AEROSPACE MATERIAL SPECIFICATION

AMS5920™	REV. C

Issued 2003-04
Reaffirmed 2007-08
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Superseding AMS5920B

Cobalt-Nickel Alloy, Corrosion- and Heat-Resistant, Round Bars
19Cr - 36Co - 25Ni - 7.0Mo - 0.50Cb (Nb) - 2.9Ti - 0.20Al - 9.0Fe
Vacuum Induction Plus Vacuum Consumable Electrode Melted
Solution Heat Treated, Work-Strengthened, and Aged, Modified Strength
(Composition similar to UNS R30159)

RATIONALE

AMS5920C is the result of a Five-Year Review and update of the specification. The revision updates composition testing and reporting (see 3.1 and 3.1.1), adds strain rate control (see 3.5.1.1.1), adds recommendation to use nickel tables (see 8.3), addresses the use of prior revisions (see 8.5), and updates the exception requirements (see 8.6).

1. SCOPE

1.1 Form

This specification covers a corrosion- and heat-resistant, work-strengthened, and aged cobalt-nickel-chromium alloy in the form of bars 2 inches (50 mm) and under in nominal diameter.

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 International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS2261 Tolerances, Nickel, Nickel Alloy, and Cobalt Alloy Bars, Rods, and Wire

AMS2269 Chemical Check Analysis Limits, Nickel, Nickel Alloys, and Cobalt Alloys

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

For more information on this standard, visit
https://www.sae.org/standards/content/AMS5920C

AMS2283 Composition Testing Methods for Nickel- and Cobalt-Based Alloys

AMS2371 Quality Assurance Sampling and Testing, Corrosion and Heat-Resistant Steels and Alloys, Wrought Products and Forging Stock

AMS2750 Pyrometry

AMS2806 Identification Bars, Wire, Mechanical Tubing, and Extrusions, Carbon and Alloy Steels, and Corrosion and Heat-Resistant Steels and Alloys

AS7766 Terms Used in Aerospace Metals Specifications

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM E8/E8M Tension Testing of Metallic Materials

ASTM E18 Rockwell Hardness of Metallic Materials

ASTM E112 Determining Average Grain Size

ASTM E140 Hardness Conversion Tables for Metals Relationship Among Brinell Hardness, Vickers Hardness, Rockwell Hardness, Superficial Hardness, Knoop Hardness, Scleroscope Hardness, and Leeb Hardness

3. TECHNICAL REQUIREMENTS

3.1 Composition

Composition shall conform to the percentages by weight shown in Table 1, determined in accordance with AMS2283 or by other analytical methods acceptable to the 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 (Niobium)	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 The producer may test for any element not listed in Table 1 and include this analysis in the report of 4.4. Reporting of any element not listed in the composition table is not a basis for rejection unless limits of acceptability are specified by the purchaser.

3.1.2 Check Analysis

Composition variations shall meet the applicable requirements of AMS2269.

3.2 Melting Practice

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

3.3 Condition

Bars shall be solution heat treated, work strengthened, 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 work strengthening, bars shall be 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 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 AMS2750.

3.5 Properties

Bars shall conform to the following requirements:

3.5.1 Tensile Properties

Tensile properties at room temperature, shall be as shown in Table 2, determined in accordance with ASTM E8/E8M on specimens as in 4.3.1 (see 8.2).

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 or 2 inches (50 mm)	15%
Reduction of Area	40%

3.5.1.1.1 Unless otherwise specified, the strain rate shall be set at 0.005 in/in/min (0.005 mm/mm/min) and maintained within a tolerance of ±0.002 in/in/min (±0.002 mm/mm/min) through 0.2% offset yield strain. After the yield strain, the speed of the testing machine shall be set between 0.05 in/in and 0.5 in/in (0.05 mm/mm and 0.5 mm/mm) of the length of the reduced parallel section (or distance between the grips for specimens not having a reduced section) per minute. Alternatively, an extensometer and strain rate indicator may be used to set the strain rate between 0.05 in/in/min and 0.5 in/in/min (0.05 mm/mm/min and 0.5 mm/mm/min). The requirement for compliance becomes effective for material produced 1 year after the publication date of this specification.

3.5.1.2 Mechanical property requirements for product outside the thickness range of 1.1 shall be as agreed upon by the purchaser and producer and reported in 4.4.4.

3.5.2 Hardness

Hardness shall be not lower than 36 HRC, or equivalent (see 8.3), determined in accordance with ASTM E18.

3.5.3 Average Grain Size

Average grain size shall be ASTM No. 4 or finer, determined in accordance with ASTM E112.

3.6 Quality

Bars, as received by the 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

Tolerances shall conform to all applicable requirements of AMS2261.

3.8 Exceptions

Any exceptions shall be authorized by the purchaser and reported as in 4.4.4.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The producer of bars shall supply all samples for the producer's tests and shall be responsible for the performance of all required tests. The 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

Sampling and testing shall be in accordance with AMS2371 and the following:

4.3.1 In testing round bars, specimens for tensile testing shall be of standard proportions in accordance with ASTM E8/E8M 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 inches (20.32 mm) and under in nominal diameter and from mid-radius of larger size bars.

4.4 Reports

The producer of the bars shall furnish with each shipment a report showing the producer’s name, country where the metal was melted (e.g., final melt in the case of metal processed by multiple melting operations), and the following results of tests and relevant information:

4.4.1 For Each Heat:

Composition

4.4.2 For Each Lot:

Tensile properties
Hardness
Average grain size
Specific temperature and time used in the aging cycle (see 3.4)

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

4.4.4 When material produced to this specification is beyond the sizes allowed in the scope or other exceptions are taken to the technical requirements listed in Section 3 (see 5.2.1), the report shall contain a statement “This material is certified as AMS5920C(EXC) because of the following exceptions:” and the specific exceptions shall be listed.

4.4.5 Purchase Order Number

Heat and lot numbers
AMS5920C
Size
Quantity