

FED. SUPPLY CLASS

1. SCOPE
 - 1.1 This specification establishes the acceptance criteria for Metallurgical Properties of externally threaded fasteners used in airborne systems and in associated ground support systems. These fasteners are generally considered as being aerospace quality fasteners. This specification is only applicable to fasteners which require rolled external threads and forged heads.
 - 1.2 Recommendations for changes of this specification should be directed to an NASC representative of an AIA Member Company or to the Executive Secretary of the National Aerospace Standards Committee.
2. APPLICABLE SPECIFICATIONS, STANDARDS, AND OTHER PUBLICATIONS
 - 2.1 Unless otherwise specified herein, referenced documents shall be the issue in effect on date of manufacture. However, existing material inventory certified to a previous revision of the applicable material specification(s) is acceptable for use until depletion. In case of conflict, this standard takes precedence over documents referenced herein.
 - 2.2 SAE International

AMS2644 Inspection Material, Penetrant

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

ASTM E3 Standard Guide for Preparation of Metallographic Specimens

ASTM E112 Standard Test Method for Determining Average Grain Size

ASTM E340 Standard Test Method for Macroetching Metals & Alloys

ASTM E407 Standard Test Practice for Microetching Metals & Alloys

ASTM E1417/E1417M Standard Practice for Liquid Penetrant Testing

ASTM E1444/E1444M Standard Practice for Magnetic Particle Testing

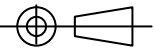
ASTM E1447 Standard Test Method for Determination of Hydrogen in Titanium and Titanium Alloys by Inert Gas Fusion Thermal Conductivity/Infrared Detection Method.

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

NASM1312-6 Fastener Test Methods, Method 6, Hardness

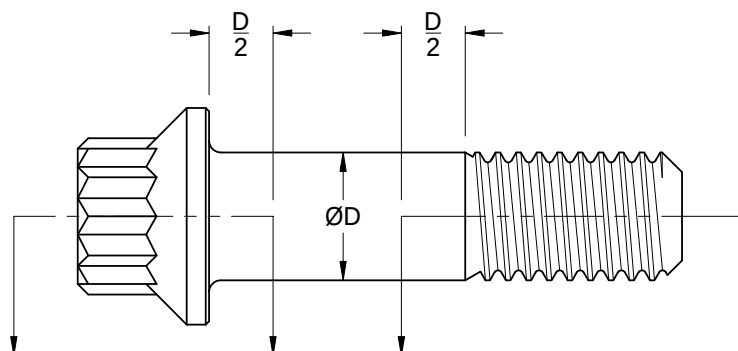
Copies can be obtained from the Aerospace Industries Association, 1000 Wilson Blvd., Suite 1700, Arlington, VA 22209. www.aia-aerospace.org

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THIRD ANGLE PROJECTION		CUSTODIAN NATIONAL AEROSPACE STANDARDS COMMITTEE	REVISION 1
PROCUREMENT SPECIFICATION NONE		TITLE TESTING, METALLURGICAL, FASTENERS, EXTERNAL THREADS	CLASSIFICATION DESIGN STANDARD NAS4007 SHEET 1 OF 11

3. METALLURGICAL EXAMINATIONS

Specimens shall be sectioned from finished parts as shown in Figure 1, prepared in accordance with ASTM E3, and etched in accordance with ASTM E340 or ASTM E407 and examined per applicable test. Samples used for examination of discontinuities may be used as part or all of the samples for examination of other metallurgical examinations listed in Table I.



Cut specimens as indicated by arrows.

FIGURE 1 – METALLURGICAL SPECIMENS

TABLE I – METALLURGICAL EXAMINATIONS

TEST	PARAGRAPH	MAGNIFICATION
Discontinuities (Nondestructive)	3.1	N/A
Discontinuities (Microscopic)	3.2	50X to 200X
Grinding Burns	3.3	See paragraph.
Grain Growth (Microscopic)	3.4	100X to 200X
Grain Flow Head (Macroscopic)	3.5	6X to 25X
Grain Flow Thread (Microscopic)	3.6	50X to 100X
Surface Contamination (Microscopic)	3.7	See paragraph.
Hydrogen Content	3.8	N/A
Oxygen Content	3.9	N/A
Microstructure (Microscopic)	3.10	100X to 200X

3.1 DISCONTINUITIES – NONDESTRUCTIVE TEST

Unless otherwise specified, the acceptance criteria for discontinuities shall be in accordance with the limits specified in Table II, Figure 2 and Figure 3. Indications in themselves shall not be cause for rejection. Cracks, regardless of location are cause for rejection.

3.1.1 TEST METHODS

Alloy Steel: Magnetic particle inspection by longitudinal and circular methods per ASTM E1444/E1444M. For plated parts, magnetic particle inspect after plating.

Nonmagnetic Materials: Penetrant inspect per ASTM E1417/E1417M, Type I, Method B or D. Penetrant materials shall be per AMS2644, sensitivity level 2 or greater. Inspect subsequent to thread rolling and fillet rolling but prior to surface treatments such as abrasive cleaning, coating or lubrication, which may mask surface defects. Perform inspection prior to plating or with plating removed.

Fasteners shall not be marked to designate magnetic particle or penetrant inspection. Magnetic particle or penetrant inspection not required on fasteners with thread size smaller than .1900-32.

Parts with indications found by nondestructive testing shall be subjected to microscopic examination. (See Section 3.2)

3.1.2 INSPECTION SAMPLING

Sample per Table III. Increase to 100 percent inspection for screening if indications can be directly related to discontinuities exceeding specified limits of Table II or Figure 2 and Figure 3.

3.2 DISCONTINUITIES MICROSCOPIC EXAMINATION (50X TO 200X)

Requirements: Same as paragraph 3.1

3.2.1 TEST METHOD

Specimens shall be sectioned from finished parts as shown in Figure 1, etched in accordance with ASTM E407, and examined as stated below.

MAGNETIC PARTICLE OR PENETRANT INDICATIONS ARE NOT PRESENT:

Metallurgically examine a random sample per Table IV. Accept or reject lot per Table IV.

MAGNETIC PARTICLE OR PENETRANT INDICATIONS ARE PRESENT:

Specimens with magnetic particle or penetrant indications shall be sectioned through the indication for depth determination, as appropriate. Conduct examination necessary to determine whether magnetic or penetrant indications reveal discontinuities exceeding Table II limits. Non rateable indications are acceptable and shall not be cause for rejection. If one or more discontinuities are found that exceed the limits of Table II, reject the entire lot or screen to reject all parts with similar indications. Additional fasteners may be examined if unusual magnetic or penetrant indications or unusual mechanical test failure are observed. Metallurgical specimens shall be kept for six months after completion and be available for verification by the procuring agency.

AEROSPACE INDUSTRIES ASSOCIATION OF AMERICA, INC.
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THIS DRAWING SUPERSEDES ALL ANTECEDENT STANDARD DRAWINGS FOR THE SAME
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TABLE II – SURFACE CONTAMINATION AND DISCONTINUITIES
Maximum Permissible Depth Normal to the Surface

FASTENER MATERIAL	LOCATION	NOMINAL DIAMETER OF BOLT							
		.1120	.1380 .1640 .1900	.2500 .3125 .3750	.4375 .5000	.5625 .6250	.7500	.8750	1.000 And Larger
ALL	Thread pressure flank, head-to-shank fillet, root of bolt threads	.0005	.0005	.0005	.0005	.0005	.0005	.0005	.0005
	No surface contamination	.000	.000	.000	.000	.000	.000	.000	.000
MP159, MP35N, Alloy 718, A286	Thread location per Figure 2 & 3 /1/ /3/	.005	.006	.007	.008	.009	.010	.012	.014
All other material	Thread location per Figure 2 & 3 /2/ /3/	.005	.005	.005	.006	.007	.008	.009	.011
	No surface contamination.	.000	.000	.000	.000	.000	.000	.000	.000
ALL	Thread runout & transition per Figure 3 (Natural flow of material)	.0008	.0010	.0012	.0014	.0016	.0018	.0021	.0024
	No Surface contamination	.000	.000	.000	.000	.000	.000	.000	.000
ALL	Grip or shank diameter and bearing surface of head	.003	.004	.005	.006	.007	.008	.009	.011
	No surface contamination	.000	.000	.000	.000	.000	.000	.000	.000
ALL	Non-bearing surfaces of head and chamfered end	.010	.010	.010	.012	.014	.016	.018	.022
	Surface contamination	.003	.003	.003	.003	.003	.003	.003	.003
Titanium only	Overheating per microstructure requirement – protruding head (TOP)	.014	.017	.025	.044	.056	.075	.088	.100
Titanium only	Overheating per microstructure requirement – flush head (TOP)	.008	.008	.013	.020	.040	.060	.080	.090

/1/ Depth of discontinuities based on 25 percent of height of truncated thread.

/2/ Depth of discontinuities based on 20 percent of height of truncated thread.

/3/ Depth of thread crest discontinuities to be measured from the specified minimum major diameter.

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