

AEROSPACE MATERIAL SPECIFICATION

SAE AMS5653

REV. G

Issued 1963-01
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Revised 2011-05
Superseding AMS5653F

Steel, Corrosion and Heat-Resistant, Bars, Wire, Forgings, Tubing, and Rings
17Cr - 12Ni - 2.5Mo (0.030 Max C) (316L)
Solution Heat Treated
(Composition similar to UNS S31603)

RATIONALE

AMS5653G revises Tensile Properties (3.3.1) to add requirements for bars and Reports (4.4.1.4, 4.4.2), 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 both corrosion and heat resistance up to 1600 °F (871 °C), but usage is not limited to such applications.

1.2.1 At comparable elevated temperatures, strength of this steel is slightly higher than, and oxidation resistance is similar to, that of 18-8 type steels.

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 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
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 19428-2959, 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 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	--	0.030
Manganese	1.25	2.00
Silicon	--	1.00
Phosphorus	--	0.040
Sulfur	--	0.030
Chromium	16.00	18.00
Nickel	10.00	14.00
Molybdenum	2.00	3.00
Copper	--	1.00

3.1.1 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, Mechanical Tubing, and Flash Welded Rings

Solution heat treated.

3.2.1.1 Bars and Wire

3.2.1.1.1 All hexagons, regardless of size, 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 after solution heat treatment.

3.2.1.1.2 Bars, other than hexagons, over 2.75 inches (69.8 mm) in nominal diameter or least distance between parallel sides shall be hot finished, solution heat treated, and descaled.

3.2.1.2 Mechanical Tubing

Shall be cold finished after solution heat treatment.

3.2.1.3 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.

3.2.2 Stock for Forging or Flash Welded Rings

As ordered by the forging or flash welded ring manufacturer.

3.3 Properties

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

3.3.1 Tensile Properties

3.3.1.1 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	70 ksi (482 MPa)
Yield Strength at 0.2% Offset	25.0 ksi (172.4 MPa)
Elongation in 4D	40%
Reduction of Area	50%

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

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

3.3.2 Hardness

3.3.2.1 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 2.000, incl	Up to 50.80, incl	140	255
Over 2.000	Over 50.80	--	255

3.3.2.2 Mechanical Tubing

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

3.3.2.3 Forgings and Flash Welded Rings

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

3.3.3 Susceptibility to Intergranular Attack

Specimens from the product shall pass, after sensitization, the intergranular corrosion test performed in accordance with ASTM A 262, Practice E.

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

Shall be as follows:

3.5.1 Bars and Wire

In accordance with AMS2241.

3.5.2 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

Composition (3.1), tensile properties (3.3.1.1 or 3.3.1.2, as applicable), hardness (3.3.2), susceptibility to intergranular attack (3.3.3), and tolerances (3.5) are acceptance tests and shall be performed on each heat or lot as applicable.

4.2.2 Periodic Tests

Grain flow of die forgings (3.4.1) is a periodic test 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, wire, forgings, tubing and rings shall furnish with each shipment a report showing the following results of tests and relevant information:

4.4.1.1 For each heat:

Composition.