



Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 5845A

Superseding AMS 5845

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ALLOY BARS, HIGH STRENGTH, CORROSION RESISTANT
20Cr - 35Ni - 35Co - 10Mo
Solution Heat Treated, Cold Drawn, and Aged

UNS R30035

1. SCOPE:

- 1.1 **Form:** This specification covers a high-strength, corrosion-resistant alloy in the form of bars.
- 1.2 **Application:** Primarily for applications requiring a combination of high strength, good tension-tension fatigue strength, toughness, ductility, and exceptionally good corrosion resistance.

2. **APPLICABLE DOCUMENTS:** The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications (AMS) shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

- 2.1 **SAE Publications:** Available from Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

- AMS 2261 - Tolerances, Nickel, Nickel Base, and Cobalt Base Alloy Bars and Forging Stock
- AMS 2269 - Chemical Check Analysis Limits, Wrought Nickel Alloys and Cobalt Alloys
- AMS 2350 - Standards and Test Methods
- AMS 2371 - Quality Assurance Sampling of Corrosion and Heat Resistant Alloys, Wrought Products Except Forgings
- AMS 2806 - Identification - Bars, Wire, Mechanical Tubing, and Extrusions, Carbon and Alloy Steels and Heat and Corrosion Resistant Steels and Alloys

- 2.2 **ASTM Publications:** Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

- ASTM E8 - Tension Testing of Metallic Materials
- ASTM E18 - Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials
- ASTM E112 - Estimating the Average Grain Size of Metals
- ASTM E354 - Chemical Analysis of High Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt Alloys

- 2.3 **Government Publications:** Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.3.1 Federal Standards:

Federal Test Method Standard No. 151 - Metals; Test Methods

2.3.2 Military Standards:

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

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3. TECHNICAL REQUIREMENTS:

3.1 Composition: Shall conform to the following percentages by weight, determined by wet chemical methods in accordance with ASTM E354, by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other analytical methods approved by purchaser:

	min	max
Carbon	--	0.025
Manganese	--	0.15
Silicon	--	0.15
Phosphorus	--	0.015
Sulfur	--	0.010
Chromium	19.00 - 21.00	
Nickel	33.00 - 37.00	
Molybdenum	9.00 - 10.50	
Titanium	--	1.00
Iron	--	1.00
Cobalt	remainder	

3.1.1 Check Analysis: Composition variations shall meet the requirements of AMS 2269.

3.2 Condition: Solution heat treated, cold drawn, aged, and centerless ground.

3.3 Heat Treatment: Bars shall be solution heat treated by heating to $1925^{\circ}\text{F} \pm 25$ ($1050^{\circ}\text{C} \pm 15$), holding at heat for 1 - 2 hr, and cooling in air to room temperature. After cold drawing, the bars shall be aged by heating to a temperature within the range $1000^{\circ} - 1200^{\circ}\text{F}$ ($540^{\circ} - 645^{\circ}\text{C}$), holding at the selected temperature within $\pm 25^{\circ}\text{F}$ ($\pm 15^{\circ}\text{C}$) for 4 - 4-1/2 hr, and cooling in air to room temperature.

3.4 Properties: Bars shall conform to the following requirements:

3.4.1 Tensile Properties: Shall be as follows, determined in accordance with ASTM E8:

Tensile Strength, min	260,000 psi (1793 MPa)
Yield Strength at 2% Offset, min	230,000 psi (1586 MPa)
Elongation in 4D, min	8%
Reduction of Area, min	35%

3.4.2 Hardness: Shall be not lower than 44 HRC or equivalent, determined in accordance with ASTM E18.

3.4.3 Grain Size: Predominantly 4 or finer with occasional grains as large as 2 permissible, determined by comparison of a polished and etched specimen with the chart in ASTM E112.

3.5 Quality:

3.5.1 Alloy shall be produced by multiple melting using vacuum induction followed by vacuum consumable electrode melting practice.

3.5.2 Bars, as received by purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from internal and external imperfections detrimental to usage of the bars.

- 3.6 Sizes: Except when exact lengths or multiples of exact lengths are ordered, straight bars will be acceptable in mill lengths of 6 - 20 ft (1.8 - 6.1 m) but not more than 10% of any shipment shall be supplied in lengths shorter than 10 ft (3 m).
- 3.7 Tolerances: Unless otherwise specified, tolerances shall conform to all applicable requirements of AMS 2261.

4. QUALITY ASSURANCE PROVISIONS:

- 4.1 Responsibility for Inspection: The vendor of bars shall supply all samples and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.4. Purchaser reserves the right to perform such confirmatory testing as he deems necessary to ensure that the bars conform to the requirements of this specification.
- 4.2 Classification of Tests: Tests to determine conformance to all technical requirements of this specification are classified as acceptance tests and shall be performed on each lot.
- 4.3 Sampling: Shall be in accordance with AMS 2371; a heat shall be the consumable electrode remelted ingots produced from alloy originally melted as a single furnace charge; a lot shall be all bars of one size from one heat produced at the same time.
- 4.3.1 Specimens for tensile testing shall be of standard proportions in accordance with ASTM E8 with either 0.250 in. (6.25 mm) diameter at the reduced parallel gage section or smaller specimens proportional to the standard when required. Specimens shall be machined from the center of bars 0.800 in. (20.32 mm) and under in nominal diameter or distance between parallel sides and from midradius of larger size bars.
- 4.4 Reports:
- 4.4.1 The vendor of bars shall furnish with each shipment three copies of a report showing the results of tests for chemical composition of each heat and for tensile properties, hardness, and grain size of each lot. This report shall include the purchase order number, heat number, material specification number and its revision letter, size, and quantity from each heat.
- 4.4.2 The vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, material specification number and its revision letter, contractor or other direct supplier of bars, part number, and quantity. When bars for making parts are produced or purchased by the parts vendor, that vendor shall inspect each lot of bars to determine conformance to the requirements of this specification, and shall include in the report a statement that the bars conform, or shall include copies of laboratory reports showing the results of tests to determine conformance.
- 4.5 Resampling and Retesting: Shall be in accordance with AMS 2371.

5. PREPARATION FOR DELIVERY:

- 5.1 Identification: Bars shall be identified in accordance with AMS 2806.
- 5.2 Packaging:
- 5.2.1 Bars shall be prepared for shipment in accordance with commercial practice and in compliance with applicable rules and regulations pertaining to the handling, packaging, and transportation of the bars to ensure carrier acceptance and safe delivery. Packaging shall conform to carrier rules and regulations applicable to the mode of transportation.