

FED. SUPPLY CLASS

5306

1. SCOPE AND CLASSES

- 1.1 This specification defines the requirements for alloy steel externally threaded fasteners procured under part numbers listed on drawings which refer to this specification. Typically these fasteners are used for tension, shear, and tension-fatigue applications where 180 KSI Ft_u and 108 KSI Fs_u is desired with a service temperature capability to 450 °F. Receiving contractors may reject any manufacturing lot which does not conform.
- 1.2 The specification includes mechanical property requirements for two classes of fasteners as follows:
Type I – Tension head (hex, double hex, 12 spline, etc. without an internal or recess drive) and studs.
Type II – 100° full flush head and internal wrenching (pan, fillister, brazier, etc.) head configuration.
- 1.3 Workmanship of fasteners shall conform with aircraft fastener manufacturing processes.
- Recommendations for improvements or corrections to this specification should be directed to an NASC representative of a using company or to the Executive Secretary of the National Aerospace Standards Committee.
- 1.4 Specifications listed herein, of the issue in effect on date of inquiry, are a part of this specification to the extent indicated. In the case of conflict, the requirements herein shall take precedence.
- 1.5 Unless otherwise specified, part inventory manufactured to MIL-B-8831 or previous revisions of the applicable drawing or specification may be procured and used until stock is depleted.

2. APPLICABLE DOCUMENTS

2.1. INDUSTRY STANDARDS

2.1.1 SAE International

AMS2759	Heat Treatment of Steel Parts, General Requirements
AMS6322	Steel Bars, Forgings, and Rings, 0.5Cr-0.55 Ni-0.25Mo (0.38-0.43C) (SAE8740)
AMS6415	Steel Bars, Forgings, and Tubing, 0.80Cr-1.8Ni-0.25Mo (0.38-0.43C) (SAE4340)
AMS6484	Steel Bars, Forgings, and Tubing, 0.80Cr-1.8Ni-0.25Mo (0.38-0.43C) (SAE4340)
	Normalized and Tempered
AMS-QQ-P-416	Plating, Cadmium (Electrodeposited)
~~AMS-H-6875~~	~~Heat Treatment of Steel Raw Materials~~
AS8879	Screw Threads – UNJ Profile, Inch, Controlled Radius Root with Increased Minor Diameter

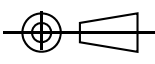
Copies can be obtained from SAE International, 400 Commonwealth Dr., Warrendale, PA 15096-0001. www.sae.org

2.1.2 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

The initial release of this document supersedes MIL-B-8831, Revision B, Amendment 2.

THIRD ANGLE PROJECTION	CUSTODIAN	REVISION
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PROCUREMENT SPECIFICATION	TITLE	CLASSIFICATION SPECIFICATION
NONE	FASTENERS, ALLOY STEEL, 450 °F EXTERNALLY THREADED, 180 KSI Ft _u , 108 KSI Fs _u , FATIGUE RATED	NASM8831

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2.1.3 American Society for Quality

ASQ Z1.4 Sampling Procedures and Tables for Inspection Attributes

Copies can be obtained from the American Society for Quality, 600 North Plankinton Ave., Milwaukee, WI 53203.
www.asq.org

2.1.4 ASTM International

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| ASTM E112 | Grain Size, Standard Test Methods for Determining Average |
| ASTM E140 | Standard Hardness Conversion Tables for Metals |
| ASTM E340 | Standard Test Methods for Macroetching Metals & Alloys |
| ASTM E407 | Standard Test Practice for Microetching Metals & Alloys |
| ASTM E1444 | Standard Practice for Magnetic Particle Testing |

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

2.1.5 AEROSPACE INDUSTRIES ASSOCIATION

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| NAS672 | Plating – High Strength Steels – Cadmium |
| NAS1348 | Fasteners – Recommended Tensile Stress Areas for Externally |
| NAS9800 | Head Protrusion Gaging 100° Flush Head Fastener Gage Block, Gage Diameters, and Stylus |
| NASM1312 | Fastener Test Methods |
| NASM1312-1 | Fastener Test Methods, Method 1, Salt Spray |
| NASM1312-5 | Fastener Test Methods, Method 5, Stress Durability |
| NASM1312-6 | Fastener Test Methods, Method 6, Hardness |
| NASM1312-8 | Fastener Test Methods, Method 8, Tensile Strength |
| NASM1312-11 | Fastener Test Methods, Method 11, Tension Fatigue |
| NASM1312-12 | Fastener Test Methods, Method 12, Thickness of Metallic Coatings |
| NASM1312-13 | Fastener Test Methods, Method 13, Double Shear Test |
| NASM1312-20 | Fastener Test Methods, Method 20, Single Shear Test |
| NASM1312-25 | Fastener Test Methods, Method 25, Driving Recess Torque, Quality Conformance Test |
| NASM14191 | Recess, Offset Cruciform, Ribbed, Dimensions of Recess, Gage and Driver for |
| NASM33750 | Recess, Dovetail and Conical Dovetail, Dimensions of Recess, Gage and Driver for |
| NASM33781 | Recess, Offset Cruciform, Dimensions of Recess, Gage and Driver for |

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

2.2 GOVERNMENT STANDARDS

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| FED-STD-H28 | Screw-Thread Standards for Federal Services |
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Copies can be obtained from the Department of Defense Single Stock Point (DODSSP). <http://assist.dla.mil>

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TABLE I – BASIC REQUIREMENTS

CHARACTERISTICS	ENGINEERING REQUIREMENTS	TESTING REQUIREMENTS (SEE 3.1)	
		TEST METHOD	SAMPLING PLAN
MATERIAL	Alloy Steel per; AMS6322 (8740) AMS6415 (4340) AMS6484 (4340)	Per material specification. Spectrographic analysis for routine checking. Chemical analysis for doubtful material.	Check material composition for 25% (or more) of the parts used for metallurgical examination. Not mandatory.
DIMENSIONS	Per fastener part standard.	Conventional measuring methods.	TABLES XI and XII.
SQUARENESS OF HEAD BEARING TO SHANK DIA.	Figure 3.		
SHANK STRAIGHTNESS	TABLE VII.		
CORNERS & EDGES	Remove all burrs and sharp edges. Break edges and corners .003 min to .016 max.		
FLUSH HEAD	Per fastener drawing or part standard.	Per NAS9800.	TABLES XI and XII.
RECESS DRIVE		Conventional measuring methods.	TABLE XIII.
SURFACE TEXTURE		Per ASME B46.1 by visual or fingernail comparison. In case of controversy, check accessible surface areas using a profilometer.	TABLE XII, 1.0% AQL.
IDENTIFICATION		Raised or depressed, measured by conventional method(s), not to exceed min or max requirements. Visual check for legibility.	TABLES XI and XII.
THREADS	Shall be rolled subsequent to thermal treatment except for bake requirements after plating or coating (see Grain Flow and Figure 2). Unless otherwise specified, dimensions and form per AS8879 except major diameter may be limited by part standard. Incomplete threads per Figures 7 and 8.	Conventional measuring methods. See Figures 7 and 8.	
HEAD TO SHANK FILLET AREA	Parts Ø.1900 and larger shall be cold worked subsequent to all thermal treatment except bake after plating or coating. The fillet radius shall conform to the part standard but may be distorted per Figure 4. Parts threaded to the head do not require cold working.	Measurement by use of a comparator in a minimum of two places.	TABLES XIII.
HEAT TREATMENT	Per ~~AMS-H-6875~~ AMS2759. Shall develop mechanical properties as defined herein without adverse effect on metallurgical properties as defined herein.	Test of mechanical and metallurgical properties verifies heat treatment.	As indicated for each test requirement.
HARDNESS	Individual hardness readings shall be within the limits of 39 to 43 HRC (or equivalent per ASTM E 140). TABLE III: /e/.	Hardness test per MIL-STD-1312-6 in accordance with NASM1312-6. TABLE I: /a/ (5)	Destructive test per TABLE XIII, 3.5% to 0.7% AQL. Non-destructive test per TABLE XII, 0.15 AQL.

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TABLE I – BASIC REQUIREMENTS (CONT)

CHARACTERISTICS	ENGINEERING REQUIREMENTS	TESTING REQUIREMENTS (SEE 3.1)	
		TEST METHOD	SAMPLING PLAN
TENSILE STRENGTH	Minimum tensile strength per TABLE III. TABLE III: /a/	Static test per MIL-STD-1312-8 in accordance with NASM1312-8. (5)	TABLE XV.
SHEAR STRENGTH	Minimum strength per TABLE III. TABLE III: /d/	Double shear test per MIL-STD-1312-13 in accordance with NASM1312-13. If fastener is too short for double shear test, use HRC value per TABLE III: /d/ or single shear test per MIL-STD-1312-20 in accordance with NASM1312-20. (5)	TABLE XV.
FATIGUE TEST	Fasteners shall pass the fatigue cycle requirements per TABLE XVI when subjected to the loads per TABLE IV.	Fatigue test per MIL-STD-1312-11 in accordance with NASM1312-11. (5)	TABLE XVI.
RECESS TORQUE	Fasteners with NASM14191, NASM33750, & NASM33781 recesses shall be capable of developing the recess torque values specified in TABLE V.	Recess torque test per MIL-STD-1312-25 in accordance with NASM1312-25 to the requirements of TABLE V: /a/ /b/ /c/ /d/. Test in both installation and removal directions. (5)	TABLE XIII.
METALLURGICAL	No cracks permitted in any location. A crack is a clean crystalline break passing through the grain or grain boundary. Other discontinuities permitted only as described in TABLES II and IX.	By longitudinal & circular method per ASTM E 1444. Perform magnetic inspection after cadmium plating. Magnetic inspection is not required on fasteners with thread size smaller than .190.	100% Inspection
UNTEMPERED MARTENSITE	Untempered martensite (or transformed structure) is an acceptable condition only when: (1) condition is not found in root of threads or head to shank fillet, (2) condition does not produce discontinuities or burrs which result in out of tolerance dimensions, (3) does not exceed depth allowed for laps or thread crest discontinuities per TABLE IX, and (4) a crack(s) is not found in any location.	Metallurgical examination. See 3.3. Strip plating and etch in 2% to 5% Nital solution. Examine at 10X to 100X.	TABLE XIV
GRINDING BURNS	None permitted on shank, head to shank fillet, threads, or bearing surface of head.		Use samples from metallurgical examination and untempered martensite.

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TABLE I – BASIC REQUIREMENTS (CONT)

CHARACTERISTICS	ENGINEERING REQUIREMENTS	TESTING REQUIREMENTS (SEE 3.1)	
		TEST METHOD	SAMPLING PLAN
MICROSTRUCTURE	Shall be free from bursts, voids, and overheating. Alloy segregation which adversely affects the mechanical or physical properties is not acceptable.	Specimens shall be cut per Figure 1, etched per ASTM E 340 and ASTM E 407, and examined per 3.3.	TABLE XIV
HYDROGEN EMBRITTLEMENT	From each manufacturing lot, no cracks or fracture of any parts subject to stress durability test. Parts plated per AMS-QQ-P-416: ~~stress durability test of each manufacturing lot per the loads as stated in AMS-QQ-P-416.~~ (5) Type I and Type II fasteners - Test load shall be 85% of the minimum tensile strength per TABLE III.	MIL-STD-1312-5, external load method, in accordance with NASM1312-5. Load shall be maintained for 23 hours. When the test load requirement is greater than the limits of the external load test equipment, the MIL-STD-1312-5 elongation or strain gage load methods shall be used. (5)	
CARBURIZATION OR DECARBURIZATION	None permitted on head bearing surface, head to shank fillet area, shank, or threads. All other areas per TABLE II.	Metallurgical examination. See 3.3. Strip plating and etch in 2% to 5% Nital solution. Examine at 10X to 100X. Referee method per Table I: /c/.	
GRAIN GROWTH	Grain size in vicinity of head or threads shall not differ from grain size in shank by more than one size (as defined in ASTM E 112).	Metallurgical examination. See 3.3.	
GRAIN FLOW THREAD	Grain flow indicative of thread forming subsequent to thermal treatment as represented by Figure 2.	Metallurgical examination. See 3.3.	
HEADS	Heads shall be forged. Grain flow lines may vary depending upon head configuration. However any metallurgical condition which adversely affects the mechanical properties of the part is not acceptable.	Metallurgical examination. See 3.3.	AMS-QQ-P-416. NAS672.
FINISH	As specified in the part standard. If AMS-QQ-P-416 or NAS672 cadmium plating is specified in the part standard, the test methods shall be as stated herein.	Salt spray, adhesion and plating thickness per AMS-QQ-P-416. The referee test method for plating thickness shall be MIL-STD-1312-12, Microscopic Method, in accordance with NASM1312-12. (5) Salt spray, adhesion and plating thickness per NAS672. The referee test method for plating thickness shall be MIL-STD-1312-12, Microscopic Method, in accordance with NASM1312-12. (5)	

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TABLE I – BASIC REQUIREMENTS (CONT)

CHARACTERISTICS	ENGINEERING REQUIREMENTS	TESTING REQUIREMENTS (SEE 3.1)	
		TEST METHOD	SAMPLING PLAN
PACKAGING	Package to prevent nicking, scratching of threads or ground surfaces, or other damage during handling, transportation or storage. Unit packages must contain fasteners of one part number from one manufacturing lot. An assortment of unit packages may be in larger packages. Packaging must allow for economical transportation.	Visual examination.	Not applicable.
MARKING	Fasteners shall be identified in accordance with the applicable part standard. Shipping packages and containers shall be marked in a durable and legible manner, located so it will not be damaged. Marking on shipping packages will include at least the following: Part number, purchase order number, and manufacturer's inspection lot number.	Visual examination.	Not applicable.

- /a/ The well prepared surface and procedure required by MIL-STD-1312-6, is a destructive test and shall be applied to all lots as follows: Fasteners which pass the shear test may be accepted for hardness on the basis of a non-destructive test, which may be applied to the threaded end before plating. In the case of controversy over non-destructive hardness readings, destructive hardness test shall be the referee method.
- (b) Parts that are plated with a non magnetic plating strike or a plated finish shall be magnetic inspected prior to any plating. All other inspection and testing requirements shall be performed on the finished product.
- /c/ Microhardness tests per MIL-STD-1312-6, except as noted, are required for referee purposes. Indenter test load shall be 200 to 500 grams. The microhardness along the fastener axis represents the core hardness. The microhardness within .003 inch of the surface represents the surface hardness. A surface hardness which is greater than the core hardness by 20 units or more diamond pyramid hardness (DPH) or knoop hardness number (KHN) shall be evidence of carburization, untempered martensite or grinding bums. A surface hardness which is less than the core hardness by 40 units or more DPH or KHN shall be evidence of decarburization. Any relative soft subsurface layer indicated by microhardness survey shall be evidence of recarburization.

3. INSPECTION

- 3.1 INSPECTION TESTS, listed in TABLE I, are required on each lot as defined in 3.1.1, for the fastener manufacturer. Receiving contractor may apply any or all tests, specified herein, to any production lot on fasteners, at any time, to verify conformance of the lot.
- 3.1.1 INSPECTION LOT: Shall consist of parts which are of the same configuration, diameter, and head style, fabricated from the same mill heat of material; heat treated and finished in one continuing process or single batch, and submitted for the manufacturer's inspection at the same time. Each inspection lot shall be identified by a number to be included in the packaging marking.
- 3.1.2 INSPECTION REPORT: Each shipment shall be accompanied by an inspection report as a part of or separate from the shipment notice. If more than one inspection lot is included in the shipment, a separate inspection report is necessary for each inspection lot and unit packages must clearly identify the applicable lot. The report(s) shall be in duplicate and be signed by an authorized employee of the shipper. This report shall provide the following:

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