SAE Aerospace
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AEROSPACE MATERIAL SPECIFICATION

SAE AMS 5759K

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Superseding AMS 5759J

Cobalt Alloy, Corrosion and Heat-Resistant, Bars, Forgings, and Rings
52Co - 20Cr - 10Ni - 15W
Solution Heat Treated

(Composition similar to UNS R30605)

1. SCOPE:

1.1 Form:

This specification covers a corrosion and heat-resistant cobalt alloy in the form of bars, forgings, flash welded rings, and stock for forging, flash welded rings, or heading.

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, 400 Commonwealth Drive, Warrendale, PA 15096-0001 or www.sae.org.

AMS 2261	Tolerances, Nickel, Nickel Alloy, and Cobalt Alloy Bars, Rods, and Wire
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 2374	Quality Assurance Sampling and Testing, Corrosion and Heat-Resistant Steel and Alloy Forgings

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: custsvc@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

2.1 (Continued):

AMS 2806	Identification, Bars, Wire, Mechanical Tubing, and Extrusions, Carbon and Alloy Steels and Corrosion and Heat-Resistant Steels and Alloys
AMS 2808	Identification, Forgings
AMS 7490	Rings, Flash Welded, Corrosion and Heat-Resistant Austenitic Steels and Austenitic-Type Alloys, or Precipitation-Hardenable Alloys

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959 or www.astm.org.

ASTM E 8	Tension Testing of Metallic Materials
ASTM E 8M	Tension Testing of Metallic Materials (Metric)
ASTM E 10	Brinell Hardness of Metallic Materials
ASTM E 139	Conducting Creep, Creep-Rupture, and Stress-Rupture Tests 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	0.05	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 Check Analysis: Composition variations shall meet the applicable requirements of AMS 2269.

3.2 Melting Practice:

Alloy shall be multiple melted using consumable electrode practice in the remelt cycle.

3.3 Condition:

The product shall be supplied in the following condition:

3.3.1 Bars, Forgings, and Flash Welded Rings: Solution heat treated and descaled.

3.3.1.1 Bars shall be hot finished; round bars shall be ground or turned.

3.3.1.2 Flash welded rings shall not be supplied unless specified or permitted on purchaser's part drawing. When supplied, rings shall be manufactured in accordance with AMS 7490.

3.3.2 Stock for Forging, Flash Welded Rings, or Heading: As ordered by the forging, flash welded ring, or heading manufacturer.

3.4 Heat Treatment:

Bars, forgings, and flash welded rings shall be solution heat treated by heating to a temperature within the range 2150 to 2250 °F (1177 to 1232 °C), holding at the selected temperature within ±25 °F (±14 °C) for a time commensurate with section thickness, and cooling at a rate equivalent to an air cool or faster.

3.5 Properties:

The product shall conform to the following requirements:

3.5.1 Bars, Forgings, and Flash Welded Rings:

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 2 - Minimum Tensile Properties

Property	Value
Tensile Strength	125 ksi (862 MPa)
Yield Strength at 0.2% Offset	45.0 ksi (310 MPa)
Elongation in 4D	30%

3.5.1.2 Hardness: Shall be as follows, determined in accordance with ASTM E 10. Product shall not be rejected on the basis of hardness if the tensile properties of 3.5.1.1 are acceptable, determined on specimens taken from the same sample as that with nonconforming hardness or from another sample with similar nonconforming hardness.

3.5.1.2.1 Bars: Not higher than 277 HB, or equivalent (See 8.2), taken approximately midway between surface and center.

3.5.1.2.2 Forgings: Not higher than 248 HB, or equivalent (See 8.2).

3.5.1.2.3 Flash Welded Rings: Not higher than 302 HB, or equivalent (See 8.2).

3.5.1.3 Stress-Rupture Properties at 1500 °F (816 °C): A tensile specimen, maintained at 1500 °F ± 3 (816 °C ± 2) 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 4D. Tests shall be conducted in accordance with ASTM E 139.

3.5.1.3.1 The test of 3.5.1.3 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 to 16 hours, the stress shall be increased in increments of 5.0 ksi (34.5 MPa). Time to rupture and elongation requirements shall be as specified in 3.5.1.3.

3.5.2 Stock for Forging, Flash Welded Rings, and Heading: As agreed upon by purchaser and vendor.

3.6 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.

3.6.1 Grain flow of die forgings, except in areas which contain flash-line end grain, shall follow the general contour of the forgings showing no evidence of reentrant grain flow.

3.7 Tolerances:

Bars shall conform to all applicable requirements of AMS 2261.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of the product shall supply all samples for vendor'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: The following requirements are acceptance tests and shall be performed on each heat or lot as applicable.

4.2.1.1 Composition (3.1) of each heat.

4.2.1.2 Tensile properties (3.5.1.1) and hardness (3.5.1.2) of each lot of bars, forgings, and flash welded rings.

4.2.1.3 Tolerances (3.7) of bars.

4.2.2 Periodic Tests: The following requirements are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser:

4.2.2.1 Stress-rupture properties (3.5.1.3) of bars, forgings, and flash welded rings.

4.2.2.2 Ability of stock for forging, flash welded rings, and heading (3.5.2) to develop required properties.

4.2.2.3 Grain flow of die forgings (3.6.1).

4.3 Sampling and Testing:

Shall be as follows:

4.3.1 Bars, Flash Welded Rings, and Stock for Forging, Flash Welded Rings, or Heading: In accordance with AMS 2371.

4.3.2 Forgings: In accordance with AMS 2374.

4.4 Reports:

The vendor of the product shall furnish with each shipment a report showing the following results of tests and relevant information:

4.4.1 For each heat: Composition.

4.4.2 For each lot of bars, forgings, and flash welded rings:

Tensile Properties
Hardness.

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

4.4.4 Purchase order number
Heat and lot numbers
AMS 5759K
Size
Quantity.

4.4.5 If forgings are supplied, the size and melt source of stock used to make the forgings.