AEROSPACE MATERIAL SPECIFICATION

AMS5610™	REV. R

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Superseding AMS5610P

Steel, Corrosion- and Heat-Resistant, Bars, Wire, Forgings, and Forging Stock 12.5Cr - Low Carbon (SAE 51416, 51416Se) Free-Machining (Composition similar to UNS S41600 and UNS S41623)

RATIONALE

AMS5610R is the result of a Five-Year Review and update of the specification. The revision includes updates to composition testing and reporting (3.1, 3.1.1), an update to the relevant heat-treatment specifications (3.2.3, 3.3.1), an update to the quality requirements for bars (3.4.1, 8.6), addresses additional properties that may be requested by the purchaser (4.4.3, 8.7), updates packaging consistent with similar material specifications (5.3), updates exception requirements (8.5), and adds Type as an ordering option (8.7).

1. SCOPE

1.1 Form

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

1.2 Application

These products have been used typically for parts requiring hardness up to 35 HRC on which the amount of machining warrants use of a free-machining grade of steel with oxidation resistance up to 1000 °F (538 °C), but usage is not limited to such applications. The product is useful at the higher temperatures only when stresses are low.

1.3 Classification

The steels covered by this specification are classified as follows:

Type 1 - 12.5Cr - 0.27Se (UNS S41623)

Type 2 - 12.5Cr - 0.28S (UNS S41600)

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

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

For more information on this standard, visit
https://www.sae.org/standards/content/AMS5610R

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, Corrosion- and Heat-Resistant Steels and Alloys, Maraging and Other Highly Alloyed Steels, and Iron Alloys

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

AMS2750 Pyrometry

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

AS7766 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 A370 Mechanical Testing of Steel Products

ASTM A751 Chemical Analysis of Steel Products

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

2.3 Definitions

Terms used in AMS are defined in AS7766.

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 the purchaser.

Table 1 - Composition

Element	Type 1 Min	Type 1 Max	Type 2 Min	Type 2 Max
Carbon	--	0.15	--	0.15
Manganese	--	1.25	--	2.50
Silicon	--	1.00	--	1.00
Phosphorus	--	0.060	--	0.060
Sulfur	--	0.030	0.15	0.40
Selenium	0.18	0.35	--	--
Chromium	11.50	13.50	11.50	13.50
Nickel	--	0.75	--	0.75
Molybdenum or Zirconium	--	0.60	--	0.60
Copper	--	0.50	--	0.50

3.1.1 The producer may test for any element not listed in Table 1 and include this analysis in the report of 4.4. Reporting of any element not listed in the composition table is not a basis for rejection unless limits of acceptability are specified by the purchaser.

3.1.2 Check Analysis

Composition variations shall meet the applicable requirements of AMS2248.

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

Annealed, having hardness not higher than 241 HBW, or equivalent (see 8.2).

3.2.1.1 All hexagons and other bars, 2.750 inches (69.85 mm) and under in nominal diameter or least distance between parallel sides shall be cold finished.

3.2.1.2 Bars, other than hexagons, over 2.750 inches (69.85 mm) in nominal diameter or least distance between parallel sides shall be hot finished or cold-finished.

3.2.1.3 Bars shall not be cut from plate (see 4.4.1).

3.2.2 Wire

Cold drawn and annealed, having tensile strength not higher than 125 ksi (862 MPa).

3.2.3 Forgings

Annealed in accordance with AMS2761.

3.2.4 Forging Stock

As ordered by the forging manufacturer.

3.3 Properties

The product shall conform to the following requirements:

3.3.1 Response to Heat Treatment

Product 0.375 inch (9.52 mm) and under in nominal diameter or least distance between parallel sides (thickness) and specimens 0.375 inch ± 0.010 inch (9.52 mm ± 0.25 mm) thick cut from larger product shall have hardness not lower than 35 HRC, or equivalent (see 8.2), determined in accordance with ASTM A370, after being heated to 1825 °F ± 25 °F (996 °C ± 14 °C), held at heat for 30 minutes ± 3 minutes, and cooled at a rate equivalent to still air. Pyrometry shall be in accordance with AMS2750.

3.4 Quality

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

3.4.1 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.

3.4.2 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.

3.5 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 4.4.2.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The producer of the product shall supply all samples for the producer's tests and shall be responsible for the performance of all required tests. The 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 (3.2), response to heat treatment (3.3.1), and tolerances (3.5) are acceptance tests and shall be performed on each heat or lot as applicable.

4.2.2 Periodic Tests

Grain flow of die forgings (3.4.2) is a periodic test 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

Shall be as follows:

4.3.1 Bars, Wire, and Forging Stock

In accordance with AMS2371.