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400 COMMONWEALTH DRIVE WARRENDALE PA 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 5833

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Revised

ALLOY WIRE, CORROSION AND HEAT RESISTANT
20Cr - 15Ni - 40Co - 7.0Mo - 0.06Be - 16Fe
Solution Heat Treated and Cold Drawn

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 in. (3.50 mm) and under in nominal diameter supplied in straight lengths.

1.2 Application: Primarily for springs and torsion bars requiring a combination of high strength up to 800°F (425°C), excellent corrosion resistance, and good fatigue properties. Alloy is nonmagnetic.

1.3 Classification: Wire covered by this specification is classified as follows:

Type I - Uncoated, diamond drawn
Type II - Lead coated

1.3.1 Unless Type I is ordered, Type II shall be supplied.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications 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 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 2806 - Identification, Bars, Wire, Mechanical Tubing, and Extrusions, Carbon and Alloy Steels and Heat and Corrosion Resistant Steels and Alloys

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM E8 - Tensile Testing of Metallic Materials
ASTM E18 - Rockwell Hardness and Rockwell Superficial Hardness of Metallic 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 Federal Specifications:

O-H-795 - Hydrofluoric Acid, Technical
O-N-350 - Nitric Acid, Technical

2.3.2 Federal Standards:

Federal Test Method Standard No. 151 - Metals; Test Methods

2.3.3 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, determined by wet chemical methods in accordance with ASTM E354, by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other analytical methods approved by purchaser:

	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	0.03	0.10
Other Elements, total	--	1.00
Iron	remainder	

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

3.2 Condition: Solution heat treated and cold drawn, in straight lengths.

3.2.1 Solution Heat Treatment: Wire shall be solution heat treated by heating to 2150°F ± 25 (1175°C ± 15), holding at heat for a suitable time, and cooling in water to room temperature.

3.3 Properties: Wire shall conform to the following requirements:

3.3.1 As Solution Heat Treated and Cold Drawn:

3.3.1.1 Tensile Properties: Shall be as specified in Table I, determined in accordance with ASTM E8.

TABLE I

Specified Diameter Inch	Tensile Strength psi, min
0.001 to 0.005, incl	260,000
Over 0.005 to 0.040, incl	240,000
Over 0.040 to 0.060, incl	235,000
Over 0.060 to 0.100, incl	225,000
Over 0.100 to 0.140, incl	220,000

TABLE I (SI)

Specified Diameter Millimetres	Tensile Strength MPa, min
0.02 to 0.12, incl	1795
Over 0.12 to 1.00, incl	1655
Over 1.00 to 1.50, incl	1620
Over 1.50 to 2.50, incl	1550
Over 2.50 to 3.50, incl	1515

3.3.2 After Aging:

3.3.2.1 Cleaning Before Aging: Before artificial aging, Type II wire shall be cleaned for removal of lead coating to avoid embrittlement. Coating can be removed in a boiling 1:3 mixture of O-H-795 hydrofluoric and O-H-350 nitric acids (4% HF to 12% HNO_3 by volume, in water). Parts shall be removed from the acid mixture immediately on dissolution of coating and thoroughly rinsed in cold water.

3.3.2.2 Tensile Properties: Shall be in accordance with Table II, determined in accordance with ASTM E8, on specimens from wire after aging by heating to a temperature within the range 900° - 1000°F (480° - 540°C), holding at the selected temperature within ±25°F (±15°C) for 5 - 5-1/2 hr, and cooling in air to room temperature.

TABLE II

Specified Diameter Inch	Tensile Strength psi, min	Yield Strength at 0.2% Offset, psi, min
0.001 to 0.005, incl	330,000	--
Over 0.005 to 0.040, incl	290,000	210,000
Over 0.040 to 0.060, incl	285,000	200,000
Over 0.060 to 0.080, incl	275,000	200,000
Over 0.080 to 0.100, incl	275,000	195,000
Over 0.100 to 0.120, incl	270,000	185,000
Over 0.120 to 0.140, incl	270,000	180,000

TABLE II (SI)

Specified Diameter Millimetres	Tensile Strength MPa, min	Yield Strength at 0.2% Offset, MPa, min
0.02 to 0.12, incl	2275	--
Over 0.12 to 1.00, incl	2000	1450
Over 1.00 to 1.50, incl	1965	1380
Over 1.50 to 2.00, incl	1895	1380
Over 2.00 to 2.50, incl	1895	1345
Over 2.50 to 3.00, incl	1860	1275
Over 3.00 to 3.50, incl	1860	1240

3.3.2.3 Hardness: Should be not lower than 46 HRC or equivalent, determined in accordance with ASTM E18, but wire shall not be rejected on the basis of hardness if the tensile property requirements of 3.3.2.2 are met.

3.4 Quality:

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

3.4.2 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.

3.5 Tolerances: Shall be as follows:

3.5.1 Diameter: In accordance with Table III.

TABLE III

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 III (SI)

Specified Diameter Millimetres	Tolerance, Millimetre plus and minus
0.02 to 0.070, excl	0.002
0.070 to 0.12 , excl	0.0038
0.12 to 0.22 , excl	0.005
0.22 to 0.40 , excl	0.0062
0.40 to 0.52 , excl	0.0088
0.52 to 0.95 , excl	0.0112
0.95 to 1.28 , excl	0.0138
1.28 to 2.48 , excl	0.0162
2.48 to 3.50 , incl	0.018

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

3.5.3 Straightness: Wire shall be of such straightness that the maximum curvature (depth of arc) shall not exceed 0.016 in. (0.04 mm) in any 6 in. (150 mm) of length.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of wire shall supply all samples for vendor's tests and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.4. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the wire conforms to the requirements of this specification.