

NOTICE OF
ADOPTION

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SUPERSEDING
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Title of Document: Steel Bars, Forgings, and Rings
0.50Cr - 0.55Ni - 0.20Mo - (0.28 - 0.33C) (SAE 8630)

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AEROSPACE MATERIAL SPECIFICATION

SAE AMS-6280

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Superseding AMS-6280G

Submitted for recognition as an American National Standard

STEEL BARS, FORGINGS, AND RINGS
0.50Cr - 0.55Ni - 0.20Mo (0.28 - 0.33C) (SAE 8630)

UNS G86300

1. SCOPE:

1.1 Form: This specification covers an aircraft-quality, low alloy steel in the form of bars, forgings, flash welded rings, and stock for forging or flash welded rings.

1.2 Application: Primarily for parts, with sections 0.500 inch (12.70 mm) and under in thickness at time of heat treatment, requiring a through-hardening steel capable of developing hardness as high as 35 HRC when properly hardened and tempered and also parts of greater thickness but requiring proportionately lower hardness.

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.

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

2.1.1 Aerospace Material Specifications:

AMS-2251 - Tolerances, Low-Alloy Steel Bars

MAM-2251 - Tolerances, Metric, Low-Alloy Steel Bars

AMS-2259 - Chemical Check Analysis Limits, Wrought Low-Alloy and Carbon Steels

AMS-2301 - Aircraft-Quality Steel Cleanliness, Magnetic Particle Inspection Procedure

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2.1.1 (Continued):

- AMS-2370 - Quality Assurance Sampling of Carbon and Low-Alloy Steels, Wrought Products Except Forgings and Forging Stock
- AMS-2372 - Quality Assurance Sampling of Carbon and Low-Alloy Steels, Forgings and Forging Stock
- 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
- AMS-7496 - Rings, Flash Welded, Carbon and Low-Alloy Steels

2.1.2 Aerospace Standards:

- AS1182 - Standard Machining Allowance, Aircraft-Quality and Premium Aircraft-Quality Steel Bars and Mechanical Tubing

2.2 ASTM Publications: Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

- ASTM A 255 - End-Quench Test for Hardenability of Steel
- ASTM A 370 - Mechanical Testing of Steel Products
- ASTM E 112 - Determining Average Grain Size
- ASTM E 350 - Chemical Analysis of Carbon Steel, Low-Alloy Steel, Silicon Electrical Steel, Ingot Iron, and Wrought Iron
- ASTM E 381 - Macroetch Testing, Inspection, and Rating Steel Products, Comprising Bars, Billets, Blooms, and Forgings

2.3 U.S. Government Publications: Available from Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

2.3.1 Military Standards:

- MIL-STD-163 - Steel Mill Products, Preparation for Shipment and Storage

3. TECHNICAL REQUIREMENTS:

3.1 Composition: Shall conform to the following percentages by weight, determined by wet chemical methods in accordance with ASTM E 350, by spectrochemical methods, or by other analytical methods acceptable to purchaser:

	min	max
Carbon	0.28	0.33
Manganese	0.70	0.90
Silicon	0.15	0.35
Phosphorus	--	0.025
Sulfur	--	0.025
Chromium	0.40	0.60
Nickel	0.40	0.70
Molybdenum	0.15	0.25
Copper	--	0.35

- 3.1.1 Check Analysis: Composition variations shall meet the applicable requirements of AMS-2259.
- 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:
- 3.2.1.1 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 125,000 psi (862 MPa) or hardness not higher than 27 HRC.
- 3.2.1.2 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.
- 3.2.2 Forgings and Flash Welded Rings: As ordered.
- 3.2.2.1 Flash welded rings shall not be supplied unless specified or permitted on purchaser's part drawing. When supplied, rings shall be manufactured in accordance with AMS-7496.
- 3.2.3 Stock for Forging or Flash Welded Rings: As ordered by the forging or flash welded ring 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: Visual examination of transverse sections as in 4.3.3 from bars, billets, and stock for forging or flash welded rings, etched in accordance with ASTM E 381 in hot hydrochloric acid, shall show no pipe or cracks. Porosity, segregation, inclusions, and other imperfections shall be no worse than the following macrographs of ASTM E 381:
- | Section Size | | Macrographs |
|----------------------|-----------------------|----------------|
| Square Inches | Square Centimetres | |
| Up to 36, incl | Up to 232, incl | S2-R1-C2 |
| Over 36 to 100, incl | Over 232 to 645, incl | S2-R2-C3 |
| Over 100 | Over 645 | As agreed upon |
- 3.3.2 Grain Size: Predominantly 5 or finer with occasional grains as large as 3 permissible, determined in accordance with ASTM E 112.
- 3.3.3 Hardenability: Shall be J35=5 minimum and J28=8 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 1525°F ± 10 (829°C ± 6). The hardenability test is not required on a product which will not yield a suitable specimen but the steel from which the product is made shall conform to the hardenability specified.

3.3.4 Decarburization:

- 3.3.4.1 Bars and flash welded rings ordered ground, turned, or polished shall be free from decarburization on the ground, turned, or polished surfaces.
- 3.3.4.2 Allowable decarburization of bars and billets ordered for redrawing or forging or to specified microstructural requirements shall be as agreed upon by purchaser and vendor.
- 3.3.4.3 Decarburization of bars and flash welded rings to which 3.3.4.1 or 3.3.4.2 is not applicable shall be not greater than shown in Table I:

TABLE I

Nominal Diameter or Distance Between Parallel sides Inches	Depth of Decarburization Inch
Up to 0.375, incl	0.010
Over 0.375 to 0.500, incl	0.012
Over 0.500 to 0.625, incl	0.014
Over 0.625 to 1.000, incl	0.017
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 I (SI)

Nominal Diameter or Distance Between Parallel Sides Millimetres	Depth of Decarburization Millimetres
Up to 9.52, incl	0.25
Over 9.52 to 12.70, incl	0.30
Over 12.70 to 15.88, incl	0.36
Over 15.88 to 25.40, incl	0.43
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

- 3.3.4.3.1 When permitted by purchaser, flash welded rings, to be machined all over, may have decarburization greater than shown in Table I provided such decarburization is removable within the machining allowance for the part.
- 3.3.4.4 Limits for depth of decarburization of bars and ring cross-sections over 4.000 inches (101.60 mm) in nominal diameter or distance between parallel sides shall be as agreed upon by purchaser and vendor.

3.3.4.5 Decarburization shall be measured by the microscopic method or by Rockwell Superficial 30-N scale or equivalent hardness testing method on hardened but untempered specimens 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 or lack of decarburization thereon.

3.3.4.6 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:

3.4.1 Steel shall be aircraft quality conforming to AMS-2301.

3.4.2 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.

3.4.2.1 Bars ordered hot rolled or cold drawn and bars and flash welded rings
Ø ordered 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.

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

3.5 Sizes: Except when exact lengths or multiples of exact lengths are ordered, straight bars will be acceptable in mill lengths of 6 - 20 feet (1.8 - 6.1 m) but not more than 10% of any shipment shall be supplied in lengths shorter than 10 feet (3 m).

3.6 Tolerances: Bars shall conform to all applicable requirements of AMS-2251 or MAM-2251.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of the product shall supply all
Ø samples for vendor's tests and shall be responsible for performing all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the product conforms to the requirements of this specification.

4.2 Classification of Tests: Tests for all technical requirements are
Ø acceptance tests and shall be performed on each heat or lot as applicable.