AEROSPACE MATERIAL SPECIFICATION

AMS5877™	REV. C

Issued 1989-07
Reaffirmed 2018-10
Revised 2023-12

Superseding AMS5877B

Alloy, Corrosion- and Heat-Resistant, Bars, Forgings, Rings and Stock for Forgings, Rings or Heading 29Fe - 22Cr - 21Ni - 18.5Co - 3.2Mo - 2.8W - 0.78Ta 0.30Al - 0.05La - 0.20N (HS-556) Solution Heat Treated

(Composition similar to UNS R30556)

RATIONALE

AMS5877C is the result of a Five-Year Review and update of the specification. The revision updates the Title to match the Scope, noting that producers treat this alloy as a nickel material, updates composition method and reporting (see 3.1 and 3.1.1), requires strain rate control during tensile testing (see 3.4.1.1.1), prohibits unauthorized exceptions (see 3.7, 4.4.3, and 8.5), requires reporting of country of origin (see 4.4.1 and 4.4.2), updates options for ordering forging stock (see 4.4.2 and 8.6), and allows prior revisions (see 8.4).

1. SCOPE

1.1 Form

This specification covers a corrosion- and heat-resistant 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, such as turbine rotors, shafts, blades, and bolts, requiring high strength 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.

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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

AMS2283 Composition Testing Methods for Nickel- and Cobalt-Based Alloys

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 E8/E8M Tension Testing of Metallic Materials

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

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2.3 Definitions

Terms used in AMS are defined in AS7766.

3. TECHNICAL REQUIREMENTS

3.1 Composition

Composition shall conform to the percentages by weight shown in Table 1, determined in accordance with AMS2283 or by other analytical methods acceptable to the purchaser.

Table 1 - Composition

Element	Min	Max
Carbon	0.05	0.15
Manganese	0.50	2.00
Silicon	0.20	0.80
Phosphorus	--	0.04
Sulfur	--	0.015
Chromium	21.00	23.00
Nickel	19.00	22.50
Cobalt	16.00	21.00
Molybdenum	2.50	4.00
Tungsten	2.00	3.50
Tantalum	0.30	1.25
Aluminum	0.10	0.50
Zirconium	0.001	0.10
Lanthanum	0.005	0.10
Nitrogen	0.10	0.30
Columbium	--	0.30
Boron	--	0.02
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; check analysis limits for lanthanum shall be 0.002 under minimum and 0.01 over maximum.

3.2 Condition

The product shall be supplied in the following condition:

3.2.1 Bars, forgings, and flash-welded rings shall be solution heat treated. Forgings shall be 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.

3.2.2 Stock for forging, flash-welded rings, or heading shall be as ordered by the forging, flash-welded ring, or heading manufacturer.

3.3 Heat Treatment

The product shall be solution heat treated by heating to a temperature within the range 2100 to 2225°F (1149 to 1218°C), holding at the selected temperature within ±25°F (±14°C) for a time commensurate with cross-sectional thickness but not less than 20 minutes, and quenching in water. Pyrometry shall be in accordance with AMS2750.

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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 shown in Table 2, determined in accordance with ASTM E 8/E8M.

Table 2 - Minimum tensile properties

Property	Value
Tensile Strength	100 ksi (689 MPa)
Yield Strength at 0.2% Offset	47.0 ksi (324 MPa)
Elongation in 4D or 2 inches (50 mm)	40%

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

3.4.1.2 Hardness

Hardness shall be not higher than 241 HBW, or equivalent (see 8.2), determined in accordance with ASTM E10. Product shall not be rejected on the basis of hardness if the tensile properties of 3.4.1.1 are acceptable, determined on specimens taken from the same sample as that with nonconforming hardness or from another sample with similar nonconforming hardness.

3.4.1.3 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 19.0 ksi (131 MPa) or higher is applied continuously, shall not rupture in less than 24 hours. Elongation after rupture, measured at room temperature, shall be not less than 25% in 4D. Tests shall be conducted in accordance with ASTM E139.

3.4.1.3.1 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 19.0 ksi (131 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 (13.8 MPa). Time to rupture and elongation requirements shall be as specified in 3.4.1.3.

3.4.2 Forging Stock

When a sample of stock is forged to a test coupon and heat treated as in 3.3, specimens taken from the heat-treated coupon shall conform to the requirements of 3.4.1.1, 3.4.1.2, and 3.4.1.3. If specimens taken from the stock after heat treatment as in 3.3 conform to the requirements of 3.4.1.1, 3.4.1.2, and 3.4.1.3, 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 as in 3.3. shall conform to the requirements of 3.4.1.1, 3.4.1.2, and 3.4.1.3.

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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 shall conform to all applicable requirements of AMS2261.

3.7 Exceptions

Any exceptions shall be authorized by the purchaser and reported as in 4.4.3.

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 Tensile properties (see 3.4.1.1), hardness (see 3.4.1.2), and stress-rupture (see 3.4.1.3) properties of each lot of bars, forgings, and flash-welded rings.

4.2.1.3 Tolerances (see 3.6) of bars.

4.2.2 Periodic Tests

Tests of forging stock (see 3.4.2) and of stock for flash-welded rings or heading (see 3.4.3) to demonstrate ability to develop required properties and grain flow of die forgings (see 3.5.1) are periodic tests and shall be performed at a frequency selected by the producer unless frequency of testing is specified by the purchaser.

4.3 Sampling and Testing

4.3.1 Bars, flash-welded rings, and stock for forging, flash-welded rings, or heading shall be sampled and tested in accordance with AMS2371.

4.3.2 Forgings shall be sampled and tested in accordance with AMS2374.

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