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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 5759H

Issued 1 FEB 1986
Revised 1 OCT 1991

Submitted for recognition as an American National Standard

Superseding AMS 5759G

ALLOY, CORROSION AND HEAT RESISTANT, BARS, FORGINGS, AND RINGS
52Co - 20Cr - 10Ni - 15W
Solution Heat Treated

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 typically used 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 following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

2.1.1 Aerospace Material Specifications:

AMS 2261 - Tolerances, Nickel, Nickel Alloy, and Cobalt Alloy Bars and Forging Stock
MAM 2261 - Tolerances, Metric, Nickel, Nickel Alloy, and Cobalt Alloy Bars and Forging Stock
AMS 2269 - Chemical Check Analysis Limits, Wrought 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

2.1.1 Aerospace Material Specifications: (Cont'd.)

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

2.2 ASTM Publications: Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

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

2.3 U.S. Government Publications: Available from Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

2.3.1 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, Ø determined by wet chemical methods in accordance with ASTM E 354, by spectrochemical methods, or by other analytical methods acceptable to purchaser:

	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 requirements of AMS 2269.

3.2 Condition: The product shall be supplied in the following condition:

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

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

3.2.1.2 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.

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

3.3 Heat Treatment: Bars, forgings, and flash welded rings shall be solution heat treated by heating to a temperature within the range 2150° - 2250°F (1177° - 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.

3.4 Properties: The product shall conform to the following requirements:

3.4.1 Bars, Forgings, and Flash Welded Rings:

3.4.1.1 Tensile Properties: Shall be as follows, determined in accordance with ASTM E 8 or ASTM E 8M:

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

3.4.1.2 Hardness: Should be as follows, determined in accordance with ASTM E 10, but the product shall not be rejected on the basis of hardness if the tensile property requirements are met.

3.4.1.2.1 Bars: Not higher than 277 HB, or equivalent, taken approximately midway between surface and center.

3.4.1.2.2 Forgings: Not higher than 248 HB, or equivalent.

3.4.1.2.3 Flash Welded Rings: Not higher than 302 HB, or equivalent.

3.4.1.3 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) 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.

3.4.1.3.1 The test of 3.4.1.3 may be conducted using a load higher than required to produce an initial axial stress of 24.0 ksi (165 MPa) but load shall not be changed while test is in progress. Time to rupture and elongation requirements shall be as specified in 3.4.1.3.

3.4.1.3.2 When permitted by purchaser, the test of 3.4.1.3 may be conducted using incremental loading. In such case, the load required to produce an initial axial stress of 24.0 ksi (165 MPa) shall be used to rupture or for 24 hours, whichever occurs first. After the 24 hours and at intervals of 8 - 16 hours, preferably 8 - 10 hours, thereafter, the stress shall be increased in increments of 5.0 ksi (34.5 MPa). Elongation requirement shall be as specified in 3.4.1.3.

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

3.5 Quality:

3.5.1 Alloy shall be produced by multiple melting using consumable electrode Ø practice in the remelt cycle.

3.5.2 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 Sizes: Except when exact lengths or multiples of exact lengths are ordered, Ø straight bars will be acceptable in mill lengths of 6 - 24 feet (1.8 - 7.3 m) but not more than 25% of any shipment shall be supplied in lengths of 6 - 9 feet (1.8 - 2.7 m) except that for bars weighing over 25 pounds per foot (37 kg/m), short lengths down to 2 feet (610 mm) may be supplied.

3.7 Tolerances: Bars shall conform to all applicable requirements of AMS 2261 or MAM 2261.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Resposibility for Inspection: The vendor of the product shall supply all Ø samples for vendor's tests and shall be responsible for performing all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the product conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests for the following requirements are acceptance Ø 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 (3.4.1.1) and hardness (3.4.1.2) of each lot of bars, Ø forgings, and flash welded rings.

4.2.1.3 Tolerances (3.7) of bars.