SAE Aerospace
An SAE International Group

AEROSPACE MATERIAL SPECIFICATION

SAE AMS5632 | REV. H

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Superseding AMS5632G

Steel, Corrosion-Resistant, Bars, Wire, and Forgings 17Cr - 0.50Mo (0.95 - 1.20C) (SAE 51440F) Free-Machining, Annealed (Composition similar to UNS S44020 (Type I) or UNS S44023 (Type II))

RATIONALE

AMS5632H has been reaffirmed to comply with the SAE five-year review policy.

1. SCOPE

1.1 Form

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

1.2 Application

These products have been used typically for parts requiring resistance to both corrosion and wear with hardness up to 58 HRC, where the amount of machining warrants use of a free-machining steel, but usage is not limited to such applications.

1.3 Classification

The steel compositions covered by this specification are classified as follows:

Type 1 - 17Cr - 0.50Mo - 0.22S (0.95 - 1.20C)
Type 2 - 17Cr - 0.50Mo - 0.20Se (0.95 - 1.20C)

1.3.1 Unless a specific type is ordered, either Type I or Type II may be supplied.

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.

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

SAE values your input. To provide feedback on this Technical Report, please visit
http://www.sae.org/technical/standards/AMS5632H

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

AMS 2241	Tolerances, Corrosion and Heat-Resistant Steel, Iron Alloy, Titanium, and Titanium Alloy Bars and Wire
AMS 2248	Chemical Check Analysis Limits, Corrosion and Heat-Resistant Steels and Alloys, Maraging and Other Highly Alloyed Steels, and Iron Alloys
AMS 2371	Quality Assurance Sampling and Testing, Corrosion and Heat-Resistant Steels and Alloys, Wrought Products and Forging Stock
AMS 2374	Quality Assurance Sampling and Testing, Corrosion and Heat-Resistant Steels and Alloy 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 International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM A 370	Mechanical Testing of Steel Products
ASTM B 660	Packaging/Packing of Aluminum and Magnesium Products
ASTM E 353	Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys
ASTM E 381	Macroetch Testing, Steel Bars, Billets, Blooms, and Forgings
ASTM E 384	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 E 353, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

TABLE 1 - COMPOSITION

Element	Type 1 min	Type 1 max	Type 2 min	Type 2 max
Carbon	0.95	1.20	0.95	1.20
Manganese	--	1.25	--	1.25
Silicon	--	1.00	--	1.00
Phosphorus	--	0.040	--	0.040
Sulfur	0.10	0.35	--	0.030
Chromium	16.00	18.00	16.00	18.00
Molybdenum	0.40	0.60	0.40	0.60
Selenium	--	--	0.15	0.25
Nickel	--	0.75	--	0.75
Nitrogen	--	0.08	--	0.08
Copper	--	0.75	--	0.75
Tin	--	0.05	--	0.05

3.1.1 Check Analysis

Composition variations shall meet the applicable requirements of AMS 2248.

3.2 Condition

The product shall be supplied in the following condition; hardness and tensile strength shall be determined in accordance with ASTM A 370:

3.2.1 Bars

Annealed having hardness not higher than 285 HB, or equivalent (See 8.3).

3.2.1.1 Bars 2.750 Inches (69.85 mm) and Under in Nominal Diameter or Least Distance Between Parallel Sides and All Hexagons

Cold finished. Round bars may be centerless ground.

3.2.1.2 Bars, Other Than Hexagons, Over 2.750 Inches (69.85 mm) in Nominal Diameter or Least Distance Between Parallel Sides

Hot finished and descaled or cold finished.

3.2.2 Wire

Annealed and cold finished having tensile strength not higher than 140,000 psi (965 MPa) or equivalent hardness (See 8.2).

3.2.3 Forgings

As ordered.

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 Macrostructure

Visual examination of transverse full cross-sections from bars, billets, and forging stock, etched in hot hydrochloric acid in accordance with ASTM E 381, shall show no pipe or cracks. Porosity, segregation, inclusions, and other imperfections shall be no worse than the macrographs of ASTM E 381 agreed upon by purchaser and vendor.

3.3.2 Decarburization

3.3.2.1 Bars and wire ordered ground, turned, or polished shall be free from decarburization on the ground, turned, or polished surfaces.

3.3.2.2 Allowable decarburization of bars, wire, and billets ordered for redrawing or forging or to specified microstructural requirements shall be as agreed upon by purchaser and vendor.

3.3.2.3 Decarburization of bars and wire to which 3.3.2.1 or 3.3.2.2 is not applicable shall be not greater than shown in Table 2.

TABLE 2A - MAXIMUM DEPTH OF DECARBURIZATION, INCH/POUND UNITS

Nominal Diameter or Distance Between Parallel Sides Inches	Total Depth of Decarburization Inch
Up to 0.500, incl	0.015
Over 0.500 to 1.000, incl	0.020
Over 1.000 to 1.500, incl	0.025
Over 1.500 to 2.000, incl	0.030
Over 2.000 to 2.500, incl	0.035
Over 2.500 to 3.000, incl	0.040

TABLE 2B - MAXIMUM DEPTH OF DECARBURIZATION, SI UNITS

Nominal Diameter or Distance Between Parallel Sides Millimeters	Total Depth of Decarburization Millimeters
Up to 12.70, incl	0.38
Over 12.70 to 25.40, incl	0.51
Over 25.40 to 38.10, incl	0.64
Over 38.10 to 50.80, incl	0.76
Over 50.80 to 63.50, incl	0.89
Over 63.50 to 76.20, incl	1.02

3.3.2.4 Decarburization shall be measured by the metallographic method, by HR 30N scale hardness testing method, or by a traverse method using microhardness testing in accordance with ASTM E 384. The hardness method(s) shall be conducted on a hardened but untempered specimen protected during heat treatment to prevent changes in surface carbon content. Depth of decarburization, when measured by a hardness method, is defined as the perpendicular distance from the surface to the depth under that surface below which there is no further increase in hardness. Such measurements shall be far enough away from any adjacent surface to be uninfluenced by any decarburization on the adjacent surface. In case of dispute, the depth of decarburization determined using the microhardness traverse method shall govern.

3.3.2.5 When determining the depth of decarburization, it is permissible to disregard local areas provided the decarburization of such areas does not exceed the above limits of Table 2 by more than 0.005 inch (0.12 mm) and the width is 0.065 inch (1.65 mm) or less.

3.3.3 Response to Heat Treatment

Product 0.375 inch (9.52 mm) and under in nominal cross-section and 0.375 inch ± 0.015 (9.52 mm ± 0.38) thick specimens cut from larger product shall have hardness not lower than 58 HRC, or equivalent (See 8.3), after being heated to 1875 °F ± 10 (1024 °C ± 6), held at heat for 30 minutes ± 3, and cooled in still air.

3.4 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.

3.4.1 Bars and 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 surface.

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 AMS 2241.

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), macrostructure (3.3.1), and response to heat treatment (3.3.3), are acceptance tests and shall be performed on each heat or lot as applicable.

4.2.2 Periodic Tests

Decarburization (3.3.2) and grain flow of die forgings (3.4.2) are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by the purchaser.

4.3 Sampling

Shall be as follows:

4.3.1 Bars, Wire, and Stock for Forging

In accordance with AMS 2371.

4.3.2 Forgings

In accordance with AMS 2374.

4.4 Reports

The vendor of the product shall furnish with each shipment a report showing the results of tests for composition, macrostructure, and response to heat treatment of each heat and stating that the product conforms to the other technical requirements. This report shall include the purchase order number, heat and lot numbers, AMS 5632H, size, and quantity. If forgings are supplied, the size and melt source of stock used to make the forgings shall also be included.

4.5 Resampling and Retesting

Shall be as follows:

4.5.1 Bars, Wire, and Stock for Forging

In accordance with AMS 2371.

4.5.2 Forgings

In accordance with AMS 2374.