

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 160 KSI Ft_u and 95 KSI Fs_u is desired with a service temperature capability to 450 °F.
 - 1.2 Requirements stipulated in purchase contracts, purchase orders, part standards and/or part drawings shall take precedence over requirements stated herein. Receiving contractors may reject any lot which does not conform.
 - 1.3 The specification includes mechanical property requirements for three classes of fasteners, Types I, II and III.

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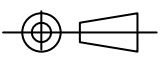
Type I - Tension head (hex, double hex, etc.) without a recess drive, long thread, (i.e. NAS6603-6620)
Type II - Tension head (hex, double hex, etc.) without a recess drive, short thread (i.e. NAS6203-6220)
100° Full flush head, long or short thread (i.e. NAS1580A)
Pan head, long or short thread (i.e. NAS1578A)
Fillister head, long or short thread (i.e. NAS1121-1128)
Full thread (threaded to the head) (i.e. NAS1801)
Type III - 100° Reduced flush head, long or short thread (i.e. NAS1581)
 - 1.4 Workmanship of fasteners shall be in conformance with aircraft fastener manufacturing processes.
 - 1.5 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.
 - 1.6 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.
 - 1.7 Should a using company require qualification testing for any product specifying this document, a report for the specific product and product diameter shall be generated by the product manufacturer from product of sufficient shank and thread length to yield inspection and test data for all requirements in TABLE I including tests categorized as not mandatory. Inspection and test data shall be generated in accordance with the prescribed test methods, utilizing the sampling plan specified for a twenty-five (25) piece manufacturing lot and submitted by the product manufacturer to the product user.
 - 1.8 Unless otherwise specified, part inventory manufactured to previous revisions of the applicable drawing or specification may be procured and used until stock is depleted.

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THIRD ANGLE PROJECTION 	CUSTODIAN NATIONAL AEROSPACE STANDARDS COMMITTEE	REVISION 11
	TITLE FASTENER, ALLOY STEEL, EXTERNALLY THREADED, 160 KSI Ft_u, 95 KSI Fs_u, 450 °F	CLASSIFICATION SPECIFICATION NAS4002
PROCUREMENT SPECIFICATION NONE		SHEET 1 OF 22

2. APPLICABLE DOCUMENTS

2.1. Industry Standards

2.1.1 American Society of Mechanical Engineers

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

2.1.2 American Society for Metals

ASM Handbook "Atlas of Microstructures of Industrial Alloys"

2.1.3 American Society for Quality Control

ASQ Z1.4, Sampling Procedures and Tables for Inspection by Attributes

2.1.4 ASTM International

ASTM E140, Standard Hardness Conversion Tables for Metals

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ASTM E340, Standard Test Methods for Macroetching Metals & Alloys

ASTM E407, Standard Practice for Microetching Metals & Alloys

ASTM E1444, Standard Practice for Magnetic Particle Examination

2.1.5 Aerospace Industries Association of America, National Aerospace Standards Committee

NAS9800, Head Protrusion Gaging 100° Flush Head Fastener Gage Block, Gage Diameters, and Stylus

NASM1312 (MIL-STD-1312) Fastener Test Methods

NASM1312-1 (MIL-STD-1312-1) Fastener Test Methods, Method 1, Salt Spray

NASM1312-6 (MIL-STD-1312-6) Fastener Test Methods, Method 6, Hardness

NASM1312-8 (MIL-STD-1312-8) Fastener Test Methods, Method 8, Tension Test

NASM1312-11 (MIL-STD-1312-11) Fastener Test Methods, Method 11, Fatigue Test

NASM1312-12 (MIL-STD-1312-12) Fastener Test Methods, Method 12, Thickness of Metallic Coatings

NASM1312-13 (MIL-STD-1312-13) Fastener Test Methods, Method 13, Double Shear Test

NASM1312-20 (MIL-STD-1312-20) Fastener Test Methods, Method 20, Single Shear Test

NASM1312-25 (MIL-STD-1312-25) Fastener Test Methods, Method 25, Driving Recess Torque, Quality Conformance test

NASM14191 (MS14191) Recess, Offset Cruciform, Ribbed, Dimensions of Recess, Gage and Driver for

NASM33750 (MS33750) Recess, Dovetail and Conical Dovetail, Dimensions of Recess, Gage and Driver for

NASM33781 (MS33781) Recess, Offset Cruciform, Dimensions of Recess, Gage and Driver for

2.1.6 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)

AMS-QQ-P-416, Plating, Cadmium (Electrodeposited)

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

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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 (SAE 8740) AMS6415 (SAE 4340)	Verify material alloy type or grade using any one of the following methods: x-ray fluorescence, optical emission spectrometry or similar methods. Trace elements analysis is not required.	Manufacturer shall verify, or contract for verification, a sample of each heat of raw material utilized for the production of fasteners specifying NAS4002 and shall retain documentation of such verification results.
DIMENSIONS	Per Fastener Drawing	Conventional measuring methods.	Per TABLE II and TABLE XII
HEAD PROTRUSION 100° FLUSH HEAD		Per NAS9800.	
WRENCHING RECESSES		Per applicable part standard for recess.	
IDENTIFICATION		Visual examination to assure legibility. Control stamp depth to assure .010 maximum is not exceeded. (11)	Per TABLE XII, 4.0% AQL
THREADS	Shall be rolled subsequent to all thermal treatment (see "Grain Flow" below) except bake after plating. Size per drawing. Unless otherwise specified, form, dimensions and processing per AS8879 except major diameter may be limited by part standard. Incomplete threads per FIGURES 1A, 2 and 3. Surface irregularities per FIGURE 1 and 1A.	See FIGURES 1, 1A, 2 and 3.	Per TABLE XII, 0.65% AQL.
HEAD TO SHANK FILLET AREA	Unless otherwise specified, on .1900 Dia. and larger fasteners, head to shank fillet radius shall be cold worked subsequent to all thermal treatment except bake after plate. The fillet radius shall conform to the applicable drawing. Threaded to the head fasteners do not require fillet cold working. The fillet area may be distorted per FIGURE 6 and TABLE VII.	Comparator measurement a minimum of two places using 10X to 50X.	TABLE XI.

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TABLE I – BASIC REQUIREMENTS (CONTINUED)

CHARACTERISTICS	ENGINEERING REQUIREMENTS	TESTING REQUIREMENTS (SEE 3.1)	
		TEST METHOD	SAMPLING PLAN
SURFACE TEXTURE	Per fastener drawing.	Visual or fingernail comparison. In case of controversy, check accessible surface areas using a profilometer.	Per TABLE XII, 4.0% AQL.
HEAT TREATMENT	Per AMS2759. Shall develop mechanical properties as defined herein without adverse affect on metallurgical properties as defined herein.	Test of mechanical and metallurgical properties verifies heat treatment.	As indicated for each test requirement.
HARDNESS (11)	Individual hardness readings shall be within the limits of Rockwell 36 to 40 HRC (or equivalent per ASTM E140). See Table I, Note /d/	Hardness test per MIL-STD-1312-6. See Note /a/ and /c/ of Table I.	Destructive test per Table IX. Non-destructive test per Table XII, .015 AQL.
TENSILE STRENGTH	Minimum tensile strength per TABLE III. Reference Table I, Note /a/ and TABLE III, Note /a/.	Static tensile test per MIL-STD-1312-8	TABLE VIII.
SHEAR STRENGTH	Minimum strength per TABLE III. Limitations per Note /h/ under TABLE III. (11)	Double shear test per MIL-STD-1312-13. Single shear test per MIL-STD-1312-20.	
FATIGUE TEST	Fasteners shall meet the test cycle requirements per TABLE X when subjected to the loads per TABLE IV.	MIL-STD-1312-11	TABLE X.
RECESS TORQUE	Fasteners with a recess conforming to NASM14191, NASM33750 or NASM33781 specifications shall develop the torque values as specified in TABLE XIII. See Recess Torque Sampling Plan. (11)	Torque test with specified driver in both installation and removal directions per MIL-STD-1312-25 and TABLE XIII. Axial end load shall not exceed 20 lbf in the installation direction and 40 lbf in the removal direction ±10%. (11)	TABLE XI. (11)
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 TABLE V. See Table I, Note /b/. Fasteners shall not be marked for magnetic inspection.	Magnetic inspect by longitudinal & circular method per ASTM E1444. Apply magnetic inspection after plating except as stated in Note /b/. Magnetic inspection is not required for sizes smaller than .1900-32. (11)	Sample per TABLE XII, .15% AQL. Increase to 100% if any indications which exceed permissible discontinuity limits are found in samples during the inspection process.

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TABLE I – BASIC REQUIREMENTS (CONTINUED)

CHARACTERISTICS	ENGINEERING REQUIREMENTS	TESTING REQUIREMENTS (SEE 3.1)	
		TEST METHOD	SAMPLING PLAN
UNTEMPERED MARTENSITE	Untempered martensite or transformed structure is an acceptable condition only when: (1) no cracks are found in any location, (2) condition is not found in the root of threads or head to shank fillet, (3) condition in the thread crests does not exceed depth allowed for laps per Table V, (4) condition does not produce crests, burrs or discontinuities which result in dimensions out of tolerance. (11)	Strip plating and etch in 2% to 5% Nital solution. Examine at 10X to 100X.	Per TABLE IX. (11)
GRINDING BURNS (11)	None permitted on shank, head to shank fillet or bearing surface of head. (11)	Examine fasteners for grinding burns during metallurgical examination or check for untempered martensite. (11)	Use samples for metallurgical examination and untempered martensite. (11)
MICROSTRUCTURE (11)	Shall be free from bursts, voids and overheating. Alloy segregation which adversely affects mechanical or physical properties of the part is not acceptable. Microstructure shall exhibit a uniform tempered martensitic structure typical of medium carbon content alloys per ASM Handbook "Atlas of Microstructures of Industrial Alloys".	Metallurgical examination. See 3.3	Per TABLE IX. (11)
HYDROGEN EMBRITTLEMENT	Plated fasteners shall be capable of meeting the AMS-QQ-P-416 hydrogen embrittlement requirements.	Per AMS-QQ-P-416.	AMS-QQ-P-416.

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TABLE I – BASIC REQUIREMENTS(CONTINUED)

CHARACTERISTICS	ENGINEERING REQUIREMENTS	TESTING REQUIREMENTS (SEE 3.1)	
		TEST METHOD	SAMPLING PLAN
CARBURIZATION OR DECARBURIZATION	None permitted on head bearing surface, head to shank fillet radius, shank or threads. Permitted in other areas in accordance with TABLE XIV.	Metallurgical See 3.3	Per TABLE IX.
GRAIN FLOW-THREADS	Per Figure 5. Formed by single rolling process subsequent to all thermal treatment except bake after plating.		
GRAIN FLOW-HEADS	Heads must be forged. Grain flow in a specific part may have various characteristics depending on configuration and/or processing; however any metallurgical condition which adversely affects the mechanical properties of the part is not acceptable.		
FINISH	Per the part standard or drawing. Cadmium plating per AMS-QQ-P-416 shall meet the requirements as stated in AMS-QQ-P-416 specification unless modified herein.	In accordance with the applicable specification. The verification of the AMS-QQ-P-416 plating shall be in accordance with the AMS-QQ-P-416 specification except as may be modified herein. In case of conflict, the plating thickness referee method shall be the microscopic method.	In accordance with the applicable specification or the requirements of the AMS-QQ-P-416 except as may be modified herein.
		Lot acceptance test per either non-destructive or destructive test method listed in AMS-QQ-P-416 destructive test method for referee purposes.	Lot acceptance sampling per TABLE IX for destructive test or per TABLE XI for non-destructive test. The destructive test method will be used for referee method.

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TABLE I – BASIC REQUIREMENTS (CONTINUED)

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 inspection lot only. Assortment of unit packages may be in larger packages. Packaging must allow for economical transportation and conform to consolidated freight classification rules.	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 a minimum, the following data; part number, purchase order number and manufacturers name/logo and inspection lot number.	Visual examination.	Not applicable.

- Notes:
- 11 /a/ The well prepared surface and procedure required by NASM1312-6, is a destructive test and shall be applied to all lots as follows: Fasteners which pass the tensile 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 non-magnetic 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 herein, 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 burns. 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.
- /d/ Parts with hardness values of 35 or 41 HRC (one point below or above specification value), are acceptable if the tensile and shear yield values within specification limits and fatigue tests yield acceptable results.

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