# AEROSPACE MATERIAL SPECIFICATION

| AMS5641™ | REV. J |
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Issued 1942-06
Reaffirmed 2000-08
Revised 2021-10

Superseding AMS5641H

# Steel, Corrosion-Resistant, Bars, Wire, Forgings and Forging Stock 18.5Cr - 10Ni - 0.22Se (303Se) Free-Machining; for Swaging or Upsetting Solution Heat Treated

(Composition similar to UNS S30323)



RATIONALE

AMS5641J is the result of a Five-Year Review and update of the specification. The revision updates the title to match the scope and application, prohibits unauthorized exceptions (3.6, 4.4.4, 5.2.1.1, 8.7, deletes 8.8) updates composition testing (3.1), updates classification of tests (4.2), adds cold finished (3.2.1.2), adds strain rate control (3.3.1.1), adds AS1182 (3.4.2, 8.5), and allows prior revisions (8.6).

## 1. SCOPE

### 1.1 Form

This specification covers a free-machining, corrosion-resistant steel in the form of bars, wire, forgings, and forging stock.

### 1.2 Application

These products have been used typically for parts which may be swaged or hot upset during fabrication and on which the amount of machining warrants use of a free-machining grade of steel, but usage is not limited to such applications. Corrosion resistance is similar to that of the standard 18-8 type steel.

## 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.

AMS2241 Tolerances, Corrosion and Heat-Resistant Steel, Iron Alloy, Titanium, and Titanium Alloy Bars and Wire

AMS2248 Chemical Check Analysis Limits, Wrought Corrosion and Heat-Resistant Steels and Alloys, Maraging and Other Highly-Alloyed Steels, and Iron Alloys



**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/AMS5641J

AMS2371 Quality Assurance Sampling and Testing, Corrosion and Heat-Resistant Steels and Alloys, Wrought Products and Forging Stock

AMS2374 Quality Assurance Sampling and Testing, Corrosion and Heat-Resistant Steel and Alloy 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 Chemical Analysis of Steel Products

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

3. TECHNICAL REQUIREMENTS

3.1 Composition

Shall conform to the following percentages by weight as shown in Table 1, determined in accordance with ASTM A751 or other analytical methods approved by purchaser:

***Table 1 - Composition***

| Element | Min | Max |
|---|---|---|
| Carbon | -- | 0.12 |
| Manganese | -- | 2.00 |
| Silicon | -- | 0.70 |
| Phosphorus | 0.11 | 0.17 |
| Sulfur | -- | 0.040 |
| Chromium | 17.00 | 20.00 |
| Nickel | 8.00 | 12.00 |
| Selenium | 0.15 | 0.30 |
| Molybdenum | -- | 0.75 |
| Copper | -- | 0.75 |



3.1.1 Check Analysis

Composition variations shall meet the applicable requirements of AMS2248.

3.2 Condition

The product shall be supplied in the following condition:

3.2.1 Bars, Wire, and Forgings

Solution heat treated free from continuous carbide network.

3.2.1.1 All hexagons, other bars 2.75 inches (69.8 mm) and under in nominal diameter or distance between parallel sides, and wire shall be cold finished.

3.2.1.2 Bars, other than hexagons, over 2.75 inches (69.8 mm) in nominal diameter or distance between parallel sides shall be hot finished or cold finished.

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

3.2.2 Forging Stock

As ordered by the forging manufacturer.

3.3 Properties

Bars, wire, and forgings shall conform to the following requirements; hardness and tensile testing shall be performed in accordance with ASTM A370.

3.3.1 Tensile Properties

Shall be as shown in Table 2:

***Table 2 - Tensile properties***

| Property | Value |
|---|---|
| Tensile Strength | 75.0 to 115 ksi (517 to 793 MPa) |
| Elongation in 4D, minimum | 35% |

3.3.1.1 Unless otherwise specified, the strain rate shall be set at 0.005 in/in/min (0.005 mm/mm/min) and maintained within a tolerance of ±0.002 in/in/min (0.002 mm/mm/min) through 0.2% offset yield strain. The strain rate after yield may be increased to any value up to 0.5 in/in/min (or 0.5 mm/mm/min) or equivalent crosshead speed as a function of gage length.

3.3.1.2 Elongation requirements apply only to bars and wire 0.125 inch (3.18 mm) and over in nominal diameter or distance between parallel sides.

3.3.1.3 Elongation requirements for bars and wire outside the size range of 3.3.1.2 shall be agreed upon between purchaser and producer.

3.3.2 Hardness

3.3.2.1 Bars

Shall be as shown in Table 3, or equivalent (see 8.2), determined at approximate mid-radius or quarter thickness.

***Table 3 - Hardness of bars***

| Nominal Diameter or Distance Between Parallel Sides Inches | Nominal Diameter or Distance Between Parallel Sides Millimeters | Brinell Hardness Min | Brinell Hardness Max |
|---|---|---|---|
| Up to 2.00, incl | Up to 50.8, incl | 140 | 255 |
| Over 2.00 | Over 50.8 | -- | 255 |

3.3.2.2 Forgings

Shall be not higher than 187 HB, or equivalent (see 8.2).

3.3.2.3 Properties of forging stock shall be as agreed upon by purchaser and producer.

3.4 Quality

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

3.4.1 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 reentrant grain flow.

3.4.2 Round bars shall be free from seams, laps, tears, and cracks after removal of the standard stock removal allowance in accordance with AS1182. Superficial surface imperfections such as scratches or pits shall not exceed applicable tolerances.

3.5 Tolerances

Bars and wire shall conform to all applicable requirements of AMS2241.

3.6 Exceptions

Any exceptions shall be authorized by the purchaser and reported as in 4.4.4.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The producer of the product shall supply all samples for producer'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), tensile properties (3.3.1), and hardness (3.3.2) are acceptance tests and shall be performed on each heat or lot as applicable.

4.2.2 Periodic Tests

Condition (3.2.1) and grain flow of die forgings (3.4.1) are periodic tests and shall be performed at a frequency selected by the producer unless frequency of testing is specified by the purchaser.

4.3 Sampling and Testing

4.3.1 Bars, Wire, and Forging Stock

Shall be in accordance with AMS2371.

4.3.2 Forgings

Shall be in accordance with AMS2374.

4.4 Reports

4.4.1 The producer of bars, wire, and forgings shall furnish with each shipment a report showing the producer’s name and country where the metal was melted (e.g., final melt in the case of metal processed by multiple melting operations) and the results of tests for composition of each heat and for tensile properties and hardness of each lot. This report shall include the purchase order number, heat and lot numbers, AMS5641J, size, and quantity. If forgings are supplied, the size and melt source of stock used to make the forgings shall also be included.

4.4.1.1 When the product size is outside the range covered by 3.3.1.2, the report shall contain a statement to that effect.