AEROSPACE MATERIAL SPECIFICATION

AMS6257™	REV. F
Issued 1990-07 Revised 2016-08 Superseding AMS6257E	

Steel Bars, Forgings, and Tubing
1.6Si - 0.82Cr - 1.8Ni - 0.40Mo - 0.08V (0.40 - 0.44C)
Consumable Electrode Vacuum Remelted
Normalized and Tempered
(Similar to UNS K44220)

RATIONALE

AMS6257F results from a review and update of this specification that revises micro-inclusion (3.4.2.1), test procedure for decarburization (3.4.4.5), quality (3.5), and reporting (4.4).

1. SCOPE

1.1 Form

This specification covers a premium aircraft-quality, 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 under 3.5 inches (89 mm) in thickness requiring a through-hardening steel capable of developing a minimum hardness of 52 HRC, the parts being subject to very rigid magnetic particle inspection standards, 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 occurrences.

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

AMS2300 Steel Cleanliness, Premium Aircraft-Quality Magnetic Particle Inspection Procedure

AMS2310 Qualification Sampling and Testing of Steels for Transverse Tensile Properties

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

AMS2750 Pyrometry

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

AMS2808 Identification Forgings

AMS-H-6875 Heat Treatment of Steel Raw Materials

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

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 A604 Macroetch Testing of Consumable Electrode Remelted Steel Bars and Billets

ASTM E45 Determining the Inclusion Content of Steel

ASTM E112 Determining Average Grain Size

ASTM E140 Hardness Conversion Tables for Metals

ASTM E350 Chemical Analysis of Carbon Steel, Low-Alloy Steel, Silicon Electrical Steel, Ingot Iron, and Wrought Iron

ASTM E384 Microindentation Hardness of Materials

3. TECHNICAL REQUIREMENTS

3.1 Composition

Shall conform to the percentages by weight shown in Table 1, determined by wet chemical methods in accordance with ASTM E350, by spectrochemical, or by other analytical methods approved by purchaser.

Table 1 - Composition

Element	min	max
Carbon	0.40	0.44
Manganese	0.65	0.90
Silicon	1.45	1.80
Phosphorus	--	0.010
Sulfur	--	0.008
Chromium	0.70	0.95
Nickel	1.65	2.00
Molybdenum	0.35	0.45
Vanadium	0.05	0.10
Copper	--	0.35

3.1.1 Check Analysis

Composition variations shall meet the applicable requirements of AMS2259, except that check analysis limits for carbon shall be 0.01 under minimum or over maximum.

3.2 Melting Practice

Steel shall be multiple melted using vacuum consumable electrode practice in the remelt cycle.

3.3 Condition

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

3.3.1 Bars and Tubing

Normalized and tempered at a temperature not higher than 1250 °F (677 °C). Pyrometry shall be in accordance with AMS2750. Bar shall not be cut from plate (also see 4.4.2).

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

Cold finished having tensile strength not higher than 130 ksi (896 MPa), or equivalent hardness (see 8.2).

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

Hot finished unless otherwise ordered, having hardness not higher than 341 HB, or equivalent (see 8.3). Bars ordered cold finished may have hardness as high as 341 HB (see 8.3).

3.3.1.3 Mechanical Tubing

Cold finished, unless otherwise ordered, having hardness not higher than 341 HB or equivalent (see 8.3). Tubing ordered hot finished and annealed shall have hardness not higher than 99 HRB, or equivalent (see 8.3).

3.3.2 Forgings

Normalized and tempered in accordance with AMS-H-6875 to a hardness not higher than 341 HB, or equivalent (see 8.3).

3.3.3 Forging Stock

As ordered by the forging manufacturer.

3.4 Properties

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

3.4.1 Macrostructure

Visual examination of transverse sections from bars, billets, tube rounds, or forging stock, etched in hot hydrochloric acid in accordance with ASTM A604, shall not show pipe or cracks. Porosity, segregation, inclusions, and other imperfections for product 144 in^2 (929 cm^2) and under in nominal cross-sectional area shall not be worse than the macrographs of ASTM A604 shown in Table 2.

Table 2 - Macrostructure limits

Class	Condition	Severity
1	Freckles	A
2	White Spots	A
3	Radial Segregation	B
4	Ring Pattern	B

3.4.2 Micro-Inclusion Rating of Each Heat

No specimen shall exceed the limits shown in Table 3, determined in accordance with ASTM E45, Method D.

Table 3 - Micro-inclusion rating limits

Type	A Thin	A Heavy	B Thin	B Heavy	C Thin	C Heavy	D Thin	D Heavy
Worst Field Severity	1.5	1.0	1.0	1.0	1.0	1.0	1.5	1.0
Worst Field Frequency, maximum	a	1	a	1	a	1	3	1
Total Rateable Fields, Frequency, maximum	b	1	b	1	b	1	8	1

a - Combined A+B+C, not more than 3 fields
b - Combined A+B+C, not more than 8 fields

3.4.2.1 A rateable field is defined as one which has a Type A, B, C, or D inclusion rating of at least 1.0 thin or heavy in accordance with ASTM E45.

3.4.3 Average Grain Size of Bar, Forgings, and Tubing

Shall be ASTM 6 or finer, determined in accordance with ASTM E112.

3.4.4 Decarburization

3.4.4.1 Bars and tubing ordered ground, turned, or polished shall be free from decarburization on the ground, turned, or polished surfaces. Decarburization on tubing ID shall not exceed the maximum depth specified in Table 5.

3.4.4.2 Allowable decarburization of bars, billets, and tube rounds ordered for redrawing or forging or to specified microstructural requirements shall be as agreed upon by purchaser and producer.