



AEROSPACE MATERIAL SPECIFICATION	AMS5620™	REV. J
	Issued 1945-07 Reaffirmed 2012-04 Revised 2023-03	
Superseding AMS5620H		
Steel, Corrosion- and Heat-Resistant, Bars, Wire, Forgings, and Forging Stock 13Cr (0.30 - 0.40C) (420F, 420FSe) Free-Machining Grade, Annealed (Composition similar to UNS S42020 [Type 2]) (Composition similar to UNS S42023 [Type 1])		

RATIONALE

AMS5620J is the result of a Five-Year Review and update of the specification. The revision updates the title to match the scope, clarifies composition requirements (3.1.1), aligns bar and wire conditions and testing to other similar specifications (3.2.1, 3.2.2, 8.3), prohibits bar cut from plate (3.2.1.3, 4.4.1), removes macroetch requirements similar to other specifications (3.3.1), updates decarburization requirements (3.3.1.4), updates tolerances for temperature and time for heat treatment and adds pyrometry control similar to other specifications (3.3.2), updates AS1182 requirements (3.4.1, 8.5), adds allowance for testing forging stock (4.4.3), and updates the product exception requirements (8.6).

1. SCOPE

1.1 Form

This specification covers two types of corrosion- and heat-resistant steel in the form of bars, wire, forgings, and forging stock.

1.2 Application

These products have been used typically for parts on which the amount of machining warrants use of a free-machining grade of steel and requiring hardness within the range of 40 to 50 HRC with corrosion resistance and oxidation resistance up to 1000 °F (538 °C), but useful at the higher temperatures only when stresses are moderately low, but usage is not limited to such applications. Certain design and processing procedures may cause these products to become susceptible to stress-corrosion cracking. ARP1110 recommends practices to minimize such conditions.

1.3 Classification

The steel compositions covered by this specification are classified as follows:

Type 1 - 13Cr - 0.26Se (0.30 - 0.40C) (420FSe)

Type 2 - 13Cr - 0.25S (0.30 - 0.40C) (420F)

1.3.1 Unless a specific type is ordered, either Type 1 or Type 2 may be supplied.

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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), or 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
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
ARP1110	Minimizing Stress Corrosion Cracking in Wrought Forms of Steels and Corrosion-Resistant Steels and Alloys
AS1182	Standard Stock Removal Allowance, Aircraft-Quality and Premium Aircraft-Quality Steel Bars and Mechanical Tubing
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, or www.astm.org.

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
ASTM E1077	Estimating the Depth of Decarburization of Steel Specimens

2.3 Definitions

Terms used in AMS are defined in AS7766.

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	Type 1	Type 1	Type 2	Type 2
	Min	Max	Min	Max
Carbon	0.30	0.40	0.30	0.40
Manganese	--	1.25	--	1.25
Silicon	--	1.00	--	1.00
Phosphorus	--	0.060	--	0.060
Sulfur	--	0.030	0.15	0.35
Chromium	12.00	14.00	12.00	14.00
Selenium	0.18	0.35	--	--
Nickel	--	0.50	--	0.50
Molybdenum and/or Zirconium	--	0.60	--	0.60

3.1.1 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.

3.2 Condition

The product shall be supplied in the following condition; hardness and tensile strength shall be determined in accordance with ASTM A370:

3.2.1 Bars

Annealed having hardness not higher than 241 HBW, or equivalent (see 8.2).

3.2.1.1 All hexagons regardless of size, and other bars 2.750 inches (69.85 mm) and under in nominal diameter or least distance between parallel sides, shall be cold finished.

3.2.1.2 Bars, other than hexagons, over 2.750 inches (69.85 mm) in nominal diameter or least distance between parallel sides shall be hot finished or cold finished.

3.2.1.3 Bars shall not be cut from plate (see 4.4.1).

3.2.2 Wire

Cold finished and annealed having tensile strength not higher than 125 ksi (862 MPa), or equivalent hardness (see 8.3).

3.2.3 Forgings

As ordered.

3.2.4 Forging Stock

As ordered by the forging manufacturer.

3.3 Properties

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

3.3.1 Decarburization

3.3.1.1 Bars and wire ordered ground, turned, or polished shall be free from decarburization on the ground, turned, or polished surfaces.

3.3.1.2 Allowable decarburization of bars, wire, and billets ordered for redrawing or forging or to specified microstructural requirements shall be as agreed upon by purchaser and producer.

3.3.1.3 Decarburization of bars and wire to which 3.3.1.1 or 3.3.1.2 is not applicable shall be not greater than shown in Table 2.

Table 2A - Maximum decarburization limits, inch/pound units

Nominal Diameter or Distance Between Parallel Sides Inches	Total Depth of Decarburization Inches
Up to 0.375, incl	0.010
Over 0.375 to 0.500, incl	0.012
Over 0.500 to 0.625, incl	0.014
Over 0.625 to 1.000, incl	0.017
Over 1.000 to 1.500, incl	0.020
Over 1.500 to 2.000, incl	0.025
Over 2.000 to 2.500, incl	0.030
Over 2.500 to 3.000, incl	0.035
Over 3.000 to 4.000, incl	0.045

Table 2B - Maximum decarburization limits, SI units

Nominal Diameter or Distance Between Parallel Sides Millimeters	Total Depth of Decarburization Millimeters
Up to 9.52, incl	0.25
Over 9.52 to 12.70, incl	0.30
Over 12.70 to 15.88, incl	0.36
Over 15.88 to 25.40, incl	0.43
Over 25.40 to 38.10, incl	0.51
Over 38.10 to 50.80, incl	0.64
Over 50.80 to 63.50, incl	0.76
Over 63.50 to 76.20, incl	0.89
Over 76.20 to 101.60, incl	1.14

3.3.1.4 Decarburization shall be evaluated by one of the two methods of 3.3.1.4.1 or 3.3.1.4.2.

3.3.1.4.1 Metallographic (Microscopic) Method

A cross section taken perpendicular to the surface shall be etched and examined metallographically at a magnification not to exceed 200X in accordance with ASTM E1077. The sample shall not show a layer of complete (ferrite) or partial decarburization exceeding the limits of Table 2.

3.3.1.4.2 Hardness Traverse (Microindentation) Method

The total depth of decarburization shall be determined by a traverse method using microindentation hardness testing in accordance with ASTM E1077. Samples shall be hardened in a protective atmosphere to prevent changes in surface carbon content. Samples may be tempered at the option of the producer. Measurements shall be far enough away from any adjacent surface to be uninfluenced by any decarburization on the adjacent surface. Acceptance shall be as listed in Table 2.

3.3.1.4.3 When determining the depth of decarburization, it is permissible to disregard local areas provided the decarburization of such areas does not exceed the above limits by more than 0.005 inch (0.13 mm) and the width is 0.065 inch (1.65 mm) or less.

3.3.1.4.4 In case of dispute, the total depth of decarburization determined using the microindentation traverse method shall govern.

3.3.2 Response to Heat Treatment

Samples from product 0.500 inch (12.70 mm) and under in nominal thickness and 0.500 inch \pm 0.010 inch (12.70 mm \pm 0.25 mm) thick specimens cut from larger bars and forgings shall have hardness not lower than 50 HRC, or equivalent (see 8.2), after being heated to 1825 °F \pm 25 °F (996 °C \pm 14 °C), held at heat for 30 minutes \pm 3 minutes, and cooled in still air. Pyrometry shall be in accordance AMS2750.

3.4 Quality

The product, as received by purchaser, shall be uniform in quality and condition, sound, and consistent with the type of steel involved, free from foreign materials and from imperfections detrimental to usage of the product.

3.4.1 Bars shall be free from seams, laps, tears, and cracks after removal of the standard stock removal allowance in accordance with AS1182.

3.4.2 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.

3.6 Exceptions

Any exceptions shall be authorized by the purchaser and reported as in 4.4.2.

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), hardness or tensile strength as received (3.2), decarburization (3.3.1), response to heat treatment (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

Grain flow of die forgings (3.4.2) is a periodic test 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 in accordance with the following:

4.3.1 Bars, Wire, and Forging Stock

In accordance with AMS2371.

4.3.2 Forgings

In accordance with AMS2374.

4.4 Reports

The producer of the product 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 hardness or tensile strength, macrostructure, and response to heat treatment 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, AMS5620J, 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 Report the nominal metallurgically worked cross sectional size and the cut size, if different (see 3.2.1.3).

4.4.2 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 AMS5620J(EXC) because of the following exceptions:" and the specific exceptions shall be listed.

4.4.3 The producer of stock for forging 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 and macrostructure of each heat and the results of any additional property requirements imposed by 8.8. This report shall include the purchase order number, heat number, AMS5620J, size, and quantity.

4.5 Resampling and Retesting

Shall be in accordance with the following:

4.5.1 Bars and Forging Stock

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 and wire 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).

5.2 Identification

Shall be as follows:

5.2.1 Bars and Wire

In accordance with AMS2806.