

FED. SUPPLY CLASS
5306

1. SCOPE

- 1.1 This specification defines the requirements for H-11 alloy steel externally threaded fasteners procured under part numbers listed on drawings which refer to this specification. Drawings may carry notes which modify the requirements of this specification. Receiving contractors may reject any lot which does not conform.
- 1.2 Recommendations for improvements or correction of this specification should be directed to a NASC representative of a using aerospace company or to National Aerospace Standards Committee, Aerospace Industries Association, 1000 Wilson Boulevard, Suite 1700, Arlington, VA 22209. www.aia-nas.org

2. APPLICABLE DOCUMENTS

- 2.1 Documents listed herein of the issue in effect on date of price inquiry are part of this specification to the extent indicated. In the event of conflict between the requirements of this specification and referenced documents, the requirements herein shall govern.

FEDERAL STANDARD

FED-STD-H28/21

Screw-Thread Standards for Federal Services; Section 21, Metric Screw-Threads

INDUSTRY STANDARDS

ANSI/ASQ Z1.4

Sampling Procedures and Tables for Inspection by Attributes

ASME B46.1

Surface Texture (Surface Roughness, Waviness, and Lay)

ASTM E112

Standard Test Methods for Determining Average Grain Size

③ ASTM E1444/E1444M

Standard Practice for Magnetic Particle Testing

AMS2759

Heat Treatment of Carbon and Low-Alloy Steel Parts

AMS6487

Steel, Bars, and Forgings (UNS T20811)

③ 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

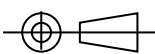
Fastener Test Methods, Method 11, Tension Fatigue

③ NASM1312-13

Fastener Test Methods, Method 13, Double Shear Test

3. REQUIREMENTS

- 3.1 General. Fasteners supplied to this specification shall comply with all of the requirements of this specification and shall have passed all of the tests herein.
- 3.2 Materials. Fasteners shall be fabricated from alloy steel conforming to AMS6487 (UNS T20811).
- 3.3 Design and Construction. Fastener design and construction shall conform to the following requirements:
- 3.3.1 Dimensions. Dimensions shall be in accordance with the applicable detail drawing. Dimensions shall include the finishes designated on the detailed drawing. Dimensions shall exclude dry film lubricants. Measurements shall be made per 4.4.1.
- 3.3.2 Surface Texture. Surface texture shall be in accordance with the requirements of the detail drawing.
- 3.3.3 Thread Form. Thread form end dimensions shall conform to the MJ thread of FED-STD-H28/21 or as required by the applicable drawing.
- 3.3.3.1 Thread Forming. Threads shall be fully formed after final heat treatment. Threads shall be formed by a single rolling process.

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PROCUREMENT SPECIFICATION NONE	TITLE BOLT, ALLOY STEEL, 1550 MPa TENSILE, PROCUREMENT SPECIFICATION	CLASSIFICATION SPECIFICATION DA0071 SHEET 1 OF 14 

- 3.3.3.2 Incomplete Threads. Incomplete thread pitches are permissible at the chamfer end and at the juncture of the unthreaded portion of the shank, per FED-STD-H28/21. The incomplete thread pitch next to the shank shall include a thread run-out at least one pitch and not more than two pitches.
- 3.3.3.3 Chamfer. The entering point of the thread shall be chamfered as specified in the applicable detail drawing.
- 3.3.3.4 Irregular Flank. The flank of the incomplete thread closest to the grip, or head, may be irregular due to natural flow of material that is not controlled by thread rolling dies. Folds or laps in excess of those permitted by Figure 5 and paragraph 3.7.2.3 shall not be considered "Natural Flow". The roots and flanks of threads in the run-out area shall be filleted, smooth and devoid of abrupt tool marks. The root radius in the run-out area shall not be less than the radius in the full thread area.
- 3.3.3.5 Grain Flow. The grain flow in the threads shall be continuous and shall follow the general contour with the maximum density at the bottom of the root radius as illustrated in Figure 1.

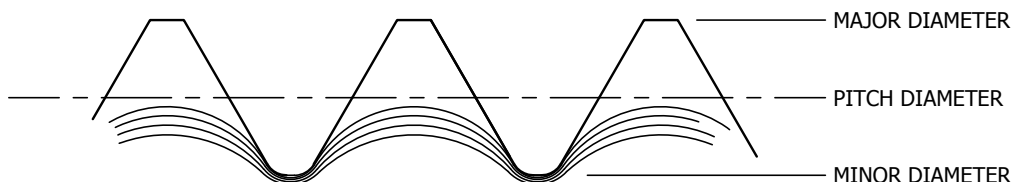


FIGURE 1 – GRAIN FLOW, THREADS

- 3.3.3.5.1 Grain Size. Grain size in the vicinity of the head or the threads shall not differ from the grain size in the shank by more than one size (as defined in ASTM E112).
- 3.3.4 Heads. Fastener heads shall be formed by forging before heat treatment. Lightening holes may be forged or machined.
- 3.3.4.1 Bearing Surfaces. The bearing surface of fastener heads shall be oriented relative to the shank within the limits shown in Figure 2. The angular variation of the underside of the head must be uniform around the shank within a tolerance of plus or minus 10 minutes, as measured from the bearing surface of the head at a length along the shank approximately equal to the diameter of the fastener.

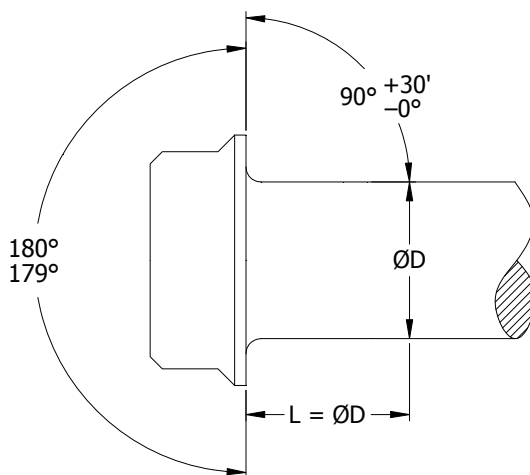


FIGURE 2 – HEAD ANGULARITY

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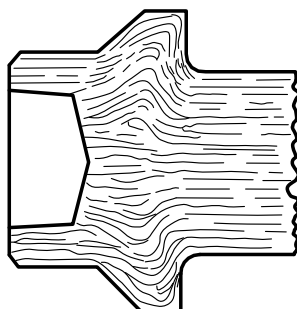
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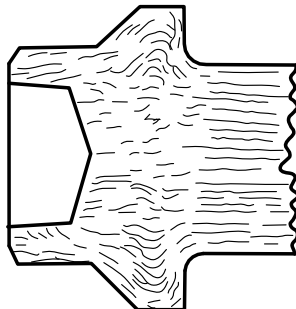
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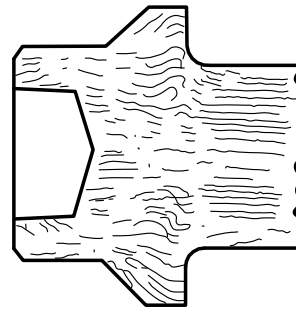
- 3.3.4.2 Head Structure and Grain Flow. A metallographic cross section of the head shall show no detrimental defects (see section 4.4.4) and shall exhibit flow lines that closely resemble Figure 3A. Grain flow lines shall be continuous and shall not terminate in the head to shank fillet, but may show minor interruptions resulting from finish machining operations, as shown in Figure 3B. Excessive cutting of the grain flow lines in the bearing surface or in the head to shank fillet as shown in Figure 3C is not permissible.



(A) SATISFACTORY
GRAIN FLOW



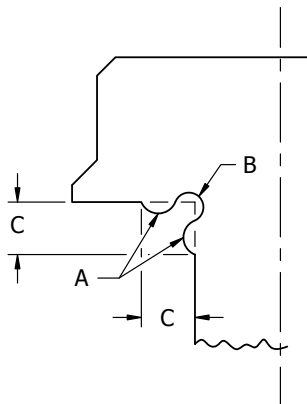
(B) MINIMUM ACCEPTABLE
STANDARD



(C) UNACCEPTABLE
GRAIN FLOW

FIGURE 3 – GRAIN FLOW, HEADS

- 3.3.5 Head to Shank Fillet. The juncture of the fastener head and head to shank fillet shall be cold worked by a rolling process after completion of all machining, grinding and thermal treatments. Fillet radius shall conform to the requirements of the detail drawings and shall show no evidence of seams or inclusions. Distortion from the smooth contour resulting from cold working shall not extend beyond the limits of Figure 4.



MAXIMUM DISTORTION	NOMINAL SIZE				
	UNDER 8mm	8mm thru 10mm	12mm thru 16mm	18mm thru 24mm	OVER 24mm
C	1,5	2,5	3,2	4,0	4,8

Cold working of head to shank fillet may cause distortion of fillet area. Distortion shall not exceed 0,05mm above "A" or below "B" contour shown on bolt drawing. Distorted area shall not extend beyond "C" as illustrated.

FIGURE 4 – FILLET DISTORTION

- 3.3.6 Straightness. The straightness of the fastener shank shall be within the limits of Table I when the fastener shank is rolled in "V" blocks (maximum width each block 8mm) placed on surface plates and the greatest deviation is measured with a dial indicator.

TABLE I – SHANK STRAIGHTNESS

NOMINAL SHANK DIAMETER	MAXIMUM DEVIATION (mm per 10mm of Length)
8mm and under	0,020
10mm and larger	0,015

- 3.3.7 Coaxiality. The coaxiality tolerance between the thread and the shank of bolts, which is the coaxiality of the shank with respect to the pitch diameter as the datum, shall be as specified on the detailed drawing. The position of measurement shall be at a distance of 1x ØD from the point where the thread run-out meets the shank. When the shank length is less than 2x ØD, coaxiality shall be measured at a distance midway between the head and the thread run-out.
- 3.4 Heat Treat. Fasteners shall be heat treated including triple tempering to develop the mechanical properties specified herein. All fasteners shall be retempered, subsequent to grinding and prior to thread rolling and fillet working, at a temperature of 14 °C below the original tempering temperature. Equipment and controls shall be in accordance with AMS2759.
- 3.5 Hardness. Fasteners shall have a Rockwell hardness in the range of 47–50 HRC when tested in accordance with 4.3.2.4.
- 3.6 Mechanical Properties. Mechanical properties of fastener shall conform to the following requirements.
- 3.6.1 Ultimate Tensile Strength. When tested in accordance with 4.4.2.1, the minimum tensile strength shall conform to the requirements of Table II and 4.4.2.3. Tensile tests are not applicable to full threaded fasteners whose length is less than three times the diameter, or to grip-type threaded fasteners with a grip less than two times the nominal diameter.
- 3.6.2 Ultimate Double Shear Strength. When tested in accordance with 4.4.2.2, the minimum ultimate double shear strength shall conform to the requirements of Table II and 4.4.2.3. Shear tests are not applicable to fasteners whose grip is less than two times the nominal diameter.

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TABLE II – TENSILE AND SHEAR PROPERTIES

THREAD		TENSILE	MINIMUM TENSILE	AREA OF SHANK	MINIMUM DOUBLE
DIAMETER	PITCH	STRESS AREA	STRENGTH	AT NOMINAL	SHEAR STRENGTH
mm	mm	(A _{tu}) mm ²	NEWTONS	DIA (A _{su}) mm ²	NEWTONS
		/a/	/b/	/c/	/d/
5	0,8	15,8	24 500	19,6	36 500
6	1	22,5	34 900	28,3	52 600
8	1	42,4	65 700	50,3	93 600
10	1,25	66,3	103 000	78,5	146 000
12	1,25	98,3	152 000	113	210 000
14	1,5	133	206 000	154	286 000
16	1,5	177	274 000	201	374 000
18	1,5	228	353 000	254	472 000
20	1,5	284	440 000	314	584 000
22	1,5	347	538 000	380	707 000
24	2	405	628 000	452	841 000
27	2	519	804 000	573	1 070 000
30	2	647	1 000 000	707	1 320 000
33	2	789	1 220 000	855	1 590 000
36	2	746	1 470 000	1020	1 900 000
39	2	1120	1 740 000	1200	2 230 000

/a/ Area = 0,7854PD² where PD is the basic pitch diameter.

/b/ Tensile strength is calculated from the formula $T = A_{tu} \times 1550 \text{ MPa}$, where A_{tu} = the tensile stress area.

/c/ Area = 0,7854D² where D = the nominal diameter.

/d/ Double shear strength is calculated from the formula $S = A_{su} \times 2(930) \text{ MPa}$, where A_{su} = the area at the nominal diameter.

3.6.3 Fatigue Life. When tested in accordance with 4.4.2.4, the fatigue life shall conform to 4.4.2.5. High force and low force shall be as specified in Table III. Fasteners with drilled shanks are not subject to fatigue testing. Fatigue tests are not applicable to fasteners having a grip less than twice the nominal diameter.

3.6.4 Stress Durability. The fasteners shall satisfactorily pass the stress durability test per 4.4.2.7.

TABLE III – FATIGUE LOADING

THREAD		FATIGUE LOADING		THREAD		FATIGUE LOADING	
		NEWTONS /e/				NEWTONS /e/	
DIAMETER	PITCH	HIGH	LOW	DIAMETER	PITCH	HIGH	LOW
5	0,8	12 700	1 270	20	1,5	229 000	22 900
6	1	18 100	1 810	22	1,5	280 000	28 000
8	1	34 200	3 420	24	2	327 000	32 700
10	1,25	53 600	5 360	27	2	418 000	41 800
12	1,25	79 000	7 900	30	2	520 000	52 000
14	1,5	107 000	10 700	33	2	634 000	63 400
16	1,5	142 000	14 200	36	2	764 000	76 400
18	1,5	184 000	18 400	39	2	905 000	90 500

/e/ High fatigue loading is 52% of the ultimate tensile strength listed in Table II. Low load is 10% of the high load.

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