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SAE-AMS6267, "STEEL BARS, FORGINGS, AND TUBING 1.2CR - 3.25NI - 0.12MO (0.07 - 0.13C) (SAE 9310) ELECTROSLAG REMELTED OR CONSUMABLE ELECTRODE VACUUM REMELTED", was adopted on 10-MAR-89 for use by the Department of Defense (DoD). Proposed changes by DoD activities must be submitted to the DoD Adopting Activity: Commander, Defense Supply Center Philadelphia, ATTN: DSCP-ILEA, 700 Robbins Avenue, Philadelphia, PA 19111-5096. Copies of this document may be purchased from the Society of Automotive Engineers 400 Commonwealth Drive Warrendale, Pennsylvania, United States, 15096-0001. <http://www.sae.org/>

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# AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard



AMS 6267E

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Superseding AMS 6267D

STEEL, BARS, FORGINGS, AND TUBING  
1.2Cr - 3.25Ni - 0.12Mo (0.07 - 0.13C) (SAE 9310)  
Electroslag Remelted or Consumable Electrode Vacuum Remelted

UNS G93106

## 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 carburized parts requiring high minimum core hardness with a narrow range and subject to stringent magnetic particle inspection standards, but usage is not limited to such applications.

### 1.3 Classification:

Steel covered by this specification is classified by melting practice as follows:

Type 1 - Electroslag remelted (ESR)

Type 2 - Consumable electrode vacuum remelted (VAR)

1.3.1 Unless a specific type is ordered, either type may be supplied.

## 2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

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## 2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 2251	Tolerances, Low-Alloy Steel Bars
MAM 2251	Tolerances, Metric, Low-Alloy Steel Bars
AMS 2253	Tolerances, Carbon and Alloy Steel Tubing
MAM 2253	Tolerances, Metric, Carbon and Alloy Steel Tubing
AMS 2259	Chemical Check Analysis Limits, Wrought Low-Alloy and Carbon Steels
AMS 2300	Premium Aircraft-Quality Steel Cleanliness, Magnetic Particle Inspection Procedure
MAM 2300	Premium Aircraft-Quality Steel Cleanliness, Magnetic Particle Inspection Procedure, Metric (SI) Measurement
AMS 2370	Quality Assurance Sampling and Testing, Carbon and Low-Alloy Steel Wrought Products and Forging Stock
AMS 2372	Quality Assurance Sampling and Testing, Carbon and Low-Alloy Steel Forgings
AMS 2806	Identification, Bars, Wire, Mechanical Tubing, and Extrusions, Carbon and Alloy Steels and Corrosion and Heat Resistant Steels and Alloys
AMS 2808	Identification, Forgings
AS1182	Standard Machining Allowance, Aircraft-Quality and Premium Aircraft-Quality Steel Bars and Mechanical Tubing

## 2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM A 255	End-Quench Test for Hardenability of Steel
ASTM A 370	Mechanical Testing of Steel Products
ASTM A 604	Macroetch Testing of Consumable Electrode Remelted Steel Bars and Billets
ASTM E 112	Determining the Average Grain Size
ASTM E 350	Chemical Analysis of Carbon Steel, Low-Alloy Steel, Silicon Electrical Steel, Ingot Iron, and Wrought Iron

## 2.3 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-STD-163	Steel Mill Products, Preparation for Shipment and Storage
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## 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 E 350, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

TABLE 1 - Composition

Element	min	max
Carbon	0.07	0.13
Manganese	0.40	0.70
Silicon	0.15	0.35
Phosphorus	--	0.015
Sulfur	--	0.015
Chromium	1.00	1.40
Nickel	3.00	3.50
Molybdenum	0.08	0.15
Boron	--	0.001 (10 ppm)
Copper	--	0.35

3.1.1 Check Analysis: Composition variations shall meet the applicable requirements of AMS 2259.

## 3.2 Melting Practice:

Steel shall be multiple melted using either electroslag remelt practice (ESR) or consumable electrode vacuum practice (VAR) 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 A 370:

## 3.3.1 Bars:

3.3.1.1 Bars 0.500 Inch (12.70 mm) and Under in Nominal Diameter or Distance Between Parallel Sides: Cold finished having tensile strength not higher than 125 ksi (862 MPa) or hardness not higher than 262 HB, or equivalent (See 8.2).

3.3.1.2 Bars Over 0.500 Inch (12.70 mm) in Nominal Diameter or Distance Between Parallel Sides: Hot finished and annealed having hardness not higher than 229 HB, or equivalent, except that bars ordered cold finished may have hardness as high as 248 HB, or equivalent (See 8.2).

3.3.2 Forgings: As ordered.

3.3.3 Mechanical Tubing: Cold finished having hardness not higher than 25 HRC, or equivalent, except that tubing ordered hot finished and annealed or tempered shall have hardness not higher than 99 HRB, or equivalent (See 8.2).

3.3.4 Forging Stock: As ordered by the forging manufacturer.

3.4 Properties:

The product shall conform to the following requirements; hardness testing shall be performed in accordance with ASTM A 370:

3.4.1 Macrostructure: Visual examination of transverse full cross-sections from bars, billets, tube rounds or tubes, and forging stock etched in hot hydrochloric acid in accordance with ASTM A 604, shall show no pipe or cracks. Except as specified in 3.4.1.1, porosity, segregation, inclusions, and other imperfections for product 36 square inches (232 cm<sup>2</sup>) and under in nominal cross-sectional area shall be no worse than the macrographs of ASTM A 604 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

3.4.1.1 If tubes are produced directly from ingots or large blooms, transverse sections may be taken from tubes rather than tube rounds. Macrostructure standards for such tubes shall be as agreed upon by purchaser and vendor.

3.4.2 Average Grain Size: Shall be ASTM No. 5 or finer, determined in accordance with (R) ASTM E 112 (See 8.3).

3.4.3 Hardenability: Shall be J41=1 maximum and J32=6 minimum, determined on the standard end quench test specimen in accordance with ASTM A 255, except that the steel shall be normalized at 1700 °F ± 10 (927 °C ± 6) and the test specimen austenitized at 1500 °F ± 10 (816 °C ± 6).

3.5 Quality:

The product, as received by purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from imperfections detrimental to usage of the product.

3.5.1 Steel shall conform to AMS 2300 or MAM 2300.

3.5.2 Bars and mechanical tubing ordered hot rolled or cold drawn or ground, turned, or polished shall, after removal of the standard machining allowance in accordance with AS1182, be free from seams, laps, tears, and cracks open to the ground, turned, or polished surfaces.

3.5.3 Grain flow of die forgings, except in areas which contain flash-line end grain, shall follow the general contour of the forgings showing no evidence of re-entrant grain flow.

3.6 Tolerances:

Shall be as follows:

3.6.1 Bars: In accordance with AMS 2251 or MAM 2251.

3.6.2 Mechanical Tubing: In accordance with AMS 2253 or MAM 2253.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of the product shall supply all samples for vendor's tests and shall be responsible for the performance of all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the product conforms to specified requirements.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Composition (3.1), condition (3.3), macrostructure (3.4.1), average grain size (3.4.2), hardenability (3.4.3), frequency-severity cleanliness rating (3.5.1), and tolerances (3.6) are acceptance tests and shall be performed on each heat or lot as applicable.

4.2.2 Periodic Tests: Grain flow of die forgings (3.5.3) is a periodic test and shall be performed at a (R) frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.3 Sampling and Testing:

Shall be as follows:

4.3.1 Bars, Mechanical Tubing, and Forging Stock: In accordance with AMS 2370.

4.3.2 Forgings: In accordance with AMS 2372.