

AEROSPACE MATERIAL SPECIFICATION

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Superseding AMS 5833B

Cobalt Alloy, Corrosion and Heat-Resistant, Round Wire

20Cr - 15Ni - 40Co - 7.0Mo - 16Fe
Solution Heat Treated and Cold Drawn

(Composition similar to UNS R30003)

1. SCOPE:

1.1 Form:

This specification covers a corrosion and heat-resistant cobalt alloy in the form of round wire 0.140 inch (3.56 mm) and under in nominal diameter supplied in straight lengths.

1.2 Application:

This wire has been used typically for springs and torsion bars requiring a combination of high strength up to 800 °F (427 °C) after aging, excellent corrosion resistance, and good fatigue properties, but usage is not limited to such applications. The alloy is nonmagnetic.

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 supplied 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.

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2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

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	Tensile Testing of Metallic Materials
ASTM E 8M	Tensile Testing of Metallic Materials (Metric)
ASTM E 18	Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials
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	--	0.15
Manganese	1.5	2.5
Silicon	--	1.20
Phosphorus	--	0.015
Sulfur	--	0.015
Chromium	19.0	21.0
Nickel	14.0	16.0
Cobalt	39.0	41.0
Molybdenum	6.0	8.0
Beryllium	--	0.10
Other Elements, total	--	1.00
Iron	remainder	

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

3.2 Melting Practice:

The alloy shall be produced by multiple melting using vacuum induction followed by vacuum consumable electrode or electroslag remelting practices.

3.3 Condition:

Solution heat treated and cold drawn.

3.4 Solution Heat Treatment:

Wire shall be solution heat treated by heating to $2150\text{ }^{\circ}\text{F} \pm 25$ ($1177\text{ }^{\circ}\text{C} \pm 14$), holding at heat for a time commensurate with section thickness, and cooling as required. Pyrometry shall be in accordance with AMS 2750.

3.5 Properties:

Wire shall conform to the following requirements:

3.5.1 As Solution Heat Treated and Cold Drawn:

3.5.1.1 Tensile Properties: Shall be as shown in Table 2, determined in accordance with ASTM E 8 or ASTM E 8M.

TABLE 2A - Minimum Tensile Strength, Inch/Pound Units

Specified Diameter Inch	Tensile Strength ksi
0.001 to 0.005, incl	260
Over 0.005 to 0.040, incl	240
Over 0.040 to 0.060, incl	235
Over 0.060 to 0.100, incl	225
Over 0.100 to 0.140, incl	220

TABLE 2B - Minimum Tensile Strength, SI Units

Specified Diameter Millimeters	Tensile Strength MPa
0.03 to 0.13, incl	1793
Over 0.13 to 1.02, incl	1655
Over 1.02 to 1.52, incl	1620
Over 1.52 to 2.54, incl	1551
Over 2.54 to 3.56, incl	1517

3.5.2 After Aging: Wire shall meet the requirements of 3.5.2.1 and 3.5.2.2 after being aged by heating to a temperature within the range 900 to 1000 °F (482 to 538 °C), holding at the selected temperature within ± 25 °F (± 14 °C) for 5 to 5-1/2 hours, and cooling to room temperature at a rate equivalent to air cool.

3.5.2.1 Tensile Properties: Shall be in accordance with Table 3, determined in accordance with ASTM E 8 or ASTM E 8M.

TABLE 3A - Minimum Tensile Properties, Inch/Pound Units

Specified Diameter Inch	Tensile Strength ksi	Yield Strength at 0.2% Offset, ksi
0.001 to 0.005, incl	330	--
Over 0.005 to 0.040, incl	290	210
Over 0.040 to 0.060, incl	285	200
Over 0.060 to 0.080, incl	275	200
Over 0.080 to 0.100, incl	275	195
Over 0.100 to 0.120, incl	270	185
Over 0.120 to 0.140, incl	270	180

TABLE 3B - Minimum Tensile Properties, SI Units

Specified Diameter Millimeters	Tensile Strength MPa	Yield Strength at 0.2% Offset, MPa
0.03 to 0.13, incl	2275	--
Over 0.13 to 1.02, incl	1999	1448
Over 1.02 to 1.52, incl	1965	1379
Over 1.52 to 2.03, incl	1896	1379
Over 2.03 to 2.54, incl	1896	1344
Over 2.54 to 3.05, incl	1862	1276
Over 3.05 to 3.56, incl	1862	1241

3.5.2.2 Hardness: Shall be not lower than 46 HRC, or equivalent (See 8.2), determined in accordance with ASTM E 18.

3.6 Quality:

Wire, 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 wire.

3.7 Tolerances:

Shall be as follows:

3.7.1 Diameter: In accordance with Table 4.

TABLE 4A - Diameter Tolerances, Inch/Pound Units

Specified Diameter Inch	Tolerance, Inch, plus and minus
0.001 to 0.0028, excl	0.0001
0.0028 to 0.005, excl	0.00015
0.005 to 0.009, excl	0.0002
0.009 to 0.016, excl	0.00025
0.016 to 0.021, excl	0.00035
0.021 to 0.038, excl	0.00045
0.038 to 0.051, excl	0.00055
0.051 to 0.099, excl	0.00065
0.099 to 0.140, incl	0.0007

TABLE 4B - Diameter Tolerances, SI Units

Specified Diameter Millimeters	Tolerance, Millimeter, plus and minus
0.025 to 0.071, excl	0.0025
0.071 to 0.13, excl	0.0038
0.13 to 0.23, excl	0.005
0.23 to 0.41, excl	0.0064
0.41 to 0.53, excl	0.0089
0.53 to 0.97, excl	0.0114
0.97 to 1.30, excl	0.0140
1.30 to 2.51, excl	0.0165
2.51 to 3.56, incl	0.018

3.7.2 Out-of-Round: Wire shall not be out-of-round by more than one-half of the total tolerance shown in Table 4.

3.7.3 Straightness: Wire shall be of such straightness that the maximum curvature (depth of arc) shall not exceed 0.016 inch (0.41 mm) in any 6-inch (152-mm) length.