AERONAUTICAL MATERIAL SPECIFICATIONS

SOCIETY OF AUTOMOTIVE ENGINEERS, Inc. 485 Lexington Ave., New York 17, N.Y.

AMS 7478B

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BOLTS AND SCREWS, STEEL, CORROSION AND HEAT RESISTANT
Heat Treated - Roll Threaded

1. ACKNOWLEDGMENT: A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.

2. APPLICATION: High quality bolts and screws made from AMS 5733 or AMS 5735 steel for use up to 1200 F.

3. MATERIAL: Shall be AMS 5733 or AMS 5735 steel as specified on the drawing.

4. FABRICATION: Heads may be formed by hot-cold upsetting at a temperature not higher than 1600 F, by cold upsetting, or by machining. Threads shall be formed on the finished and solution heat treated blanks by a single rolling.

5. TECHNICAL REQUIREMENTS:

5.1 Stock: Unless otherwise permitted by purchaser, shall be reduced 15 - 25% in cross sectional area during final drawing or rolling at a temperature not higher than 1600 F and shall have hardness of Brinell 201 - 285 or equivalent. Stock may be centerless ground but, if ground, it shall be given a final light cold pass to remove grinding marks. When heads are machined, stock may be solution heat treated before machining.

5.2 Flow Lines: Flow lines of upset heads shall conform to the general arrangement shown in Figure 1A, 1B, or 1C. The intersection of the longitudinal axis of the part and the approximate transverse axis of the flow lines shall be not less than D/4 in. from the bearing surface for hexagonal, round, and square head bolts and screws and not less than D/7 in. from the bearing surface for 12 point head bolts and screws where D is the nominal diameter of the shank after heading.

5.2.1 Examination for Internal Defects: Visual examination of a longitudinal section of a head and 1/4 in. or more of the shank, after etching in approximately 50% hydrochloric acid (sp gr 1.19), 20% hydrofluoric acid (sp gr 1.15), 4% nitric acid (sp gr 1.42), and 26% water for 10 - 30 min. at room temperature shall reveal no cracks, laps, or porosity.

5.3 Machining: The metal removed from the bearing surface of the head of upset-head parts shall be as little as practicable to obtain a clean, smooth surface.

5.4 Solution Heat Treatment: Headed and machined blanks, unless machined from solution heat treated stock, shall, before rolling the threads, be solution heat treated in accordance with AMS 5733 or AMS 5735 as applicable.

5.4.1 Heating Equipment: Furnaces may be any type ensuring uniform temperature throughout the parts being heated and shall be equipped with, and operated by, automatic temperature controllers. The heating medium or atmosphere shall cause no surface hardening by carburizing or nitriding.

5.5 Threads:

5.5.1 Flow lines at threads shall be continuous, shall follow the general thread contour, Ø and shall be of maximum density at root of thread (see Figure 2).

5.5.2 Threads shall have no multiple or single laps at the root or on the sides (see Figures 3, 4, and 5) except that slight laps are permissible at the crest, on the non-pressure side inside the pitch diameter, and on the sides outside the pitch diameter (see Figures 6, 7, and 8). Slight deviation from thread contour is permissible at the crest of the thread as shown in Figure 9; the incomplete thread at each end of the threaded section may also deviate slightly from contour.

5.5.3 Parts having holes for locking devices are permitted to have slight ovalization of the hole and the countersink and slight flattening of the crest of the thread at the countersink, provided the diameter of the hole is within specified tolerances.

5.6 Precipitation Heat Treatment: The finished parts shall be precipitation heat treated in accordance with AMS 5733 or AMS 5735 as applicable.

5.6.1 Heating Equipment: Shall conform to 5.4.1.

5.7 Structure: Parts shall have microstructure of completely recrystallized material except in the area of the threads. Grain size after solution heat treatment shall be 5 or finer, by comparison of polished and etched specimens with the chart in ASTM E19-46. Up to 25%, by area, of abnormally large grains will be permitted in any specific area of 100 or more adjacent grains; abnormally large grains are defined as grains more than 3 ASTM numbers coarser than the average grain size of the part.

5.8 Hardness: Shall be uniform and within the range of Brinell 248 - 321 or equivalent, but hardness of the threaded portion may be higher as a result of the thread rolling.

5.9 Tensile Properties:

5.9.1 Finished Parts: Shall be capable of showing tensile strength not lower than 130,000 psi when aligned in fixtures so that at least three threads are exposed in the gage section. The diameter of the area on which stress is based shall be taken as the mean of the nominal root and pitch diameters of the part or the shank diameter, whichever is smaller.

5.9.2 Tensile Test Specimens: Tensile test specimens machined from finished parts shall conform to the following requirements:

Tensile Strength, psi	130,000 min
Yield Strength at 0.2% Offset or at 0.0098 in. in 2 in. Extension Under Load (E = 29,100,000), psi	85,000 min
Elongation, % in 4D	15 min
Reduction of Area, %	20 min

5.10 Stress-Rupture Test at 1200 F: Material shall be capable of meeting the notched stress-rupture test of AMS 5733 or AMS 5735 as applicable, using a finished part as the test specimen. The diameter of the area on which stress is based shall be taken as the mean of the nominal root and pitch diameters of the part or the shank diameter, whichever is smaller.

5.10.1 If the geometry of the thread is substantially different from that of the notched specimen described in the applicable material specification, or if the size or shape of a part is such that the part cannot be tested satisfactorily, a test may be made on a specimen machined from the stock and heat treated in the same manner as the parts.

5.11 Straightness, Concentricity, and Squareness: For purposes of these inspections, Ø shank and threads shall be included but shall be considered as separate elements of the bolt.

5.11.1 Straightness of Shank and Threads: Shank and threads shall be straight within the limits specified on the drawing for the total length (L) of the bolt under Ø the head (see Figure 10). Visibly abrupt changes in diameter or shape of the shank and threads which might cause stress concentrations are not permissible.

5.11.2 Concentricity of Thread Pitch Diameter: The concentricity of thread pitch diameter in relation to shank diameter shall be within the limits specified on the drawing for a distance of not less than 1.5 times the nominal bolt diameter away Ø from the last full thread along the shank (see Figure 11). For bolts having a shank length less than 1.5 times the nominal bolt diameter, the concentricity of the shank diameter over its full length in relation to the thread pitch diameter shall be within the limits specified on the drawing.

5.11.3 Concentricity of Head: The concentricity of the head in relation to the shank diameter shall be within the limits specified on the drawing for a distance of not less than 1.5 times the nominal bolt diameter away from the washer face Ø along the shank (see Figure 12). For bolts threaded to the head and for bolts having shank length less than 1.5 times the nominal bolt diameter, concentricity of head shall be measured in relation to thread pitch diameter in lieu of shank diameter.

5.11.4 Squareness of Washer Face: The squareness of the washer face with the shank diameter shall be within the limits specified on the drawing for a distance of not less than 1.5 times the nominal bolt diameter away from the washer face along Ø the shank (see Figure 12). For bolts threaded to the head and for bolts having a shank length less than 1.5 times the nominal bolt diameter, squareness of washer face shall be measured in relation to thread pitch diameter in lieu of shank diameter.

6. QUALITY: Parts shall be uniform in quality and condition, clean, sound, smooth, and free from burrs and foreign materials and from internal and external imperfections detrimental to their performance. Discoloration resulting from precipitation heat treatment will not be considered objectionable except when the drawing requires that parts be plated.

6.1 Parts subject to fluorescent penetrant inspection shall not reveal indications of cracks, seams, pipes, or rolling laps as shown by Figures 3, 4, and 5, except that indications of slight laps as shown by Figures 6, 7, and 8 will be permitted.

7. REJECTIONS: Parts not conforming to this specification or to authorized modifications will be subject to rejection.

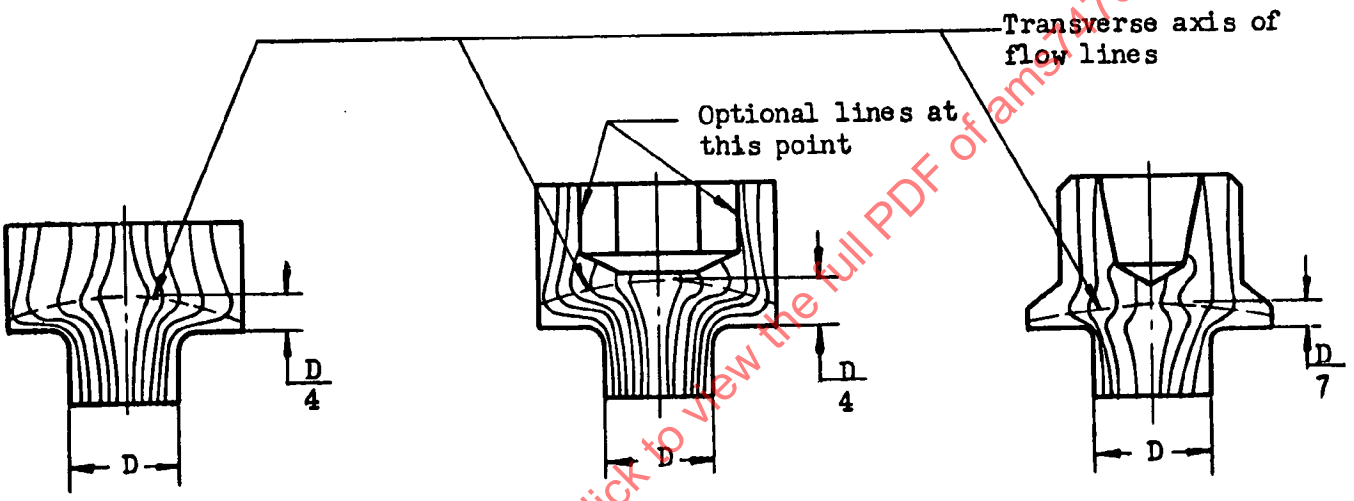

Figure 1A

Figure 1B

Figure 1C

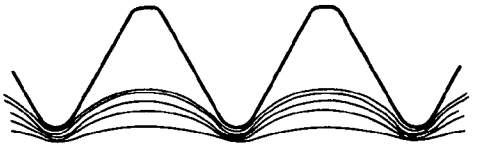

FIGURE 2
FLOW LINES
ROLLED THREAD

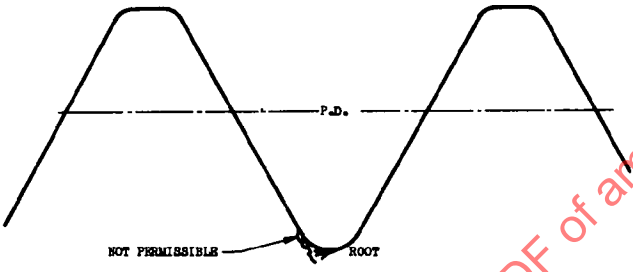

FIGURE 3
ROLLED THREAD

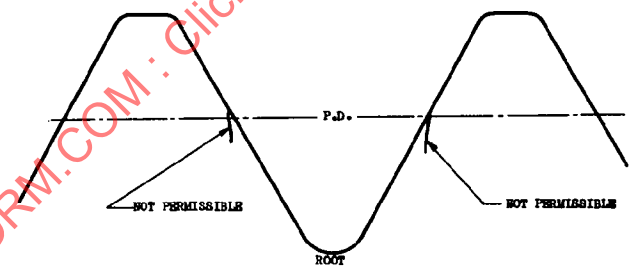

FIGURE 4
ROLLED THREAD

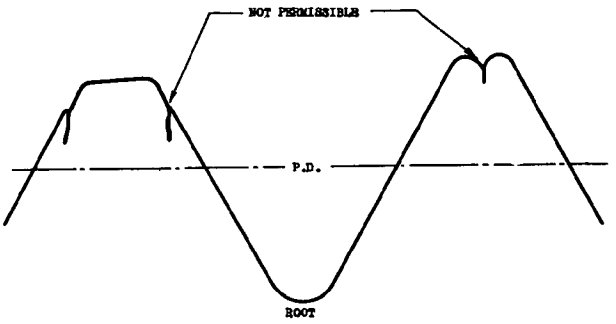

FIGURE 5
ROLLED THREAD