SAE Aerospace
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AEROSPACE MATERIAL SPECIFICATION

SAE AMS 5919

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Cobalt-Nickel Alloy, Corrosion and Heat-Resistant, Round Bars 19Cr - 36Co - 25Ni - 7.0Mo - 0.50Cb - 2.9Ti - 0.20Al - 9.0Fe Vacuum Induction Plus Vacuum Consumable Electrode Melted Solution Heat Treated and Work Strengthened, Modified Strength

(Composition similar to UNS R30159)

RATIONALE

This document has been reaffirmed to comply with the SAE 5-year Review policy.

1. SCOPE:

1.1 Form:

This specification covers a corrosion and heat-resistant, work strengthened cobalt-nickel-chromium alloy in the form of bars 2 inches (50.8 mm) and under in nominal diameter (See 8.2).

1.2 Application:

These bars have been used typically for parts, such as fasteners, requiring a room temperature minimum tensile strength of 170 ksi (1172 MPa) for use up to 850 °F (454 °C) in applications requiring high ductility to promote toughness and resistance to cracking under shock loading conditions, but usage is not limited to such applications. This alloy exhibits exceptionally good resistance to corrosion, crevice corrosion, and stress-corrosion cracking.

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, 400 Commonwealth Drive, Warrendale, PA 15096-0001 or www.sae.org.

AMS 2261	Tolerances, Nickel, Nickel Alloy, and Cobalt Alloy Bars, Rods, and Wire
AMS 2269	Chemical Check Analysis Limits, Nickel, Nickel Alloys and Cobalt Alloys
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, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959 or www.astm.org.

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 112	Determining Average Grain Size
ASTM E 354	Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt Alloys

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 applicable 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 and work strengthened.

3.4 Solution 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. Pyrometry shall be in accordance with AMS 2750.

3.5 Properties:

Bars shall conform to the following requirements:

3.5.1 As Solution Heat Treated and Work Strengthened:

3.5.1.1 Hardness: Shall be not lower than 30 HRC, or equivalent (See 8.3), determined in accordance with ASTM E 18.

3.5.1.2 Average Grain Size: Shall be ASTM No. 4 or finer, determined in accordance with ASTM E 112.

3.5.2 After Aging: Bars, 2 inches (50.8 mm) and under in nominal diameter, solution heat treated as in 3.4 and suitably work strengthened, shall have the following properties after being aged by heating to a temperature within the range 900 to 1100 °F (482 to 593 °C), holding at the selected temperature within ±25 °F (±14 °C) for 4 to 4-1/2 hours, and cooling at a rate equivalent to an air cool (See 8.2):

3.5.2.1 Tensile Properties:

At room temperature, shall be as shown in Table 2, determined in accordance with ASTM E 8 or ASTM E 8M on specimens as in 4.3.1.

TABLE 2 - Minimum Room Temperature Tensile Properties

Property	Value
Tensile Strength	170 ksi (1172 MPa)
Yield Strength at 0.2% Offset	150 ksi (1034 MPa)
Elongation in 4D	15%
Reduction of Area	40%

3.5.2.2 Hardness: Shall be not lower than 36 HRC, or equivalent (See 8.3), determined in accordance with ASTM E 18.

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.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of bars 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 bars conform to specified requirements.

4.2 Classification of Tests:

All technical requirements are acceptance tests and shall be performed on each heat or lot as applicable.

4.3 Sampling and Testing:

Shall be in accordance with AMS 2371 and the following:

4.3.1 In testing round bars, specimens for tensile 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. All specimens shall be machined from the center of bars 0.800 inch (20.32 mm) and under in nominal diameter and from mid-radius of larger size bars.

4.4 Reports:

The vendor of the bars shall furnish with each shipment a report showing the following results of tests and relevant information:

4.4.1 For each heat:

Composition.

4.4.2 For each lot:

As solution treated:
Hardness
Average grain size.
After aging:
Tensile properties
Hardness.
Specific temperature and time used in the laboratory aging cycle (3.5.2).

4.4.3 A statement that the product conforms to the other technical requirements.

4.4.4 Purchase order number
Heat and lot numbers
AMS 5919
Size
Quantity.

4.5 Resampling and Retesting:

Shall be in accordance with AMS 2371.