AEROSPACE MATERIAL SPECIFICATION

AMS5537™	REV. K

Issued 1952-02
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Superseding AMS5537J

Cobalt Alloy, Corrosion- and Heat-Resistant, Sheet, Strip, Foil, and Plate
52Co - 20Cr - 10Ni - 15W
Solution Heat Treated
(Composition similar to UNS R30605)

RATIONALE

AMS5537K is the result of a Five-Year Review and update of the specification. The revision includes an update to the chemistry methods and reporting (3.1, 3.1.1), addresses continuous heat treatment (3.2.1, 3.2.1.1), adds strain rate requirement for tensile testing (3.3.1.1), updates stress rupture testing (3.3.2.2), prohibits unauthorized exceptions (3.3.3, 3.6, 4.4.5, 8.3), allows prior revisions (8.4), and updates ordering information (8.5).

1. SCOPE

1.1 Form

This specification covers a corrosion- and heat-resistant cobalt alloy in the form of sheet, strip, foil, and plate up to 2.250 inches (57.15 mm), inclusive, in nominal thickness.

1.2 Application

These products have been used typically for parts requiring high strength up to 1500 °F (816 °C) and oxidation resistance up to 2000 °F (1093 °C), but usage is not limited to such applications.

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.

AMS2262	Tolerances, Nickel, Nickel Alloy, and Cobalt Alloy, Sheet, Strip, and Plate
AMS2269	Chemical Check Analysis Limits, Nickel, Nickel Alloys, and Cobalt Alloys
AMS2283	Composition Testing Methods for Nickel and Cobalt Based 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/AMS5537K/

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

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

ASTM E8/E8M Tension Testing of Metallic Materials

ASTM E139 Conducting Creep, Creep-Rupture, and Stress-Rupture Tests of Metallic Materials

ASTM E290 Bend Test of Materials for Ductility

ASTM E345 Tension Testing of Metallic Foil

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 purchaser.

Table 1 - Composition

Element	Min	Max
Carbon	0.05	0.15
Manganese	1.00	2.00
Silicon	--	0.40
Phosphorus	--	0.040
Sulfur	--	0.030
Chromium	19.00	21.00
Nickel	9.00	11.00
Tungsten	14.00	16.00
Iron	--	3.00
Cobalt	remainder	

3.1.1 Producer may test for any element not listed in Table 1 and include this analysis in the report of 4.5. 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 Condition

The product shall be supplied in the following condition:

3.2.1 Sheet, Strip, and Foil

Hot or cold rolled, solution heat treated, and, unless solution heat treatment is performed in an atmosphere yielding a bright finish, descaled having a surface appearance as described in ASTM A480/A480M, AS4194, and 3.2.1.1 or 3.2.1.2 as applicable.

3.2.1.1 Continuous Heat Treatment

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 3.3.

3.2.1.2 Sheet

No. 2D finish.

3.2.1.3 Strip

No. 1 strip finish.

3.2.2 Plate

Hot rolled, solution heat treated, and descaled.

3.3 Properties

The product shall conform to the following requirements:

3.3.1 Tensile Properties

Shall be as shown in Table 2, determined in accordance with ASTM E8/E8M or ASTM E345 for foil.

Table 2A - Tensile properties, inch/pound units

Nominal Thickness Inches	Tensile Strength ksi, Min	Yield Strength at 0.2% Offset ksi	Elongation in 2 Inches %, Min
Up to 0.003, excl	130	55 min	Report
0.003 to 0.005, incl	130	55 to 80	25
Over 0.005 to 0.020, incl	130	55 to 80	30
Over 0.020 to 0.032, incl	130	55 to 80	35
Over 0.032 to 0.043, incl	130	55 to 80	40
Over 0.043 to 2.250, incl	130	55 to 80	45

Table 2B - Tensile properties, SI units

Nominal Thickness Millimeters	Tensile Strength MPa, Min	Yield Strength at 0.2% Offset MPa	Elongation in 50 mm %, Min
Up to 0.076, excl	896	379 min	Report
0.076 to 0.127, incl	896	379 to 552	25
Over 0.127 to 0.51, incl	896	379 to 552	30
Over 0.51 to 0.81, incl	896	379 to 552	35
Over 0.81 to 1.09, incl	896	379 to 552	40
Over 1.09 to 57.15, incl	896	379 to 552	45

3.3.1.1 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 and 0.5 in/in (0.05 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 and 0.5 in/in/min (0.05 and 0.5 mm/mm/min). The requirement for compliance becomes effective for material produced 1 year after the publication date of this specification.

3.3.1.2 Bending

Product 0.1874 inch (4.760 mm) and under in nominal thickness shall be tested in accordance with ASTM E290 using a sample prepared nominally 0.75 inch (19.0 mm) in width with its axis of bending parallel to the direction of rolling and shall withstand, without cracking, when bending at room temperature through the angle shown in Table 3 around a diameter equal to the bend factor shown in Table 3 times the nominal thickness of the product. In case of dispute, the results of tests using the guided bend test of ASTM E290 shall govern.

Table 3 - Bending parameters

Nominal Thickness Inches	Nominal Thickness Millimeters	Angle Degrees	Bend Factor
Up to 0.050, incl	Up to 1.27, incl	180	1.5
Over 0.050 to 0.1874, incl	Over 1.27 to 4.760, incl	120	2

3.3.2 Stress Rupture Properties at 1500 °F (816 °C)

A tensile specimen, maintained at 1500 °F ± 3 °F (816 °C ± 2 °C) while a load sufficient to produce an initial axial stress of 24.0 ksi (165 MPa) or higher is applied continuously, shall not rupture in less than 24 hours. The test shall be continued to rupture without change of load. Elongation after rupture, measured at room temperature, shall be not less than 10% in 2 inches (50.8 mm). Tests shall be conducted in accordance with ASTM E139.

3.3.2.1 For product 0.010 inch (0.25 mm) and under in nominal thickness, stress rupture properties may be established using a sample up to 0.025 inch (0.64 mm) in nominal thickness from the same master coil and heat. The supplier's certification of test shall indicate the thickness at which the stress rupture test was performed.

3.3.2.2 The test of 3.3.2 may be conducted using incremental loading. In such case, the load required to produce an initial axial stress of 24.0 ksi (165 MPa) or higher shall be used to rupture or for 24 hours, whichever occurs first. After the 24 hours and at intervals of 8 hours minimum thereafter, the stress shall be increased in increments of 2.0 ksi (14 MPa). Time to rupture and elongation requirements shall be as specified in 3.3.2.

3.3.3 Mechanical property requirements for product outside of the range covered by 1.1 shall be agreed upon between purchaser and producer and reported per 4.4.5.

3.4 Quality

The product, 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 product.

3.5 Tolerances

Shall conform to all applicable requirements of AMS2262.

3.6 Exceptions

Any exceptions shall be authorized by the purchaser and reported as in 4.4.5.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The producer of the product shall supply all samples for producer's tests and shall be responsible for the performance of all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the product conforms to specified requirements.

4.2 Classification of Tests

4.2.1 Acceptance Tests

Composition (3.1), tensile properties (3.3.1), bending (3.3.2), and tolerances (3.5) are acceptance tests and shall be performed on each heat or lot as applicable.

4.2.2 Periodic Tests

Stress-rupture properties (3.3.3) is a periodic test and shall be performed at a frequency selected by the producer unless frequency of testing is specified by purchaser.

4.3 Sampling and Testing

Shall be in accordance with AMS2371.

4.4 Reports

The producer of the product shall furnish with each shipment a report showing the producer’s name and the 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
Bending properties

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