AEROSPACE MATERIAL SPECIFICATION

AMS6409™ REV. F

Issued 1987-01
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Superseding AMS6409F

Steel, Bars, Forgings, Mechanical Tubing and Forging Stock 0.80Cr - 1.8Ni - 0.25Mo (0.38 - 0.43C) (SAE 4340) Special Aircraft Quality Cleanliness Normalized and Tempered (Composition similar to UNS G43406)

RATIONALE

AMS6409F results from a Five-Year Review and update of this specification that updates the title, revises composition (3.1), condition (3.2.2), updates note on Table 2, updates macrostructure (3.3.1.1, 3.3.1.2, 8.9), adds specimen heat treatment (3.3.3), updates decarburization (3.3.4.1, 3.3.4.5), adds strain rate to tensile testing (3.3.5.1), prohibits unauthorized exceptions (3.6, 4.4.5, 5.2.1, 8.8), acknowledges periodic testing (4.2.1, 4.4.4), allows prior revisions (8.7) and is the result of a Five-Year Review and update of the specification.

1. SCOPE

1.1 Form

This specification covers a low-alloy steel in the form of bars, forgings, mechanical tubing, and forging stock.

1.2 Application

These products have been used typically for parts required to meet stringent magnetic particle inspection criteria, having sections 3.5 inches (89 mm) and under in nominal thickness at time of heat treatment, and requiring a through-hardening steel capable of developing a minimum hardness of 40 HRC when properly hardened and tempered and also for parts of greater thickness, but requiring proportionately lower hardness, but usage is not limited to such applications.

1.2.1 Certain design and processing procedures may cause these products to become susceptible to stress-corrosion cracking after heat treatment; ARP1110 recommends practices to minimize such conditions.

1.2.2 These products are not recommended for use in parts heat treated to a hardness greater than 46 HRC (ultimate tensile strength over 220 ksi (1517 MPa)) or where the high transverse properties of remelted steel are required (see 8.2).

2. APPLICABLE DOCUMENTS

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

For more information on this standard, visit
https://www.sae.org/standards/content/AMS6409F/

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS2251 Tolerances Low-Alloy Steel Bars

AMS2253 Tolerances Carbon and Alloy Steel Tubing

AMS2259 Chemical Check Analysis Limits Wrought Low-Alloy and Carbon Steels

AMS2304 Steel Cleanliness, Special Aircraft-Quality Magnetic Particle Inspection Procedure

AMS2370 Quality Assurance Sampling and Testing Carbon and Low-Alloy Steel Wrought Products and Forging Stock

AMS2372 Quality Assurance Sampling and Testing Carbon and Low-Alloy Steel Forgings

AMS2759/1 Heat Treatment of Carbon and Low-Alloy Steel Parts Minimum Tensile Strength Below 220 ksi (1517 MPa)

AMS2761 Heat Treatment of Steel Raw Materials

AMS2806 Identification Bars, Wire, Mechanical Tubing, and Extrusions, Carbon and Alloy Steels and Corrosion and Heat-Resistant Steels and Alloys

AMS2808 Identification Forgings

AS1182 Standard Stock Removal Allowance Aircraft-Quality and Premium Aircraft-Quality Steel Bars and Mechanical Tubing

ARP1110 Minimizing Stress Corrosion Cracking in Wrought Forms of Steels and Corrosion Resistant Steels and Alloys

ARP1917 Clarification of Terms Used in Aerospace Metals Specifications

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM A255 Determining Hardenability of Steel

ASTM A370 Mechanical Testing of Steel Products

ASTM A751 Chemical Analysis of Steel Products

ASTM E112 Determining Average Grain Size

ASTM E140 Hardness Conversion Tables for Metals, Relationship Among Brinell Hardness, Vickers Hardness, Rockwell Hardness, Superficial Hardness, Knoop Hardness, Scleroscope Hardness, and Leeb Hardness

ASTM E381 Macroetch Testing Steel Bars, Billets, Blooms, and Forgings

ASTM E1077 Estimating the Depth of Decarburization of Steel Specimens

3. TECHNICAL REQUIREMENTS

3.1 Composition

Shall conform to the percentages by weight shown in Table 1, determined in accordance with ASTM A751 or by other analytical methods acceptable to purchaser.

Table 1 - Composition

Element	Min	Max
Carbon	0.38	0.43
Manganese	0.65	0.85
Silicon	0.15	0.35
Phosphorus	--	0.015
Sulfur	--	0.008
Chromium	0.70	0.90
Nickel	1.65	2.00
Molybdenum	0.20	0.30
Copper	--	0.35

3.1.1 Aluminum, vanadium, and columbium are optional grain refining elements and need not be determined or reported unless used to satisfy the average grain size requirements of 3.3.2.2.

3.1.2 Check Analysis

Composition variations shall meet the applicable requirements of AMS2259.

3.2 Condition

The product shall be supplied in the following condition; hardness shall be determined in accordance with ASTM A370:

3.2.1 Bars

Normalized at 1650 °F ± 25 °F (899 °C ± 14 °C) and tempered, having hardness at mid-radius not higher than 322 HBW, or equivalent (see 8.3). Bars shall have a turned, ground, polished, or burnished surface; surface hardness shall be not more than 3 points HRC harder than mid-radius hardness. Bars with a mid-radius hardness less than 20 HRC shall not have a surface hardness greater than that of the mid-radius hardness by the equivalent of 20 HBW.

3.2.1.1 When hot finished or cold drawn bars are specified, the surface hardness shall be not more than 3 points HRC harder than the mid-radius hardness as in 3.2.1. Bars with a mid-radius hardness less than 20 HRC shall not have a surface hardness greater than that of the mid-radius hardness by the equivalent of 20 HBW.

3.2.1.2 Bar shall not be cut from plate (also see 4.4.2).

3.2.2 Forgings

Normalized and tempered in accordance with AMS2761 having hardness not higher than 322 HBW, or equivalent (see 8.3).

3.2.3 Mechanical Tubing

Normalized and tempered having hardness not higher than 322 HBW, or equivalent (see 8.3). Tubing 1.0 inch (25 mm) and under in nominal OD shall be cold reduced; larger sizes shall be hot rolled.

3.2.4 Forging Stock

As ordered by the forging manufacturer.