AEROSPACE MATERIAL SPECIFICATION

AMS5650™	REV. G

Issued 1952-11
Revised 2018-03
Reaffirmed 2022-11

Superseding AMS5650F

Steel, Corrosion- and Heat-Resistant,
Bars, Wire, Forgings, Mechanical Tubing, and Rings
23Cr - 13.5Ni (309S)
Solution Heat Treated
(Composition similar to UNS S30908)

RATIONALE

AMS5650G revises title, composition analysis standards (3.1), reports (4.4), and identification (5.2.1), and results from a Five-Year Review and update of this specification.

AMS5650G has been reaffirmed to comply with the SAE Five-Year Review policy.

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 typically used for parts requiring corrosion and heat resistance and where such parts may require welding during fabrication, and for parts requiring 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.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

For more information on this standard, visit
https://www.sae.org/standards/content/AMS5650G/

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

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

ARP1917 Clarification of 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 A262 Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels

ASTM A370 Mechanical Testing of Steel Products

ASTM A751 Standard Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products

ASTM E140 Hardness Conversion Tables for Metals Relationship Among Brinell Hardness, Vickers Hardness, Rockwell Hardness, Superficial Hardness, Knoop Hardness, Scleroscope Hardness, and Leeb Hardness

3. TECHNICAL REQUIREMENTS

3.1 Composition

Shall conform to the percentages by weight shown in Table 1, determined in accordance with ASTM A751 or by other analytical methods acceptable to purchaser.

Table 1 - Composition

Element	Min	Max
Carbon	--	0.08
Manganese	--	2.00
Silicon	--	1.00
Phosphorus	--	0.040
Sulfur	--	0.030
Chromium	22.00	24.00
Nickel	12.00	15.00
Molybdenum	--	0.75
Copper	--	0.75

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, 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., except round bars shall be ground or turned.

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 A370.

3.3.1 Tensile Properties

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

3.3.2 Hardness

3.3.2.1 Bars

Shall be not higher than 187 HB, or equivalent (see 8.2), except that, if supplied cold finished, hardness may be as high as 229 HB, or equivalent, determined approximately at mid-radius or quarter-thickness.

3.3.2.2 Forgings and Flash Welded Rings

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

3.3.2.3 Mechanical Tubing

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

3.3.2.4 Susceptibility to Intergranular Attack

Specimens from the product shall pass the intergranular corrosion test performed in accordance with ASTM A262, 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 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

Composition (3.1), tensile properties (3.3.1), hardness (3.3.2), and tolerances (3.5) are acceptance tests and shall be performed on each heat or lot as applicable.

4.2.2 Periodic Tests

Susceptibility to intergranular attack (3.3.2.4) 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

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

The producer of bars, wire, forgings, mechanical tubing, and 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 of each heat and for tensile properties, if wire, 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, AMS5650G, size, and quantity. If forgings are supplied, the size and melt source of stock used to make the forgings shall also be included.

4.4.1 When material produced to this specification has exceptions taken to the technical requirements listed in Section 3 (see 5.2.1.1), the report shall contain a statement "This material is certified as AMS5650G(EXC) because of the following exceptions." and the specific exceptions shall be listed.

4.4.2 The producer of stock for forging 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 chemical composition of each heat. This report shall include the purchase order number, heat number, AMS5650G, size, and quantity.

4.5 Resampling and Retesting

Shall be as follows:

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

In accordance with AMS2371.

4.5.2 Forgings

In accordance with AMS2374.

5. PREPARATION FOR DELIVERY

5.1 Sizes

Except when exact lengths or multiples of exact lengths are ordered, straight bars, wire, and mechanical tubing will be acceptable in mill lengths of 6 to 20 feet (1.8 to 6.1 m) but not more than 10% of any shipment shall be supplied in lengths shorter than 10 feet (3 m).