

AERONAUTICAL MATERIAL SPECIFICATION

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Revised

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

1. **ACKNOWLEDGMENT:** A vendor shall mention this specification number in all quotations and when acknowledging purchase orders.
2. **APPLICATION:** Primarily bolts and screws made from AMS 5616 steel, for use up to 900 F.
3. **FABRICATION:** Heads may be formed by hot upsetting, cold upsetting or machining. Threads shall be formed by rolling after heat treatment.
4. **TECHNICAL REQUIREMENTS:**
 - 4.1 **Flow Lines:** Flow lines of upset heads shall conform to the general arrangement shown in Figure 1A or 1B. The intersection of the longitudinal axis of the part and the approximate transverse axis of the flow lines shall be not less than $H/3$ in. from the bearing surface.
 - 4.1.1 **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 equal volumes of hydrochloric acid (sp gr 1.19) and water at 160 - 180 F for 10-15 min., shall reveal no cracks, laps or porosity.
 - 4.2 **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.
 - 4.3 **Heat Treatment:** Headed and machined blanks, shall, before finishing the shank and the bearing surface of the head and rolling the threads, be heat treated as follows:
 - 4.3.1 **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 other than that permitted by 4.6.
 - 4.3.2 **Hardening:** Blanks of AMS 5616 shall be uniformly heated to 1750 F $\pm$ 10, held at that temperature for 15-20 min. and quenched in oil. Elapsed time between hardening and tempering shall be as short as practicable.
 - 4.3.3 **Tempering:** Hardened blanks shall be tempered by heating uniformly to the temperature necessary to produce the specified hardness, holding at that temperature for not less than 1 hr and cooling.
 - 4.4 **Threads:**
 - 4.4.1 Threads shall be produced on the heat treated and finished blanks by a single rolling. Flow lines at threads shall be continuous, shall follow the general thread contour, and shall be of maximum density at root of thread (see Figure 2).

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- 4.4.2 Threads shall have no multiple or single laps at the root or on the sides (see Figures 3, 4 and 5), except that single 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 thread may also deviate slightly from contour.
- 4.4.3 Parts having holes for locking devices are permitted to have slight ovalization of the hold 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.
- 4.5 Structure: Parts shall have microstructure of tempered martensite.
- 4.6 Surface Hardening: Parts shall have no surface hardening except as produced during rolling of threads. Determinations of surface hardening may be made by microscopic method or by a sensitive hardness testing instrument.
- 4.7 Hardness: Hardness shall be uniform and as specified on the drawing but hardness of the threaded portion may be higher as a result of the thread rolling.
5. QUALITY: Parts shall be uniform in quality and condition, clean, sound, smooth, and free from burrs and foreign materials and from internal and external defects detrimental to their performance.
6. REJECTIONS: Parts not conforming to this specification or to authorized modifications will be subject to rejection.

TRANSVERSE AXIS OF FLOW LINES

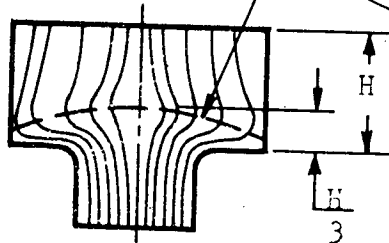


FIGURE 1A

FLOW LINES

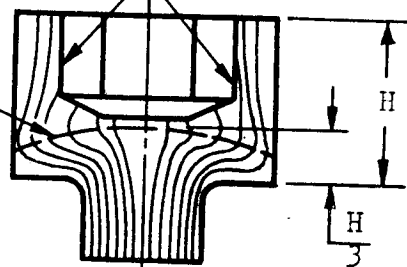
OPTIONAL LINES
AT THIS POINT

FIGURE 1B

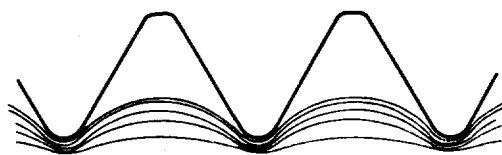


FIGURE 2
FLOW LINES
ROLLED THREAD

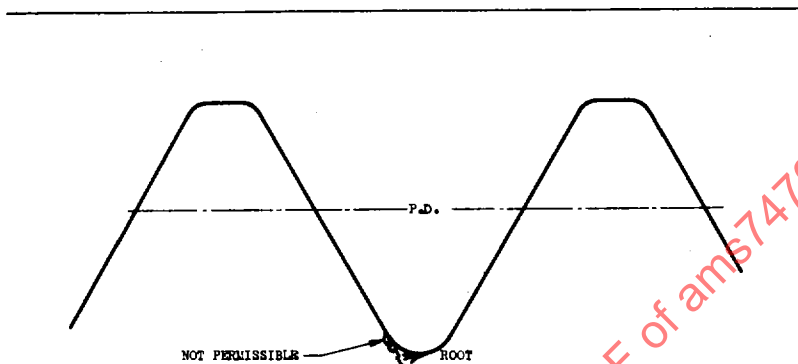


FIGURE 3
ROLLED THREAD

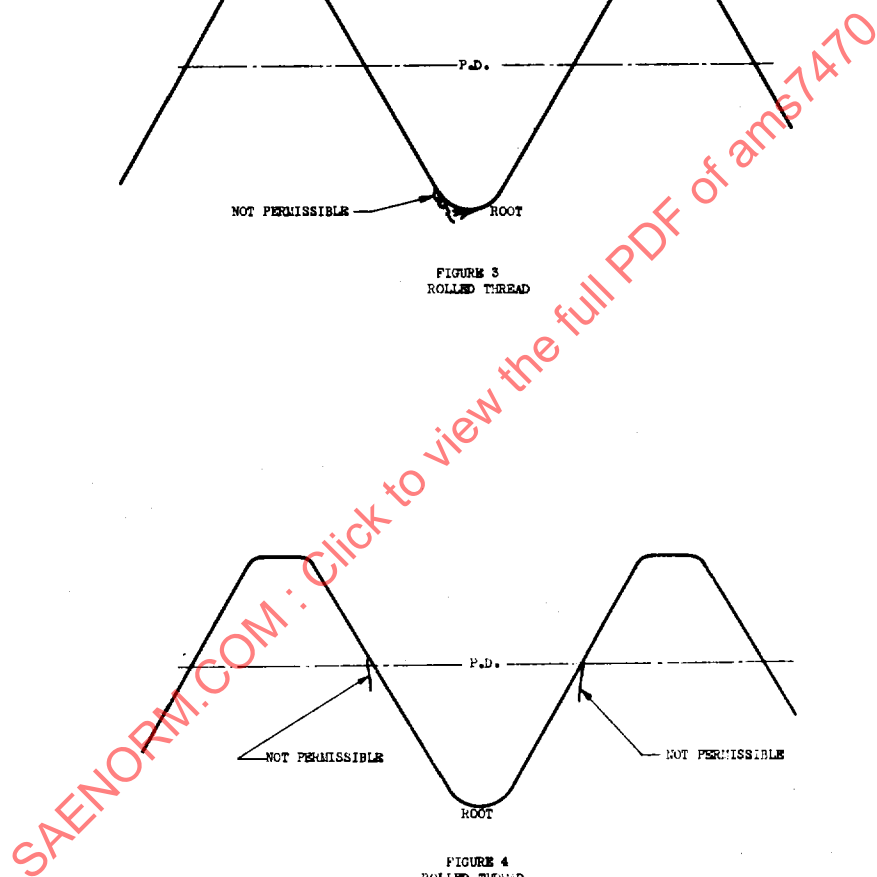


FIGURE 4
ROLLED THREAD

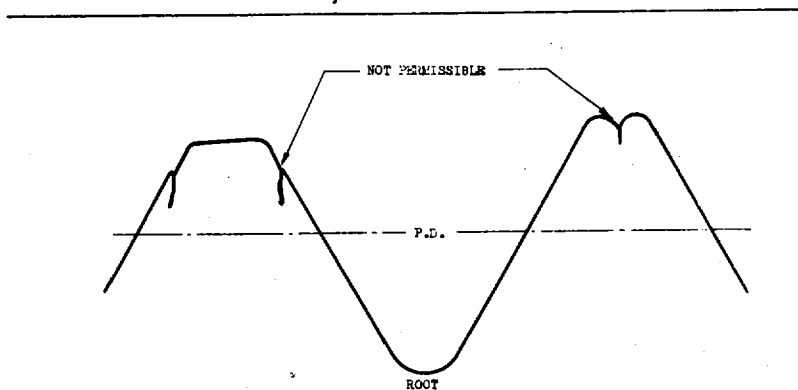


FIGURE 5
ROLLED THREAD