



# AEROSPACE MATERIAL SPECIFICATION

**AMS5833****REV. D**

Issued 1984-10  
Reaffirmed 2008-05  
Revised 2014-02

Superseding AMS5833C

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)

## RATIONALE

AMS5833D results from a Five Year Review and update that revises Properties (3.5.3) and Reports (4.4).

### 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. (See 8.4.)

#### 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.

#### 2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), [www.sae.org](http://www.sae.org).

|         |                                                                                                                            |
|---------|----------------------------------------------------------------------------------------------------------------------------|
| AMS2269 | Chemical Check Analysis Limits, Nickel, Nickel Alloys and Cobalt Alloys                                                    |
| AMS2371 | Quality Assurance Sampling and Testing, Corrosion and Heat Resistant Steels and Alloys, Wrought Products and Forging Stock |
| AMS2750 | Pyrometry                                                                                                                  |

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<http://www.sae.org/technical/standards/AMS5833D>**

AMS2806 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 International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959  
Tel: 610-832-9585, [www.astm.org](http://www.astm.org).

ASTM E 8/E 8M Tensile Testing of Metallic Materials

ASTM E 18 Rockwell 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 AMS2269.

### 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  $2150^{\circ}\text{F} \pm 25$  ( $1177^{\circ}\text{C} \pm 14$ ), holding at heat for a time commensurate with section thickness, and cooling as required. Pyrometry shall be in accordance with AMS2750.

### 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/E 8M.

TABLE 2A - MINIMUM TENSILE STRENGTH, INCH/POUND UNITS

| Specified Diameter<br>Inch | Tensile Strength<br>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<br>Millimeters | Tensile Strength<br>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  $\pm 25$  °F ( $\pm 14$  °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/E 8M.

TABLE 3A - MINIMUM TENSILE PROPERTIES, INCH/POUND UNITS

| Specified Diameter<br>Inch | Tensile Strength<br>ksi | Yield Strength<br>at 0.2% Offset,<br>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<br>Millimeters | Tensile<br>Strength<br>MPa | Yield Strength<br>at 0.2% Offset,<br>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                                     |

3.5.3 Tensile property requirements for product outside of the range covered by 1.1 shall be agreed upon between purchaser and producer.

#### 3.5.3.1 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<br>Inch | Tolerance, Inch,<br>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<br>Millimeters | Tolerance, Millimeter,<br>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                                    |