.5.4 Tension-tension fatigue. The fastener shall withstand an average of not less than 60,000 cycles, but no single specimen shall fail in less than 40,000 cycles. The test may be discontinued on any single fastener under test if the fastener does not fail below 200,000 cycles (see 4.6.3). No value above 200,000 shall be used in calculating the average.
- 3.5.5 Pin retention. The pin of a driven fastener shall withstand a steadily applied axial push out minimum load as shown in Table V (see 4.6.4).
- 3.5.6 Sheet take-up. The fasteners shall have sufficient sheet take-up or pull-together to meet the requirements of Table V, when tested in steel plates having a total thickness equal to maximum grip of fastener (see 4.5.6).

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- 3.5.7 Stress durability (pin). The pin shall not fail when subjected to the stress durability test values in Table V (see 4.6.5).
- 3.6 Design and construction, Type II.
- 3.6.1 Construction. The fastener shall be constructed of three separate components (nut body-corebolt-sleeve) assembled as an integral single unit. A visible means shall be provided to lock the installed components together. The dimensions, concentricity, roundness and marking requirements shall be as specified on the applicable specification sheet or standard.
- 3.6.2 Installation. The fastener shall be installed by threading the corebolt into the nut, forming the sleeve into a blind head on the back side of the assembly and thereafter breaking off the wrenching portion of the corebolt.
- The fastener when installed with the applicable driving tool shall meet the visual acceptance criteria of Figure 4. The fastener shall also meet the corebolt break off limits, the formed sleeve outside diameter, the backside protrusion, and the seating torque as specified in Table XI and Figure 3. The driving tool shall be of a type listed in Appendix B (see 4.7.1). A means of visual inspection for proper installation shall be provided.
- 3.6.3 Component heads. The heads of all corebolts and nuts shall be forged.
- 3.6.4 Threads. The threads shall be left hand and the corebolt thread shall be formed by a single rolling process. Thread form, contour and dimensions are optional.
- 3.6.5 Material. Fasteners furnished to this specification shall be constructed of the following materials:
- 3.6.5.1 Nut and corebolt: The nut and corebolt shall be alloy steel in accordance with the applicable specification sheet.
- 3.6.5.2 Sleeve: The sleeve shall be corrosion and heat resistant steel or nickel base alloy in accordance with the applicable specification sheet.
- 3.6.6 Heat treatment. Heat treatment of all components shall be as required to meet the strength requirements and metallurgical properties defined herein.
- 3.6.6.1 Hardness. All alloy steel components shall be within the hardness range specified on the applicable specification sheet (see 4.5.3).
- 3.6.6.2 Surface effects. When examined in accordance with 4.5.5, alloy steel components shall show no evidence of carbon enrichment, nitrogenization or complete decarburization. Partial decarburization shall be not greater than a depth of .003-inch on the bearing surface of the heads, head shank fillets, or threads. The average of three microhardness readings taken at the thread root shall be within 30 Knoop numbers of the average of three readings taken at the centerline (see Figure 5).
- 3.6.7 Protective treatment.
- 3.6.7.1 Nut and corebolt. The nut and corebolt shall be cadmium plated in accordance with NAS672, with supplementary chromate treatment in accordance with AMS-QQ-P-416.
- 3.6.7.2 Sleeve. The sleeve shall be cadmium plated in accordance with AMS-QQ-P-416, Type II, Class 2.
- 3.6.8 Lubricant. Lubricant may be used on any component to improve driving, provided the lubricant is not detrimental to the corrosion-resisting capabilities of the fastener. The lubricant may be cetyl alcohol in accordance with MIL-L-87132 AS87132, WWM carbo-wax or dry film lubricant in accordance with MIL-L-46010 AS5272.
- 3.7 Discontinuities, Type II (see 4.5.2).
- 3.7.1 Cracks. Fastener components shall be free of cracks in any direction or location. A crack is defined as a clean crystalline break passing through the grain boundary with or without the inclusion of foreign elements.

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- 3.7.2 Laps and Seams. Fastener components may possess laps and seams not exceeding the depths specified in Table VIII, except in prohibited locations (see Figure 2).
- 3.7.2.1 Nuts. Discontinuities shall not be permitted in the head to shank fillet. Laps, seams, nicks and gouges are acceptable on the non-bearing surface of head provided the depth does not exceed two times the value specified for the nut component in Table VIII.
- 3.7.2.2 Corebolts. Discontinuities shall not be permitted in the head to shank fillet. Thread laps which are not permissible and thread laps which are permissible within the limits of Table VIII are illustrated in Figure 2. Laps, seams, nicks and gouges are acceptable on the non-bearing surface of head provided the depth does not exceed three times the value specified for the bolt components in Table VIII.
- 3.7.2.3 Sleeves. The sleeves shall contain no longitudinal discontinuities.
- 3.8 Mechanical properties, Type II.
- 3.8.1 Ultimate double shear strength. The shear strength of the fastener shall be as specified in Table IX (see 4.7.2).
- 3.8.2 Ultimate tensile strength. The tensile strength of the driven fastener shall be as specified in Table IX (see 4.5.4).
- 3.8.3 Tensile preload. The driven fastener shall develop tensile preload values as specified in Table IX (see 4.5.4).
- 3.8.4 Tension-tension fatigue. The fastener shall withstand an average of not less than 30,000 cycles, but no single specimen shall fail in less than 15,000 cycles (see 4.7.3 and Table X). The test may be discontinued on any single fastener under test if the fastener does not fail below 100,000 cycles. No value above 100,000 shall be used in calculating the average.
- 3.8.5 Sheet take-up. The fasteners shall have sufficient sheet take-up or pull-together to meet the requirements of Table X when tested in steel plates having a total thickness equal to maximum grip of bolts (see 4.5.6).
- 3.8.6 Vibration. Specimens prepared and tested as specified (see 4.7.4) shall withstand not less than 30,000 cycles without failure. The relative rotation of the nut and corebolt shall not exceed 360 degrees. The fastener shall not develop any cracks or broken segments.
- 3.8.7 Locking torque. The assembled fasteners shall develop locking torque values equal to or greater than the minimum required torque in accordance with Table X (see 4.7.5).
- 3.8.8 Stress durability. The fastener shall not fail when subjected to the stress durability test (see 4.7.6).
- 3.8.9 Workmanship. The fastener shall be free from burrs, scale, excessive seams, and other defects which would interfere with their intended use.

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 purchase 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 procuring activity. The procuring activity 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.

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

- (a) Verification of Compliance (see 4.3)
- (b) Quality Conformance inspection (see 4.4)

4.2.1 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified (applicable test method document of applicable paragraph(s) in this specification).

4.3 Verification of compliance. Manufacturers shall verify that fasteners comply with or exceed the following requirements:

Type I – Tensile Preload, Sheet Take-Up, and Tension-Tension Fatigue as specified in paragraphs 3.5.3, 3.5.6 and 3.5.4 respectively.

Type II – Stress Durability, Tension-Tension Fatigue, Sheet Take-Up, and Vibration as specified in paragraphs 3.8.8, 3.8.4, 3.8.5 and 3.8.6 respectively.

4.3.1 Certified test reports. Manufacturers shall maintain on file certified test reports indicating that both Verification of Compliance and Quality Conformance tests are met. Each report shall be available to the buyer upon request.

Samples for qualification testing

FASTENER, BLIND, HIGH STRENGTH, INSTALLATION
FORMED, ALLOY STEEL

Name of manufacturer
Manufacturer's part number
Submitted by (name) (date) for qualification testing in
accordance with NASM81177 under authorization
(reference letter of authorization)

Qualification of the flush head configuration constitutes qualification of the equivalent protruding head configuration; except on Type I, tensile strength and tension-tension fatigue tests shall be performed on both head types.

4.4 Quality conformance inspection. Quality conformance inspections shall consist of all the examinations and tests listed in Table XII for Type I and Table XIII for Type II.

4.4.1 Inspection lot. An assembly inspection lot shall consist of finished assembled components of the same configuration, diameter, and heat of material. The inspection lot assemblies and their components shall have been manufactured under the same conditions, heat treated in the same manner in one continuous run, and presented for delivery at the same time.

4.4.1.1 Plating lot. A plating lot shall consist of all parts cadmium plated in the plating tank in any one 24 hour period. Cadmium plating shall be in accordance with AMS-QQ-P-416 or NAS672, as applicable.

4.4.2 Sampling. Samples shall be selected at random in accordance with ASQ Z1.4, Inspection Level and Acceptance Quality Level (AQL) as specified in Table XII for Type I and Table XIII for Type II. Identical sample items may be used for any of the tests, provided selection of random samples is maintained and known characteristics of the sample are not used to influence the integrity of the test results. Reduced sampling level shall be instituted after five consecutive lots have passed the acceptance criteria.

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