AEROSPACE MATERIAL SPECIFICATION

AMS5876™	REV. F

Issued 1984-10
Reaffirmed 2014-06
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Superseding AMS5876E

Cobalt Alloy, Corrosion- and Heat-Resistant, Strip
20Cr - 15Ni - 40Co - 7.0Mo - 16Fe
Vacuum Induction Plus Consumable Electrode Remelted
Solution Heat Treated and Cold Rolled
(Composition similar to UNS R30003)

RATIONALE

AMS5876F 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), revises the finish requirements (see 3.3), adds strain rate control during tensile testing (see 3.5.1.1.1 and 3.5.2.1.1), prohibits unauthorized exceptions (see 1.1, 3.5.3, 3.8, and 8.4), and revises hardness conversion methods (see 3.5.2.2.1 and 3.5.2.2.2).

1. SCOPE

1.1 Form

This specification covers a corrosion- and heat-resistant cobalt alloy in the form of strip 0.100 inch (2.54 mm) and under in specified thickness and 4.000 inches (101.60 mm) and under in specified width in the solution heat-treated and cold rolled condition.

1.2 Application

This strip has been used typically for springs 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 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.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
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For more information on this standard, visit
https://www.sae.org/standards/content/AMS5876F/

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.

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

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

AMS2807 Identification, Carbon and Low-Alloy Steels, Corrosion and Heat-Resistant Steels and Alloys Sheet, Strip, Plate, and Aircraft Tubing

AS4194 Sheet and Strip Surface Finish Nomenclature

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 A480/A480M General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip

2.3 Definitions

Terms used in AMS are defined in AS7766.

3. TECHNICAL REQUIREMENTS

3.1 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	--	0.15
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
Iron	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 or electroslag remelting practices.

3.3 Condition

Solution heat treated and cold rolled. Unless solution heat treatment is performed in an atmosphere yielding a bright finish, descaled having a surface finish comparable to the following commercial finish as described in ASTM A480/A480M and AS4194.

3.3.1 No. 1 strip finish.

3.4 Solution Heat Treatment

Except as specified in 3.4.1, strip shall be solution heat treated by heating to 2150 °F ± 25 °F (1177 °C ± 14 °C), holding at heat for a time commensurate with section thickness, and cooling as required. Pyrometry shall be in accordance with AMS2750.

3.4.1 Continuous Heat Treating

When continuous heat treating is used, process parameters (e.g., furnace temperature set points, heat input, travel rate, etc.) for continuous heat-treating lines shall be established by the material producer and validated by testing of product to the requirements of 3.5.

3.5 Properties

Strip shall conform to the following requirements:

3.5.1 As Solution Heat Treated and Cold Rolled

3.5.1.1 Tensile Properties

Shall be as shown in Table 2, determined in accordance with ASTM E8/E8M:

Table 2A - Minimum tensile strength, inch/pound units

Specified Thickness Inches	Tensile Strength ksi
Up to 0.0043, incl	260
Over 0.0043 to 0.01875, incl	250
Over 0.01875 to 0.025, incl	240
Over 0.025 to 0.047, incl	220
Over 0.047 to 0.075, incl	180
Over 0.075 to 0.100, incl	130

Table 2B - Minimum tensile strength, SI units

Specified Thickness Millimeters			Tensile Strength MPa
Up	to 0.109,	incl	1793
Over 0.109	to 0.4762,	incl	1724
Over 0.4762	to 0.64,	incl	1655
Over 0.64	to 1.19,	incl	1517
Over 1.19	to 1.90,	incl	1241
Over 1.90	to 2.54,	incl	896

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.

3.5.2 Response to Aging Heat Treatment

Samples of strip 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 850 to 950 °F (454 to 510 °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 cooling.

3.5.2.1 Tensile Properties

Shall be as shown in Table 3, determined in accordance with ASTM E8/E8M.

Table 3A - Minimum tensile properties, inch/pound units

Specified Thickness Inches			Tensile Strength ksi	Yield Strength at 0.2% Offset ksi	Elongation in 2 Inches or 4D %
Up	to 0.0043,	incl	325	250	-
Over 0.0043	to 0.01875,	incl	315	225	-
Over 0.01875	to 0.025,	incl	300	225	1
Over 0.025	to 0.047,	incl	275	225	1
Over 0.047	to 0.075,	incl	225	160	3
Over 0.075	to 0.100,	incl	170	100	17

Table 3B - Minimum tensile properties, SI units

Specified Thickness Millimeters			Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 50 mm or 4D %
Up	to 0.109,	incl	2241	1724	-
Over 0.109	to 0.4762,	incl	2172	1551	-
Over 0.4762	to 0.64,	incl	2068	1551	1
Over 0.64	to 1.19,	incl	1896	1551	1
Over 1.19	to 1.90,	incl	1551	1103	3
Over 1.90	to 2.54,	incl	1172	689	17

3.5.2.1.1 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.

3.5.2.1.2 Elongation requirements do not apply to strip 0.01875 inch (0.4762 mm) and under in specified thickness.

3.5.2.2 Hardness

Shall be not lower than 46 HRC, or equivalent (see 3.5.2.2.1), determined in accordance with ASTM E18.

3.5.2.2.1 Hardness conversions, when required, shall be agreed upon between the producer and the purchaser.

3.5.2.2.2 The product shall not be rejected on the basis of hardness if the tensile properties of 3.5.2.1 are acceptable, determined on specimens taken from the same sample as that with nonconforming hardness or from another sample with similar nonconforming hardness.

3.5.3 Mechanical property requirements for product outside of the range covered by 1.1 shall be agreed upon between the producer and purchaser and reported per 4.4.1.

3.6 Quality

Strip, 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 strip.

3.7 Tolerances

Width and thickness tolerances shall be in accordance with Tables 4 and 5, respectively.

3.7.1 Width

Shall be as shown in Table 4.

Table 4A - Width tolerances, inch/pound units

Specified Width Inches	Tolerance, Inches Plus and Minus
Up to 0.3755, incl	0.0030
Over 0.3755 to 0.4999, incl	0.0040
Over 0.4999 to 4.0000, incl	0.0050

Table 4B - Width tolerances, SI units

Specified Width Millimeters	Tolerance, Millimeters Plus and Minus
Up to 9.538, incl	0.076
Over 9.538 to 12.697, incl	0.102
Over 12.697 to 101.60, incl	0.127

3.7.2 Thickness

Shall be as shown in Table 5.

Table 5A - Thickness tolerances, inch/pound units

Specified Thickness Inches	Tolerance, Inches Plus and Minus
0.001 to 0.002, incl	0.00015
Over 0.002 to 0.004, incl	0.0002
Over 0.004 to 0.006, incl	0.0003
Over 0.006 to 0.009, incl	0.0004
Over 0.009 to 0.012, incl	0.0005
Over 0.012 to 0.015, incl	0.00065
Over 0.015 to 0.020, incl	0.00075
Over 0.020 to 0.025, incl	0.0010
Over 0.025 to 0.030, incl	0.00125
Over 0.030 to 0.050, incl	0.0015
Over 0.050 to 0.070, incl	0.00175
Over 0.070 to 0.100, incl	0.002

Table 5B - Thickness tolerances, SI units

Specified Thickness Millimeters	Tolerance, Millimeters Plus and Minus
0.02 to 0.05, incl	0.0038
Over 0.05 to 0.10, incl	0.005
Over 0.10 to 0.15, incl	0.008
Over 0.15 to 0.23, incl	0.010
Over 0.23 to 0.30, incl	0.013
Over 0.30 to 0.38, incl	0.0165
Over 0.38 to 0.51, incl	0.0190
Over 0.51 to 0.64, incl	0.025
Over 0.64 to 0.76, incl	0.0318
Over 0.76 to 1.27, incl	0.038
Over 1.27 to 1.78, incl	0.0444
Over 1.78 to 2.54, incl	0.051

3.8 Exceptions

Any exceptions shall be authorized by the purchaser and reported as in 4.4.1.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The producer of strip shall supply all samples for the producer's tests and shall be responsible for the performance of all required tests. Cognizant engineering organization reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the strip conforms 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 AMS2371.