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400 Commonwealth Dr., Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

AMS 5843B

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Superseding AMS 5843A

ALLOY BARS, CORROSION AND HEAT RESISTANT
19Cr - 36Co - 25Ni - 7.0Mo - 0.50Cb - 2.9Ti - 0.20Al - 9.0Fe
Vacuum Induction Plus Vacuum Consumable Electrode Melted
Solution Heat Treated, Work Strengthened, and Aged

UNS R30159

1. SCOPE:

1.1 Form: This specification covers a high strength, corrosion and heat resistant cobalt-chromium-nickel alloy in the form of bars.

1.2 Application: Primarily for applications requiring a combination of high strength up to 1100°F (593°C), good tension-tension fatigue strength, toughness, and ductility. This alloy exhibits exceptionally good resistance to corrosion, crevice-corrosion, stress-corrosion cracking, and elevated temperature relaxation.

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 documents shall be as specified in AMS 2350.

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

2.1.1 Aerospace Material Specifications:

AMS 2261 - Tolerances, Nickel, Nickel Alloy, and Cobalt Alloy Bars and Forging Stock
MAM 2261 - Tolerances, Metric, Nickel, Nickel Alloy, and Cobalt 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 Steels and Alloys, Wrought Products Except Forgings and Forging Stock
AMS 2750 - Pyrometry
AMS 2806 - Identification, Bars, Wire, Mechanical Tubing, and Extrusions, Carbon and Alloy Steels and Corrosion and Heat Resistant Steels and Alloys

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

ASTM E8 - Tension Testing of Metallic Materials
ASTM E8M - Tension Testing of Metallic Materials (Metric)
ASTM E18 - Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials
ASTM E21 - Elevated Temperature Tension Tests of Metallic Materials
ASTM E112 - Determining Average Grain Size
ASTM E139 - Conducting Creep, Creep-Rupture, and Stress-Rupture Tests of Metallic Materials
ASTM E292 - Conducting Time-for-Rupture Notch Tension Tests of Materials
ASTM E354 - Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt Alloys

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

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, Ø determined by wet chemical methods in accordance with ASTM E354, by spectrochemical methods, or by other analytical methods acceptable to purchaser:

	min	max
Carbon	--	0.04
Manganese	--	0.20
Silicon	--	0.20
Phosphorus	--	0.020
Sulfur	--	0.010
Chromium	18.00	20.00
Cobalt	34.00	38.00
Molybdenum	6.00	8.00
Columbium	0.25	0.75
Titanium	2.50	3.25
Aluminum	0.10	0.30
Iron	8.00	10.00
Boron	--	0.03
Nickel	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 a Ø temperature within the range 1900° - 1925°F (1038° - 1052°C), holding at the selected temperature within ±25°F (±14°C) for 4 - 8 hours, and quenching in water. After cold drawing, bars shall be aged by heating to a temperature within the range 1200° - 1250°F (649° - 677°C), holding at the selected temperature within ±25°F (±14°C) for not less than 4 hours, and cooling at a rate equivalent to an air cool or faster. Pyrometry shall be in accordance with AMS 2750.

3.4 Properties: Bars 1-3/4 inches (44.4 mm) and under in nominal diameter shall conform to the following requirements.

3.4.1 Tensile Properties:

3.4.1.1 At Room Temperature: Shall be as follows, determined in accordance with ASTM E8 or ASTM E8M on specimens as in 4.3.1:

Tensile Strength, minimum	260,000 psi (1793 MPa)
Yield Strength at 0.2% Offset, minimum	250,000 psi (1724 MPa)
Elongation in 4D, minimum	6%
Reduction of Area, minimum	22%

3.4.1.2 At 1100°F (593°C): Shall be as follows, determined in accordance with ASTM E21 on specimens as in 4.3.1 heated to 1100°F ± 10 (593°C ± 6), held at heat for 20 - 30 minutes before testing, and tested at 1100°F ± 10 (593°C ± 6):

Tensile Strength, minimum	205,000 psi (1413 MPa)
Yield Strength at 0.2% Offset, minimum	190,000 psi (1310 MPa)
Elongation in 4D, minimum	5%
Reduction of Area, minimum	15%

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.

3.4.4 Stress-Rupture Properties at 1200°F (649°C): Shall be as follows; testing of notched specimens and of combination smooth-and-notched specimens shall be in accordance with ASTM E292 and of smooth specimens in accordance with ASTM E139:

3.4.4.1 Ø A standard cylindrical combination smooth-and-notched specimen conforming to ASTM E292, maintained at 1200°F ± 3 (649°C ± 2) while a load sufficient to produce an initial axial stress of 140,000 psi (965 MPa) is applied continuously, shall not rupture in less than 23 hours. The test shall be continued to rupture without change of load. After 23 hours, if rupture occurs in the notch, the smooth section shall, by suitable means, be continued to rupture or a separate smooth specimen shall be tested to rupture under the above conditions. Elongation of the smooth section after rupture, measured at room temperature, shall be not less than 5% in 4D.

3.4.4.2 Ø As an alternate procedure, separate smooth and notched specimens, machined from adjacent sections of the same piece with gage sections conforming to the respective dimensions shown in ASTM E292, may be tested individually under the conditions of 3.4.4.1. The smooth specimen shall not rupture in less than 23 hours and elongation after rupture, measured at room temperature, shall be not less than 5% in 4D. The notched specimen shall not rupture in less time than the companion smooth specimen.

3.4.4.3 The tests of 3.4.4.1 and 3.4.4.2 may be conducted using a load higher than required to produce an initial axial stress of 140,000 psi (965 MPa) but load shall not be changed while test is in progress. Time to rupture and elongation requirements shall be as specified in 3.4.4.1.

3.4.4.4 When permitted by purchaser, the tests of 3.4.4.1 and 3.4.4.2 may be conducted using incremental loading. In such case, the load required to produce an initial axial stress of 140,000 psi (965 MPa) shall be used to rupture or for 23 hours, whichever occurs first. After 23 hours and at intervals of 8 - 16 hours, preferably 8 - 10 hours, thereafter, the stress shall be increased in increments of 5,000 psi (34.5 MPa). Time to rupture and elongation requirements shall be as specified in 3.4.4.1.