



AEROSPACE MATERIAL SPECIFICATION

AMS5915™**REV. B**Issued 2014-02
Revised 2022-10

Superseding AMS5915A

Nickel Alloy, Corrosion- and Heat-Resistant, Bars and Forgings,
57Ni - 20Cr - 10Co - 8.5Mo - 2.1Ti - 1.5Al - 0.005B,
Vacuum Induction and Consumable Electrode Melted,
Solution Heat Treated, Precipitation Heat Treatable
(Composition similar to UNS N07208)

RATIONALE

AMS5915B is the result of a limited scope ballot that revised the annealing temperature range.

1. SCOPE

1.1 Form

This specification covers a corrosion- and heat-resistant nickel alloy in the form of bars, forgings, and stock for forging.

1.2 This specification applies to bars 6.00 inches (152 mm) and under in nominal diameter or least distance between parallel sides, and to forgings 6.00 inches (152 mm) and under in nominal radial thickness, and stock of any size for forging (see 8.5).

1.3 Application

These products have been used typically for parts requiring high strength up to 1600 °F (871 °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.

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.

AMS2261 Tolerances, Nickel, Nickel Alloy, and Cobalt Alloy Bars, Rods, and Wire

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

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SAE WEB ADDRESS:

For more information on this standard, visit
<https://www.sae.org/standards/content/AMS5915B/>

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
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	Tensions Testing of Metallic Materials
ASTM E18	Rockwell Hardness of Metallic Materials
ASTM E112	Determining Average Grain Size
ASTM E139	Conducting Creep, Creep-Rupture, and Stress-Rupture Tests of Metallic Materials
ASTM E140	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 by wet chemical methods in accordance with ASTM E354, by spectrochemical methods or by other analytical methods acceptable to purchaser.

Table 1 - Composition

Element	Min	Max
Carbon	0.04	0.08
Manganese	--	0.3
Silicon	--	0.15
Phosphorus	--	0.015
Sulfur	--	0.015
Chromium	18.5	20.5
Cobalt	9.0	11.0
Molybdenum	8.0	9.0
Tungsten	--	0.5
Columbium (Niobium)	--	0.2
Titanium	1.90	2.30
Tantalum	--	0.1
Aluminum	1.38	1.65
Boron	0.003	0.010
Iron	--	1.5
Copper	--	0.1
Zirconium	--	0.020
Nickel	remainder	

3.1.1 Check Analysis

Composition variations shall meet the applicable requirements of AMS2269.

3.2 Melting Practice

Alloy shall be multiple melted using vacuum induction melting followed by consumable electrode remelting.

3.3 Condition

The product shall be supplied in the following condition:

3.3.1 Bars and Forgings

Solution heat treated and descaled. Bars may be either hot or cold finished. Round bars shall be ground or turned.

3.3.1.1 Bars shall not be cut from plate (also see 4.4.1.1).

3.3.2 Stock for Forging

As ordered by the forging manufacturer.

3.4 Heat Treatment

Bars and forgings shall be solution heat treated by heating to a temperature within the range of 2000 to 2100 °F ± 25 °F (1093 to 1149 °C ± 14 °C), holding at heat for a time commensurate with cross-sectional thickness, and cooling at a rate equivalent to an air cool or faster. Pyrometry shall be in accordance with AMS2750.

3.5 Properties

The product shall conform to the following requirements:

3.5.1 Bars and Forgings

3.5.1.1 As Solution Heat Treated

3.5.1.1.1 Average Grain Size

Shall be ASTM No. 2.5 or finer, determined in accordance with ASTM E112.

3.5.1.1.2 Hardness

Shall be not higher than 30 HRC determined in accordance with ASTM E18 or equivalent (see 8.2). Product shall not be rejected on the basis of hardness if the tensile property requirements of 3.5.1.2.1 are acceptable, determined on specimens taken from the same sample as that with nonconforming hardness, or from another sample with similar nonconforming hardness.

3.5.1.2 After Precipitation Heat Treatment

Specimens from product shall have the following properties after being precipitation heat treated by heating to 1850 °F $\pm$ 15 °F (1010 °C $\pm$ 8 °C), holding at heat for 2 hours ($\pm$ 15 minutes) and cooling at a rate equivalent to cooling in air or faster to ambient temperature, followed by heating to 1450 °F $\pm$ 15 °F (788 °C $\pm$ 8 °C), holding at heat for not less than 8 hours ($\pm$ 15 minutes), and cooling at a rate equivalent to cooling in air.

3.5.1.2.1 Tensile Properties

The following requirements apply to bars 6.00 inches (152 mm) and under in nominal diameter or least distance between parallel sides, and to forgings 6.00 inches (152 mm) and under in nominal radial thickness. Requirements apply in the longitudinal direction.

3.5.1.2.1.1 Mechanical property requirements for product outside of the range covered by 1.2 shall be as agreed upon between purchaser and producer.

3.5.1.2.1.2 At Room Temperature

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

Table 2A - Minimum room temperature tensile properties, inch/pound units

Property	Value
Tensile Strength	149.0 ksi
Yield Strength at 0.2% Offset	86.0 ksi
Elongation in 4D	20%
Reduction of Area	16%

Table 2B - Minimum room temperature tensile properties, SI units

Property	Value
Tensile Strength	1027 MPa
Yield Strength at 0.2% Offset	593 MPa
Elongation in 4D	20%
Reduction of Area	16%

3.5.1.2.2 Hardness

Shall be not lower than 24 HRC, or equivalent (see 8.2), determined in accordance with ASTM E18. Product shall not be rejected on the basis of hardness if the tensile property requirements are acceptable, determined on specimens taken from the same sample as that with nonconforming hardness, or from another sample with similar nonconforming hardness.

3.5.1.2.3 Stress Rupture Properties at 1700 °F (927 °C)

Shall be as follows; testing of smooth specimens shall be in accordance with ASTM E139:

A tensile specimen maintained at 1700 °F $\pm$ 3 °F (927 °C $\pm$ 2 °C) while a load sufficient to produce an initial axial stress of 13 ksi (89 MPa) or higher is applied continuously, shall not rupture in less than 50 hours. The test shall be continued to rupture without change of load. Elongation after rupture, measured at room temperature, shall not be less than 10% in 4D.

3.5.2 Forging Stock

When a sample of stock is forged to a test coupon and heat treated as in 3.4 and 3.5.1.2, specimens taken from the heat treated coupon shall conform to the requirements of 3.5.1.2.1, 3.5.1.2.2, and 3.5.1.2.3. If specimens taken from the stock after heat treatment as in 3.4 and 3.5.1.2 conform to the requirements of 3.5.1.2.1, 3.5.1.2.2, and 3.5.1.2.3, the tests shall be accepted as equivalent to tests of a forged coupon.

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 AMS2261.

3.8 Exceptions

Any exception shall be authorized by purchaser and reported as in 4.4.1.2.

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

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 Average grain size (3.5.1.1.1) and hardness (3.5.1.1.2) of each lot of bars and forgings as solution heat treated.

4.2.1.3 Room-temperature tensile (3.5.1.2.1), hardness (3.5.1.2.2), and stress-rupture (3.5.1.2.3) properties of each lot of bars or forgings after precipitation heat treatment.

4.2.1.4 Tolerances (3.7) of bars.

4.2.1.5 Ability of forging stock (3.5.2) to develop required properties.

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 purchaser:

4.2.2.1 Grain flow of die forgings (3.6.1).

4.3 Sampling and Testing

Shall be as follows:

4.3.1 Bars, and Stock for Forging

In accordance with AMS2371, with stress rupture specimens oriented as specified for tensile specimens.

4.3.2 Forgings

In accordance with AMS2374, with stress rupture specimens oriented as specified for tensile specimens.

4.4 Reports

4.4.1 The producer of the bars or forgings shall furnish with each shipment a report showing the producer's name and country where the metal was melted (e.g., final melt in the case of metal processed by multiple melting operations), the results of tests for composition of each heat, grain size and hardness of each lot as solution heat treated, tensile, hardness and stress rupture properties of each lot after precipitation heat treatment, and stating that the product conforms to the other technical requirements. If periodic testing is performed, the results of the periodic testing shall be reported. This report shall include the purchase order number, heat and lot numbers, AMS5915B, size, and quantity. If forgings are supplied, the size and source of stock used to make the forgings shall also be included.

4.4.1.1 If the ship size/shape is cut from a larger cross section, report the nominal metallurgically worked size (also see 3.3.1.1).

4.4.1.2 When material produced to this specification is outside the range covered by 1.2, or has exceptions authorized by purchaser taken to the technical requirements listed in Section 3 (see 5.2.1), the report shall contain a statement "This material is certified as AMS5915B(EXC) because of the following exceptions:" and the specific exceptions shall be listed.

4.4.2 The producer of stock for forging shall furnish with each shipment a report showing the producer's name and country where the metal was melted (e.g., final melt in the case of metal processed by multiple melting operations) and the results of tests for chemical composition of each heat and the ability of forging stock to develop required properties. This report shall include the purchase order number, heat number, AMS5915B, size, and quantity.

4.5 Resampling and Retesting

Shall be as follows:

4.5.1 Bars and Stock for Forging

In accordance with AMS2371, with stress rupture specimens oriented as specified for tensile specimens.

4.5.2 Forgings

In accordance with AMS2374, with stress rupture specimens oriented as specified for tensile specimens.