

AEROSPACE MATERIAL SPECIFICATION

SAE AMS5654

REV. F

Issued 1967-11
Reaffirmed 2006-04
Revised 2011-05

Superseding AMS5654E

Steel, Corrosion and Heat Resistant, Bars, Wire, Forgings, Tubing, and Rings
18Cr - 11Ni - 0.60Cb (Nb) (347)
Premium Aircraft Quality, Consumable Electrode Melted
Solution Heat Treated

UNS S34700

RATIONALE

AMS5654F revises Tensile Properties (3.4.1) to add tensile property requirements for bars, revises Hardness (3.4.2) to change max hardness requirements for bars over 2.000 inch, 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 and heat resistant steel in the form of bars, wire, forgings, mechanical tubing, flash welded rings, and stock for forging or flash welded rings.

1.2 Application

These products have been used typically for parts requiring corrosion and heat resistance and subject to very rigid inspection standards, especially when such parts are welded during fabrication, for parts requiring oxidation resistance up to 1500 °F (816 °C) but useful at that temperature only when stresses are low, 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 724-776-4970 (outside USA), www.sae.org.

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

AMS2243 Tolerances, Corrosion and Heat-Resistant Steel Tubing

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SAE WEB ADDRESS:

AMS2248	Chemical Check Analysis Limits, Corrosion and Heat-Resistant Steels and Alloys, Maraging and Other Highly-Alloyed Steels, and Iron 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
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 19248-2959, Tel: 610-832-9585, www.astm.org.

ASTM A 262	Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels
ASTM A 370	Mechanical Testing of Steel Products
ASTM E 45	Determining the Inclusion Content of Steel
ASTM E 353	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 E 353, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

TABLE 1 - COMPOSITION

Element	min	max
Carbon	--	0.08
Manganese	--	2.00
Silicon	--	1.00
Phosphorus	--	0.020
Sulfur	--	0.020
Chromium	17.00	19.00
Nickel	9.00	13.00
Columbium (Niobium)	10xC	1.10
Tantalum	--	0.05
Molybdenum	--	0.75
Copper	--	0.75

3.1.1 Check Analysis

Composition variations shall meet the requirements of AMS2248.

3.2 Melting Practice

Product shall be multiple melted using consumable electrode practice in the remelt cycle.

3.3 Condition

The product shall be supplied in the following condition:

3.3.1 Bars, Wire, Forgings, Mechanical Tubing, and Flash Welded Rings

Solution heat treated.

3.3.1.1 Bars and Wire

3.3.1.1.1 All hexagons, other bars 2.75 inches (69.8 mm) and under in nominal diameter or least distance between parallel sides, and wire shall be cold finished.

3.3.1.1.2 Bars, other than hexagons, over 2.75 inches (69.8 mm) in nominal diameter or least distance between parallel sides, shall be hot finished.

3.3.1.2 Mechanical Tubing

Shall be cold finished.

3.3.1.3 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.

3.3.2 Stock for Forging or Flash Welded Rings

As ordered by the forging or flash welded ring manufacturer.

3.4 Properties

The product shall conform to the following requirements; hardness and tensile testing shall be performed in accordance with ASTM A 370:

3.4.1 Tensile Properties

3.4.1.1 Bars and Forgings Over 0.50 Inch (12.7 mm) in Nominal Diameter or Least Distance Between Parallel Sides

Shall be as Shown in Table 2.

TABLE 2 - MINIMUM TENSILE PROPERTIES

Property	Value
Tensile Strength	75 ksi (517 MPa)
Yield Strength at 0.2% Offset	30.0 ksi (206.8 MPa)
Elongation in 4D	30%
Reduction of Area	40%

NOTE: Minimum tensile properties for bars and forgings have been taken directly from ASTM A 276 (See 8.5)

3.4.1.2 Wire shall have tensile strength not higher than 125 ksi (862 MPa).

3.4.2 Hardness

3.4.2.1 Bars

Shall be as shown in Table 3, or equivalent (See 8.2), determined approximately at mid-radius or quarter thickness.

TABLE 3 - HARDNESS, HB

Nominal Diameter or Least Distance Between Parallel Sides Inches	Nominal Diameter or Least Distance Between Parallel Sides Millimeters	min	max
Up to 2.00, incl	Up to 50.8, incl	140	255
Over 2.00	Over 50.8	--	255

3.4.2.2 Mechanical Tubing

Shall be not higher than 90 HRB, or equivalent (See 8.2), determined approximately midway between outer and inner surfaces.

3.4.2.3 Forgings and Flash Welded Rings

Shall be not higher than 187 HB, or equivalent (See 8.2).

3.4.3 Susceptibility to Intergranular Attack

The product, after sensitizing treatment, shall pass the intergranular corrosion test performed in accordance with ASTM A 262, Practice E.

3.4.4 Micro-Inclusion Rating

No specimen shall exceed the limits shown in Table 3, determined in accordance with ASTM E 45, Method D, except that the length of any inclusion shall be not greater than 0.015 inch (0.38 mm).

TABLE 3 - MICRO-INCLUSION RATING LIMITS

Type	A	B	C	D
Thin	2.0	1.5	1.5	1.5
Heavy	1.0	1.0	1.0	1.5

3.5 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.

3.5.1 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 re-entrant grain flow.

3.6 Tolerances

Shall be as follows:

3.6.1 Bars and Wire

In accordance with AMS2241.

3.6.2 Mechanical Tubing

In accordance with AMS2243.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The vendor of the product shall supply all samples for vendor'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) and micro-inclusion rating (3.4.4) of each heat.

4.2.1.2 Tensile properties (3.4.1) of each lot of bars, forgings, and wire.

4.2.1.3 Hardness (3.4.2) of each lot of bars, mechanical tubing, forgings, and flash welded rings.

4.2.1.4 Tolerances (3.6) of bars, wire, and mechanical tubing.

4.2.2 Periodic Tests

Susceptibility to intergranular attack (3.3.3), and grain flow of die forgings (3.5.1) are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.3 Sampling and Testing

Shall be as follows:

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

In accordance with AMS2371.

4.3.2 Forgings

In accordance with AMS2374.

4.4 Reports

4.4.1 The vendor of bars, forgings, mechanical tubing, and flash welded rings shall furnish with each shipment a report showing the results of tests for composition and micro-inclusion rating of each heat and for tensile properties or 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, AMS5654F, product form, size, and quantity. If forgings are supplied, the part number and the size and melt source of stock used to make the forgings shall also be included.

4.4.2 The vendor of stock for forging or flash welded rings shall furnish with each shipment a report showing the results of tests for chemical composition and micro-inclusion rating of each heat, and the results of any additional property requirements imposed by the purchase order (See 8.6). This report shall include the purchase order number, heat number, AMS5654F, size, and quantity.