

FED. SUPPLY CLASS

5306

1. SCOPE AND CLASSES

1.1 This Specification defines the requirements for externally threaded fasteners produced from a corrosion resistant alloy and 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 220 KSI Ft_u and 125 KSI Fs_u is desired with a service temperature capability to 900 °F (see Table III and IV).

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 This specification delineates requirements for four different fastener categories, Type I, Type II, Type III and Type IV. Each of these four fastener types incorporates different mechanical properties as prescribed in Table III and Table IV and different head configurations described as follows:

Type I – External Wrenching Tension Head (double hex, spline)

Type II – External Wrenching Shear Head (double hex, spline)

Type III – 100° Flush Tension Head that specifies an internal wrenching device.

Type IV – 100° Reduced Flush Head that specifies an internal wrenching device.

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. 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.

2. APPLICABLE DOCUMENTS

2.1 Industry Standards

2.1.1 ASME

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

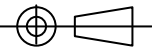
Copies can be obtained from ASME, Three Park Ave., New York, NY 10016-5990. www.asme.org

2.1.2 American Society for Quality

ASQC Z1.4 Sampling Procedures and Tables for Inspection by Attributes

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

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THIRD ANGLE PROJECTION 	CUSTODIAN NATIONAL AEROSPACE STANDARDS COMMITTEE	REVISION 1
PROCUREMENT SPECIFICATION NONE	TITLE FASTENERS, CORROSION RESISTANT NICKEL ALLOY 718, EXTERNAL THREADED, 220 KSI Ft_u, 125 KSI Fs_u, 900 °F	CLASSIFICATION SPECIFICATION NAS4008 SHEET 1 OF 20

2.1.3 ASTM International

ASTM E112	Standard Test Methods for Determining Average Grain Size
ASTM E340	Standard Test Practice for Macroetching Metals and Alloys
ASTM E407	Standard Test Practice for Microetching Metals and Alloys
ASTM E1417/E1417M	Standard Practice for Liquid Penetrant Inspection

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

2.1.4 Aerospace Industries Association

NAS9800	Head Protrusion Gaging, 100° Flush Head Fasteners, Gage Block, Gage Diameters and Stylus
NASM1312	Fastener Test Methods
NASM1312-1	Fastener Test Methods, Method 1, Salt Spray
NASM1312-8	Fastener Test Methods, Method 8, Tensile Strength
NASM1312-11	Fastener Test Methods, Method 11, Tension Fatigue
NASM1312-13	Fastener Test Methods, Method 13, Double Shear Test
NASM1312-20	Fastener Test Methods, Method 20, Single Shear
NASM1312-25	Fastener Test Methods, Method 25, Driving Recess Torque Quality Conformance Test
NAS1800	Recess, Six Lobe Drive, Internal, Dimensions for Recess and Gages
NAS7100	Recess, Ribbed Cruciform Dimensions of Recess and Gages
NASM9006	Recess, Cross, Low Torque Drive, Dimensions and Gage Dimensions for
NASM14191	Recess, Offset Cruciform, Ribbed Dimensions of Recess, Gage and Driver for
NASM33750	Recess, Dovetail Slot and Conical Dovetail Slot, 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

2.1.5 SAE International

AMS2750	Pyrometry
AMS5662	Nickel Alloy, Corrosion and Heat-Resistant, Bars, Forgings, and Rings 52.5Ni - 19Cr - 3.0Mo - 5.1Cb (Nb) - 0.90Ti - 0.50Al - 18Fe Consumable Electrode or Vacuum Induction Melted 1775 °F (968 °C) Solution Heat Treated, Precipitation-Hardenable
AMS5962	Nickel Alloy, Corrosion and Heat-Resistant, Round Bars and Wire 52.5Ni - 19Cr - 3.0Mo - 5.1Cb - 0.90Ti - 0.50Al - 18Fe Consumable Electrode or Vacuum Induction Melted 1775 °F (968 °C) Solution Treated and Work Strengthened Precipitation Hardenable

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AMS2700

Passivation for Corrosion Resistant Steels

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

TABLE I – BASIC REQUIREMENTS /1/

CHARACTERISTICS	ENGINEERING REQUIREMENTS	TESTING REQUIREMENTS (SEE 3.1)	
		TEST METHOD	SAMPLING PLAN
MATERIAL	718 nickel base alloy with the chemistry composition per AMS5662 or AMS5962. Each fastener manufacturing lot shall be identified by a unique lot number that is traceable to the mill heat of material in accordance with Paragraph 3.1. See Table I, Note (2).	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, samples of each material coil, or samples from each bundle of material per Table XI, and retain the documentation of the material verification results.
DIMENSIONS	Per fastener drawing.	Conventional measuring methods.	Per Tables II and XII.
HEAD PROTRUSION 100° FLUSH HEAD		Per NAS9800.	
WRENCHING RECESS		Per applicable recess specified by part standard.	
IDENTIFICATION		Visual examination to assure legibility. .010 max stamp depth.	
SQUARENESS OF HEAD TO SHANK	Figure 2.	Conventional measuring methods.	Per Table XII, .65 % AQL.
SHANK STRAIGHTNESS	Table VIII.		
THREADS	Shall be rolled subsequent to all thermal treatment at temperatures that are at or above ambient and below recrystallization temperature. Unless otherwise specified, form and dimensions shall be per AS8879 except the major diameter may be limited by the part standard. Incomplete threads per Figure 5, 6 and 7. Grain flow per Figure 9. Surface irregularities per Figures 4 and 5.	See Figures 4, 5, 6 and 7.	
HEAD TO SHANK FILLET AREA	Unless otherwise specified, the head to shank fillet area shall be cold worked subsequent to all thermal treatment and shall conform to the applicable drawing. Fasteners threaded to the head do not require fillet cold working. Fillet area may be distorted per Figure 1.	Comparator measurement in a minimum of two places using 10X to 50X.	Table XIII.

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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.	Per ASME B46.1 by visual or fingernail compression. In case of controversy, profilometer may be used for checking roughness if surface is accessible.	Per Table XII, 1.0 % AQL.
HEAT TREATMENT	718 nickel base alloy with the chemistry composition per AMS5662 or AMS5962, cold worked and heat treated to develop the requirements stated herein. Processing shall be in accordance with the pyrometry requirements of AMS2750.	Heat treat processing shall be verified by means of the mechanical tests specified herein for product strength capability and examination of the microstructure and metallurgical characteristics.	In accordance with the sampling plans for the various mechanical tests and the examination of metallurgical properties.
TENSILE STRENGTH	Minimum strength per Table III. Application and limitations per Table III notes.	Static tensile test per NASM1312-8.	Table XIV.
SHEAR STRENGTH	Minimum strength per Table IV. Application and limitations per Table IV notes.	Double shear test per NASM1312-13. Single shear test per NASM1312-20.	
FATIGUE TEST	Fasteners shall be tested to test cycle requirements of Table XV when subjected to the loads in Table IV. Application and limitations per Table IV notes.	NASM1312-11.	Table XV.
RECESS TORQUE	Fasteners with a recess conforming to NASM14191, NASM33750, NASM33781 or NAS1800 specifications shall be capable of meeting the torque test requirements as specified in Table V. Torque tests not required for NAS7100 or NASM9006 recesses.	Torque test with specified driver in both installation and removal directions per the requirements of NASM1312-25 and Table V. Axial end load shall not exceed 20 lbf in the installation direction and 40 lbf in the removal direction $\pm 10\%$.	Table XVII.
METALLURGICAL	No cracks permitted in any location. A crack is a clean crystalline break passing through the grain or the grain boundary. Discontinuities are permitted as described in Table IX. Metallurgical specimen per Figure 8.	Penetrant inspection per ASTM E1417/E1417M, Type I, Method B or D. Fasteners shall not be marked for indication of penetrant inspection.	Inspection sample size per Table XII, .15 % AQL. Increase to 100 % if any indications are found during the inspection process that exceed the allowed discontinuity limits as tabulated in Table IX.

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TABLE I – BASIC REQUIREMENTS (CONTINUED)

CHARACTERISTICS	ENGINEERING REQUIREMENTS	TESTING REQUIREMENTS (SEE 3.1)	
		TEST METHOD	SAMPLING PLAN
MICROSTRUCTURE	Microstructure shall be typical of a hot forged and aged nickel base alloy, free from bursts, voids and any evidence of overheating. Material grain size shall be predominantly five (5) or finer (reference ASTM E112). Alloy segregation or surface conditions that affect the mechanical and physical properties of the fastener are not acceptable.	Metallurgical examination in accordance with Paragraph 3.3.	Select the microstructure examination test samples per Table XVI.
GRAIN FLOW – HEADS	The microstructure of the head and internal wrenching recesses, if applicable, shall exhibit grain flow lines that are representative of a forging process performed prior to final heat treatment (see Figure 10). The heat affected zone shall not extend into the fastener shank beyond .25 (1/4) times the nominal diameter. Slight cutting of flow lines due to grinding of the head bearing area, head-to-shank radius or shank is permissible. Fasteners exhibiting shear deformation or strain lines shall be acceptable if they pass the Wedge Tensile Test in Table III, Note /6/. Heating processes shall be controlled so as to minimize variation of inspection lots.		
GRAIN FLOW – THREADS	Microstructure of the thread form shall exhibit grain flow lines that are representative of threads that have been formed by a rolling process subsequent to all thermal treatment except thermal treatments as required by the application of surface coatings (see Figure 9).		

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TABLE I – BASIC REQUIREMENTS (CONTINUED)

CHARACTERISTICS	ENGINEERING REQUIREMENTS	TESTING REQUIREMENTS (SEE 3.1)	
		TEST METHOD	SAMPLING PLAN
PASSIVATED FINISH	Passivate per AMS2700, Type 2 or 8. All parts shall be capable of passing a four (4) hour Salt Spray Test after passivation. Minor corrosion products (staining) on non bearing surfaces of the head and evidence of permissible discontinuities per Table IX are acceptable after the four (4) hour test.	Salt Spray Test per NASM1312-1 except duration shall be four (4) hours.	Salt Spray Tests are not mandatory on every lot. Manufacturers shall use and retain documentation of adequate process controls and material handling that assures all fasteners will be capable of passing the Salt Spray Test.
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 shall include at least the following: part number, purchase order number, and manufacturer's name/logo and inspection lot number.	Visual examination.	Not applicable.

/1/ Unless otherwise stated by the purchase contract, the part standard or drawing, all engineering requirements, test methods and sampling plans stated herein shall be conducted prior to any supplemental surface coatings as may be prescribed by the purchase contract, part standard or drawing.

(2) Raw material acceptance of each mill heat of material shall require a raw material certification or laboratory test data verifying the material yields a minimum of 8 % elongation after aging at 1325 °F for eight (8) hours, furnace cool at 100 °F per hour to 1,150 °F for eight (8) hours and air cooled.

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