



AEROSPACE MATERIAL SPECIFICATION

AMS6440™

REV. T

Issued	1939-12
Reaffirmed	2000-09
Revised	2021-04

Superseding AMS6440S

Steel, Bars, Forgings, and Tubing
1.45Cr (0.93 - 1.05C) (SAE 52100)
For Bearing Applications
(Composition similar to UNS G52986)

RATIONALE

AMS6440T results from a Five-Year Review and update of this document that revises analytical analysis specifications (3.1), decarburization (3.3.3.4) and quality (3.4.2), revises testing frequency (4.4), allows prior revisions (8.6), and prohibits unauthorized exceptions (3.6, 4.4.5, 5.2.1, 8.8).

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 bearing components requiring a through-hardening steel, usually with hardness of approximately 60 HRC and section thickness under 0.50 inch (12.7 mm), but usage is not limited to such applications.

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.

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
AMS2301	Steel Cleanliness, Aircraft-Quality Magnetic Particle Inspection Procedure

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<https://www.sae.org/standards/content/AMS6440T/>

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
AMS2806	Identification Bars, Wire, Mechanical Tubing, and Extrusions, Carbon and Alloy Steels and Corrosion and Heat-Resistant Steels and Alloys
AMS2808	Identification Forgings
ARP1917	Clarification of Terms Used in Aerospace Metals Specifications
AS1182	Standard Stock Removal Allowance Aircraft-Quality and Premium Aircraft-Quality Steel Bars and Mechanical Tubing

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 A370	Mechanical Testing of Steel Products
ASTM A751	Standard Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products
ASTM E45	Determining the Inclusion Content of Steel
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 E384	Microindentation Hardness of Materials

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	0.93	1.05
Manganese	0.25	0.45
Silicon	0.15	0.35
Phosphorus	--	0.025
Sulfur	--	0.015
Chromium	1.35	1.60
Nickel	--	0.25
Molybdenum	--	0.10
Copper	--	0.30
Aluminum	--	0.050
Oxygen	--	0.0015

3.1.1 Check Analysis

Composition variations shall meet the applicable requirements of AMS2259.

3.2 Condition

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

3.2.1 Bars

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

3.2.1.1 Bars 0.500 Inch (12.70 mm) and Under in Nominal Diameter or Least Distance Between Parallel Sides

Cold finished, with microstructure of spheroidized cementite in ferrite matrix, having tensile strength not higher than 120 ksi (827 MPa) or equivalent hardness (see 8.2).

3.2.1.2 Bars Over 0.500 Inch (12.70 mm) in Nominal Diameter or Least Distance Between Parallel Sides

Hot finished and annealed unless otherwise ordered, with microstructure of spheroidized cementite in ferrite matrix, having hardness not higher than 207 HB, or equivalent (see 8.3). Bars ordered cold finished may have hardness as high as 248 HB, or equivalent (see 8.3).

3.2.2 Forgings

As ordered.

3.2.3 Mechanical Tubing

Cold finished unless otherwise ordered with microstructure of spheroidized cementite in ferrite matrix, having hardness not higher than 24 HRC, or equivalent (see 8.3). Tubing ordered hot finished and annealed shall have hardness not higher than 95 HRB, or equivalent (see 8.3).

3.2.4 Forging Stock

As ordered by the forging manufacturer.

3.3 Properties

The product shall conform to the following requirements; hardness testing shall be performed in accordance with ASTM A370:

3.3.1 Macrostructure

Visual examination of transverse full cross-sections from bars, billets, tube rounds, and forging stock, etched in hot hydrochloric acid in accordance with ASTM E381, shall not show pipe or cracks. Porosity, segregation, inclusions, and other imperfections shall not be worse than the macrographs of ASTM E381 agreed upon by purchaser and producer.

3.3.2 Micro-Inclusion Rating

At least one specimen from each ingot tested, as well as two-thirds of the total number of specimens and the average of all specimens, shall not exceed the limits shown in Table 2, determined in accordance with ASTM E45, Method A.

Table 2 - Micro-inclusion rating

Type	A	B	C	D
Thin	2.5	2.0	0.5	1.0
Heavy	1.5	1.0	0.5	1.0