SAE Aerospace
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AEROSPACE MATERIAL SPECIFICATION

SAE AMS5880 REV. E

Issued 1980-04
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Cancelled 2012-01
Stabilized 2013-03

Superseding AMS5880D

Steel, Corrosion-Resistant, Bars, Wire, and Forgings 17Cr 0.52Mo (0.95 1.20C) (SAE 51440C) for Bearing Applications

(Composition similar to UNS S44004)

RATIONALE

AMS5880E rescinds the previous cancellation and supersession, and at the same time stabilizes the document because it still has use in the bearing industry. For historical reference, revision D of AMS5880 cancelled the document and superseded it with AMS5618.

STABILIZATION NOTICE

AMS5880E has been declared "STABILIZED" by AMS Committee F and will no longer be subjected to periodic reviews for currency. Users are responsible for verifying references and continued suitability of technical requirements. Newer technology may exist. The last technical update of this document occurred in May, 2006. Users of this document should refer any certification issues (e.g. exceptions listed on the certification report) to the cognizant engineering organization for their disposition. CAUTION: In many cases the purchaser is not the cognizant engineering organization (i.e. purchaser may be a sub tier supplier).

AMS Committee F recommends that the following technically equivalent (e.g. properties, fit, form, function) specifications be used for future procurement. This listing does not constitute authority to substitute these specifications for the "STABILIZED" specification.

AMS5618 Steel, Corrosion-Resistant, Bars, Wire, and Forgings, 17Cr - 0.52Mo (0.95 - 1.20C) (440C), Consumable Electrode Vacuum Melted

AMS5630 Steel, Corrosion-Resistant, Bars, Wire, and Forgings, 17Cr - 0.52Mo (0.95 - 1.20C) (440C)

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
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SAE values your input. To provide feedback on this Technical Report, please visit
http://www.sae.org/technical/standards/AMS5880E

1. SCOPE

1.1 Form

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

1.2 Application

These products have been used typically for anti-friction bearing parts requiring resistance to both corrosion and wear with hardness usually not lower than 58 HRC after hardening and tempering, but usage is not limited to such applications.

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 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 Steel 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 E 45 Determining the Inclusion Content of Steel
ASTM E 112 Determining Average Grain Size
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	min	max
Carbon	0.95	1.20
Manganese	--	1.00
Silicon	--	1.00
Phosphorus	--	0.040
Sulfur	--	0.030
Chromium	16.00	18.00
Molybdenum	0.40	0.65
Nickel	--	0.75
Copper	--	0.75

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

Shall have hardness not higher than 255 HB, or equivalent (See 8.2).

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

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.

3.2.2 Wire

Cold finished having tensile strength not higher than 130 ksi (896 MPa) or equivalent hardness (See 8.3).

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; hardness testing shall be performed in accordance with ASTM A 370.

3.3.1 Macrostructure

3.3.1.1 Transverse

Visual examination of transverse full cross-sections from bars, wire, billets, and forging stock, etched in hot hydrochloric acid in accordance with ASTM E 381, shall show no pipe or cracks.

3.3.1.2 Longitudinal

Visual examination of sections as in 4.3.4 from bars, billets, and forging stock over 0.500 inch (12.7 mm) in nominal thickness or diameter, after preparation and etching as in 3.3.3.2.1, shall show no streaks longer than 1/8 inch (3.2 mm) attributable to carbide segregation.

3.3.1.2.1 The surface to be examined, 2 inches (50.8 mm) minimum by diameter or thickness, shall be polished with 180 grit or finer abrasive and etched for sufficient time to produce a dark gray background coloration. The etchant may be 1:1 hydrochloric acid at 150 to 160 °F (66 to 71 °C) or 1:1 hydrochloric acid plus 1% hydrogen peroxide swabbed at room temperature.

3.3.2 Micro-Inclusion Rating

At least one specimen from each ingot tested, as well as two-thirds of the total number of specimens and the average of all specimens, shall not exceed the limits shown in Table 2, determined in accordance with ASTM E 45, Method A, except that the length of any inclusion shall be not greater than 0.025 inch (0.64 mm).

TABLE 2 - MICRO-INCLUSION RATING LIMITS

Type	A	B	C	D
Thin	2.0	2.5	2.5	2.0
Heavy	1.5	1.5	2.0	1.5

3.3.3 Response to Heat Treatment

Specimens as in 4.3.3, protected by suitable means or treated in a neutral atmosphere to minimize scaling and prevent either carburization or decarburization, shall have hardness not lower than 58 HRC, or equivalent (See 8.2), after being heated to 1925 °F ± 25 (1052 °C ± 14), held at heat for 30 minutes ± 3, and quenched in oil.

3.3.3.1 Sub-zero cooling to -100 °F ± 20 (-73 °C ± 11), holding at that temperature for 2 hours ± 0.25, and warming in air to room temperature, after heating as in 3.4.5, is optional.

3.3.4 Average Grain Size

Shall be ASTM No. 6 or finer, determined in accordance with ASTM E 112 on specimens hardened in accordance with the procedure of 3.3.3.

3.3.5 Decarburization

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

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

3.3.5.3 Decarburization of bars and wire to which 3.3.5.1 or 3.3.5.2 is not applicable shall be not greater than shown in Table 3.

TABLE 3A - MAXIMUM DECARBURIZATION, INCH/POUND UNITS

Nominal Diameter or Distance Between Parallel Sides Inches	Total Depth of Decarburization Inch
Up to 0.500, incl	0.010
Over 0.500 to 1.000, incl	0.015
Over 1.000 to 1.500, incl	0.020
Over 1.500 to 2.000, incl	0.025
Over 2.000 to 2.500, incl	0.030
Over 2.500 to 3.000, incl	0.035
Over 3.000 to 4.000, incl	0.045

TABLE 3B - MAXIMUM DECARBURIZATION, SI UNITS

Nominal Diameter or Distance Between Parallel Sides Millimeters	Total Depth of Decarburization Millimeters
Up to 12.70, incl	0.25
Over 12.70 to 25.40, incl	0.38
Over 25.40 to 38.10, incl	0.51
Over 38.10 to 50.80, incl	0.64
Over 50.80 to 63.50, incl	0.76
Over 63.50 to 76.20, incl	0.89
Over 76.20 to 101.60, incl	1.14

3.3.5.4 Decarburization shall be measured by the metallographic method, by HR30N scale hardness testing method, or by the microhardness 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 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 decarburization on the adjacent surface. In case of dispute, the depth of decarburization determined using the microhardness traverse method shall govern.

3.3.5.4.1 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 by more than 0.005 inch (0.13 mm) and the width is 0.065 inch (1.65 mm) or less.

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 wire 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 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), condition (3.2), macrostructure (3.3.1.1 and 3.3.1.2), micro-inclusion rating (3.3.2), response to heat treatment (3.3.3), average grain size (3.3.4), decarburization (3.3.5), and tolerances (3.5) are acceptance tests and shall be performed on each heat or lot as applicable.

4.2.2 Grain flow of die forgings (3.4.2) is a periodic test and shall be performed at a 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, Wire, and Forging Stock

In accordance with AMS 2371.

4.3.2 Forgings

In accordance with AMS 2374.

4.3.3 Specimens for response to heat treatment (3.3.3) of bars, wires, and billets shall be not less than 0.375 inch (9.52 mm) in thickness. Minimum dimensions in other directions shall be either those of the product thickness or 1.125 × 1.125 inches (28.58 × 28.58 millimeters).

4.3.4 Samples for longitudinal macrostructure (3.3.1.2) testing shall be 2 inches (51 mm) long specimens taken through the center of the cross-section of the product supplied.