ADOPTION NOTICE

SAE-AMS5843, "Alloy, Corrosion and Heat Resistant, Bars 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", was adopted on 17-JAN-95 for use by the Department of Defense (DoD). Proposed changes by DoD activities must be submitted to the DoD Adopting Activity: ASC/ENOSD, Building 125, 2335 Seventh Street, Suite 6, Wright-Patterson AFB, OH 45433-7809. DoD activities may obtain copies of this standard from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 11911-5094. The private sector and other Government agencies may purchase copies from the Society of Automotive Engineers Inc., 400 Commonwealth Drive, Warrendale, PA 15096-0001.

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AEROSPACE MATERIAL SPECIFICATION

SAE AMS 5843C

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Submitted for recognition as an American National Standard

Superseding AMS 5843B

ALLOY, CORROSION AND HEAT RESISTANT, BARS
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:

These bars have been used typically for applications requiring a combination of high strength up to 1100 °F (593 °C), good tension-tension fatigue strength, toughness, and ductility, but usage is not limited to such applications. 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 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.

AMS 2261	Tolerances, Nickel, Nickel Alloy, and Cobalt Alloy Bars, Rods, and Wire
MAM 2261	Tolerances, Metric, Nickel, Nickel Alloy, and Cobalt Alloy Bars, Rods, and Wire
AMS 2269	Chemical Check Analysis Limits, Wrought Nickel Alloys and Cobalt
AMS 2371	Quality Assurance Sampling and Testing, Corrosion and Heat Resistant Steels and Alloys, Wrought Products 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 19103-1187.

ASTM E 8 Tension Testing of Metallic Materials
ASTM E 8M Tension Testing of Metallic Materials (Metric)
ASTM E 18 Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials
ASTM E 21 Elevated Temperature Tension Tests of Metallic Materials
ASTM E 112 Determining the Average Grain Size
ASTM E 139 Conducting Creep, Creep-Rupture, and Stress-Rupture Tests of Metallic Materials
ASTM E 292 Conducting Time-for-Rupture Notch Tension Tests of Materials
ASTM E 354 Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt Alloys

2.3 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-STD163 Steel Mill Products, Preparation for Shipment and Storage

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 354, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

TABLE 1 - Composition

Element	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 Melting Practice:

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

3.3 Condition:

Solution heat treated, cold drawn, aged, and centerless ground.

3.4 Heat Treatment:

Bars shall be solution heat treated by heating to a temperature within the range 1900 to 1925 °F (1038 to 1052 °C), holding at the selected temperature within ±25 °F (±14 °C) for 4 to 8 hours, and quenching in water. After cold drawing, bars shall be aged by heating to a temperature within the range 1200 to 1250 °F (649 to 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 (See 8.2). Pyrometry shall be in accordance with AMS 2750:

3.5 Properties:

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

3.5.1 Tensile Properties:

3.5.1.1 At Room Temperature: Shall be as shown in Table 2, determined in accordance with ASTM E 8 or ASTM E 8M.

TABLE 2 - Minimum Room Temperature Tensile Properties

Property	Value
Tensile Strength	260 ksi (1793 MPa)
Yield Strength at 0.2% Offset	250 ksi (1724 MPa)
Elongation in 4D	6%
Reduction of Area	22%

3.5.1.2 At 1100 °F (593 °C): Shall be as shown in Table 3, determined in accordance with ASTM E 21 on specimens heated to 1100 °F ± 10 (593 °C ± 6), held at heat for 20 to 30 minutes before testing, and tested at 1100 °F ± 10 (593 °C ± 6):

TABLE 3 - Minimum Elevated Temperature Tensile Properties

Property	Value
Tensile Strength	205 ksi (1413 MPa)
Yield Strength at 0.2% Offset	190 ksi (1310 MPa)
Elongation in 4D	5%
Reduction of Area	15%

3.5.2 Hardness: Shall be not lower than 44 HRC, or equivalent (See 8.3), determined in accordance with ASTM E 18.

3.5.3 (R) Average Grain Size: Shall be ASTM No. 4 or finer, determined in accordance with ASTM E 112 (See 8.4).

3.5.4 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 E 292 and of smooth specimens in accordance with ASTM E 139:

3.5.4.1 (R) A standard cylindrical combination smooth-and-notched specimen conforming to ASTM E 292, maintained at 1200 °F ± 3 (649 °C ± 2) while a load sufficient to produce an initial axial stress of 140 ksi (965 MPa) or higher 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.

3.5.4.2 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 E 292, may be tested individually under the conditions of 3.5.4.1. 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.

3.5.4.3 (R) The tests of 3.5.4.1 and 3.5.4.2 may be conducted using incremental loading. In such case, the load required to produce an initial axial stress of 140 ksi (965 MPa) or higher shall be used to rupture or for 23 hours, whichever occurs first. After the 23 hours and at intervals of 8 to 16 hours, thereafter, the stress shall be increased in increments of 5.0 ksi (34.5 MPa). Time to rupture and elongation requirements shall be as specified in 3.5.4.1.

3.6 Quality:

Bars, 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 bars.

3.7 Tolerances:

Shall conform to all applicable requirements of AMS 2261 or MAM 2261.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

(R)

The vendor of bars shall supply all 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 bars conform to the requirements of this specification.

4.2 Classification of Tests:

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

4.3 Sampling and Testing:

(R)

Shall be in accordance with AMS 2371.

4.3.1 Specimens for tensile and smooth-bar stress-rupture testing shall be of standard proportions in accordance with ASTM E 8 or ASTM E 8M with either 0.250 inch (6.35 mm) diameter at the reduced parallel gage section or smaller specimens proportional to the standard when required. Other stress-rupture specimens shall be as specified in 3.4.4. All specimens shall be machined from the center of bars 0.800 inch (20.32 mm) and under in nominal diameter or distance between parallel sides and from mid-radius of larger size bars.

4.4 Reports:

(R)

The vendor of bars shall furnish with each shipment a report showing the results of tests for chemical composition of each heat and the results of tests on each lot to determine conformance to the other technical requirements. This report shall include the purchase order number, heat and lot number, AMS 5843C, size, quantity, and a statement of record of specific temperature and time used in the aging cycle.

4.5 Resampling and Retesting:

Shall be in accordance with AMS 2371.