



AEROSPACE MATERIAL SPECIFICATION

AMS5656**REV. F**

Issued 1968-12
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Revised 2015-07

Superseding AMS5656E

Steel, Corrosion Resistant, Bars, Wire, Forgings,
Extrusions, and Rings
9.0Mn - 20Cr - 6.5Ni - 0.27N
Solution Heat Treated
(Composition similar to UNS S21904)

RATIONALE

AMS5656F revises Reports (4.4), and is a Five Year Review and update of this specification.

1. SCOPE

1.1 Form

This specification covers a corrosion-resistant steel in the form of bars, wire, forgings, extrusions, flash welded rings, and stock for forging, extruding, or flash welded rings.

1.2 Application

These products have been used typically for parts requiring high strength and corrosion resistance from -425 to 1100 °F (-254 to 593 °C) and where parts may require welding during fabrication, 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.

AMS2241 Tolerances, Corrosion and Heat-Resistant Steel, Iron Alloy, Titanium, and Titanium Alloy Bars and Wire

AMS2248 Chemical Check Analysis Limits, Corrosion and Heat-Resistant Steels and Alloys, Maraging and Other Highly-Alloyed Steels, and Iron Alloys

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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
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

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 A262	Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels
ASTM A370	Mechanical Testing of Steel Products
ASTM E353	Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron 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 E353, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

Table 1 - Composition

Element	min	max
Carbon	--	0.04
Manganese	8.00	10.00
Silicon	--	1.00
Phosphorus	--	0.060
Sulfur	--	0.030
Chromium	19.00	21.50
Nickel	5.50	7.50
Nitrogen	0.15	0.40
Molybdenum	--	0.75
Copper	--	0.75

3.1.1 Check Analysis

Composition variations shall meet the applicable requirements of AMS2248.

3.2 Condition

3.2.1 Bars

Hot rolled, solution heat treated, and descaled.

3.2.1.1 Round bars shall be ground or turned.

3.2.2 Wire

Cold finished, and solution heat treated.

3.2.3 Forgings, Extrusions, and Flash Welded Rings

Solution heat treated, and descaled.

3.2.3.1 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 AMS7490.

3.2.4 Stock for Forging, Flash Welded Rings, or Extrusions

As ordered by the forging, flash welded ring, or extrusion manufacturer.

3.3 Properties

The product shall conform to the following requirements; tensile and hardness testing shall be performed in accordance with ASTM A370:

3.3.1 Bars, Wire, Forgings, Extrusions, and Flash Welded Rings

3.3.1.1 Tensile Properties

Shall be as shown in Table 2.

Table 2 - Minimum tensile properties

Property	Value
Tensile Strength	90 ksi (621 MPa)
Yield Strength at 0.2% Offset	50 ksi (345 MPa)
Elongation in 4D	40%
Reduction in area	60%

3.3.1.2 Hardness

Shall be not higher than 100 HRB, or equivalent (See 8.2).

3.3.1.3 Susceptibility to Intergranular Attack

A specimen of the product shall be sensitized by heating in air to $1250^{\circ}\text{F} \pm 10$ ($677^{\circ}\text{C} \pm 6$), holding at heat for 60 minutes ± 5 , and cooling in air. The specimen shall not show any evidence of intergranular attack when immersed in acidified copper sulfate solution in accordance with ASTM A262, Practice E, except that the exposure time shall be 72 hours and the metallic copper shall not be used. The specimen, after immersion, shall withstand, without cracking, bending in accordance with ASTM A262, Practice E.

3.3.2 Stock for Forging, Extruding, or Flash Welded Rings

Shall have properties as agreed upon by purchaser and producer.

3.4 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.

3.4.1 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.

3.5 Tolerances

Bars and wire shall conform to all applicable requirements of AMS2241.

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 Tensile properties (3.3.1.1) and hardness (3.3.1.2) of each lot of bars, wire, forgings, extrusions, and flash welded rings.

4.2.1.3 Tolerances (3.5) of bars and wire.

4.2.2 Periodic Tests

Susceptibility to intergranular attack (3.3.1.3) and grain flow of die forgings (3.4.1) are periodic tests and shall be performed at a frequency selected by the producer unless frequency of testing is specified by purchaser.

4.3 Sampling and Testing

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

In accordance with AMS2371.

4.3.2 Forgings

In accordance with AMS2374.

4.4 Reports

4.4.1 The producer of the product 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 composition of each heat and for tensile properties and hardness of each lot, and stating that the product conforms to the other technical requirements. This report shall include the purchase order number, heat and lot numbers, AMS5656F, size, product form, and quantity. If forgings are supplied, the size and melt source of stock used to make the forgings shall also be included.

4.4.2 The producer of stock for forgings, extrusions or flash welded rings 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 results of tests for composition for each heat. This report shall include the purchase order number, heat number, AMS5656F, product form, size, and quantity.