



AEROSPACE MATERIAL SPECIFICATION	AMS5768™	REV. M
	Issued 1948-05 Reaffirmed 2012-07 Revised 2023-06	
Superseding AMS5768L		
Alloy, Corrosion and Heat-Resistant, Bars, Wire, Forgings, Rings and Stock for Forgings, Rings and Heading 21Cr - 20Ni - 20Co - 3.0Mo - 2.5W - 1.0Cb - 0.15N - 31Fe Solution and Precipitation Heat Treated (Composition similar to UNS R30155)		

RATIONALE

AMS5768M is the result of a Five-Year Review and update of the specification. The revision includes an update of the Title to match the Scope, revises composition testing and reporting requirements (3.1, 3.1.1), prohibits bar being cut from plate (3.2.1.2, 4.4.6), and prohibits unauthorized exceptions (3.7, 8.5).

1. SCOPE

1.1 Form

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

1.2 Application

These products have been used typically for parts, such as turbine rotors, shafts, blades, and bolts requiring high strength up to 1350 °F (732 °C) and oxidation resistance up to 1800 °F (982 °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.

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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.

AMS2248	Chemical Check Analysis Limits, Corrosion- and Heat-Resistant Steels and Alloys, Maraging and Other Highly Alloyed Steels, and Iron Alloys
AMS2261	Tolerances, Nickel, Nickel Alloy, and Cobalt Alloy Bars, Rods, and Wire
AMS2371	Quality Assurance Sampling and Testing, Corrosion and Heat-Resistant Steels and Alloys, Wrought Products and Forging Stock
AMS2374	Quality Assurance Sampling and Testing, Corrosion and Heat-Resistant Steel and Alloy Forgings
AMS2750	Pyrometry
AMS2806	Identification Bars, Wire, Mechanical Tubing, and Extrusions, Carbon and Alloy Steels, and Corrosion and Heat-Resistant Steels and Alloys
AMS2808	Identification, Forgings
AMS7490	Rings, Flash Welded, Corrosion and Heat-Resistant Austenitic Steels, Austenitic-Type Iron, Nickel or Cobalt Alloys, or Precipitation-Hardenable Alloys
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 E10	Brinell Hardness of Metallic Materials
ASTM E139	Conducting Creep, Creep-Rupture, and Stress-Rupture Tests of Metallic Materials
ASTM E140	Hardness Conversion Tables for Metals Relationship Among Brinell Hardness, Vickers Hardness, Rockwell Hardness, Superficial Hardness, Knoop Hardness, Scleroscope Hardness, and Leeb Hardness
ASTM E354	Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt Alloys

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 ASTM E354, or by other analytical methods acceptable to the purchaser.

Table 1 - Composition

Element	Min	Max
Carbon	0.08	0.16
Manganese	1.00	2.00
Silicon	--	1.00
Phosphorus	--	0.040
Sulfur	--	0.030
Chromium	20.00	22.50
Nickel	19.00	21.00
Cobalt	18.50	21.00
Molybdenum	2.50	3.50
Tungsten	2.00	3.00
Columbium	0.75	1.25
Tantalum	--	0.050
Nitrogen	0.10	0.20
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 AMS2248.

3.2 Condition

The product shall be supplied in the following condition:

3.2.1 Bars, Wire, Forgings, and Flash Welded Rings

Solution and precipitation heat treated and descaled.

3.2.1.1 Flash welded rings shall not be supplied unless specified or permitted on the purchaser's part drawing. When supplied, rings shall be manufactured in accordance with AMS7490.

3.2.1.2 Bars shall not be cut from plate (see 4.4.6).

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, wire, forgings, and flash welded rings shall be solution heat treated by heating to $2150\text{ }^{\circ}\text{F} \pm 25\text{ }^{\circ}\text{F}$ ($1177\text{ }^{\circ}\text{C} \pm 14\text{ }^{\circ}\text{C}$), holding at heat for not less than 60 minutes, and quenching in water and precipitation heat treated by heating to $1500\text{ }^{\circ}\text{F} \pm 25\text{ }^{\circ}\text{F}$ ($816\text{ }^{\circ}\text{C} \pm 14\text{ }^{\circ}\text{C}$), holding at heat for not less than 4 hours, and cooling at a rate equivalent to air cooling. Pyrometry shall be in accordance with AMS2750.

3.4 Properties

The product shall conform to the following requirements:

3.4.1 Bars, Wire, Forgings, and Flash Welded Rings

3.4.1.1 Hardness

Shall be 192 to 241 HBW, or equivalent (see 8.2), determined in accordance with ASTM E10.

3.4.1.2 Stress-Rupture Properties at 1350 °F (732 °C)

A tensile specimen, maintained at 1350 °F \pm 3 °F (732 °C \pm 2 °C) while a load sufficient to produce an initial axial stress of 32.0 ksi (221 MPa) is applied continuously, shall not rupture in less than 23 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 E139.

3.4.1.2.1 The test of 3.4.1.2 may be conducted using a load higher than required to produce an initial axial stress of 32.0 ksi (221 MPa) but load shall not be changed while test is in progress. Time to rupture and elongation requirements shall be as specified in 3.4.1.2.

3.4.1.2.2 The test of 3.4.1.2 may be conducted using incremental loading. In such case, the load required to produce an initial axial stress of 32.0 ksi (221 MPa) shall be used to rupture or for 23 hours, whichever occurs first. After the 23 hours and at intervals of 8 hours, minimum, thereafter, the stress shall be increased in increments of 2 ksi (14 MPa). Elongation requirements shall be as specified in 3.4.1.2.

3.4.2 Forging Stock

When a sample of stock is forged to a test coupon and heat treated in accordance with 3.3, specimens taken from the heat-treated coupon shall conform to the requirements of 3.4.1.1 and 3.4.1.2. If specimens taken from the stock after heat treatment as in 3.3 conform to the requirements of 3.4.1.1 and 3.4.1.2, the tests shall be accepted as equivalent to tests of a forged coupon.

3.4.3 Stock for Flash Welded Rings or Heading

Specimens taken from the stock after heat treatment in accordance with 3.3 shall conform to the requirements of 3.4.1.1 and 3.4.1.2.

3.5 Quality

The product, 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 product.

3.5.1 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.

3.6 Tolerances

Bars and wire shall conform to all applicable requirements of AMS2261.

3.7 Exceptions

Any exceptions shall be authorized by the purchaser and reported as in 4.4.7.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The producer of the product shall supply all samples for the producer's tests and shall be responsible for the performance of all required tests. The 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 (see 3.1) of each heat.

4.2.1.2 Hardness (see 3.4.1.1) of each lot of bars, wire, forgings, and flash welded rings.

4.2.1.3 Tolerances (see 3.6) of bars and wire.

4.2.2 Periodic Tests

The following requirements are periodic tests and shall be performed at a frequency selected by the producer unless frequency of testing is specified by the purchaser.

4.2.2.1 Stress-rupture properties (see 3.4.1.2) of bars, wire, forgings, and flash welded rings.

4.2.2.2 Grain flow of die forgings (see 3.5.1).

4.2.2.3 Ability of forging stock (see 3.4.2) and stock for flash welded rings or heading (see 3.4.3) to develop required properties.

4.3 Sampling and Testing

Shall be as follows:

4.3.1 Bars, Wire, Flash Welded Rings, and Stock for Forging, Flash Welded Rings, or Heading

In accordance with AMS2371.

4.3.2 Forgings

In accordance with AMS2374.

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 of bars, wire, forgings, and flash welded rings:

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
AMS5768M
Size
Quantity

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

4.4.6 Report the nominal metallurgically worked cross-sectional size and the cut size, if different (see 3.2.1.2)

4.4.7 When material produced to this specification has exceptions taken to the technical requirements listed in Section 3 (see 5.2.1.1), the report shall contain a statement "This material is certified as AMS5768M(EXC) because of the following exceptions:" and the specific exceptions shall be listed.