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400 COMMONWEALTH DRIVE WARRENDALE, PA 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 5615C

Issued 12-4-39
Revised 1-1-84

STEEL BARS AND FORGINGS, CORROSION AND MODERATE HEAT RESISTANT 12.5Cr - 1.9Ni (SAE 51414) Annealed

This specification has been declared "NONCURRENT" by the Aerospace Materials Division, SAE, as of 3-29-82. It is recommended that this specification not be specified for new designs.

This cover sheet should be attached to the "C" revision of the subject specification.

This specification is under the jurisdiction of AMS Committee "F".

Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 5615C
Superseding AMS 5615B

Issued 12-4-39
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UNS S41400

STEEL BARS AND FORGINGS, CORROSION AND MODERATE HEAT RESISTANT 12.5Cr - 1.9Ni (SAE 51414)

1. SCOPE:

1.1 Form: This specification covers a corrosion and moderate heat resistant steel in the form of bars, wire, forgings, and forging stock.

1.2 Application: Primarily for parts, such as compressor wheels and blades, requiring oxidation resistance up to 1000°F (538°C) but useful at the higher temperatures only when stresses are low. Microstructure of this steel is more uniform after heat treatment than that of the standard 12Cr type.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications (AMS) shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2241 - Tolerances, Corrosion and Heat Resistant Steel Bars and Wire and Titanium and Titanium Alloy Bars and Wire
AMS 2248 - Chemical Check Analysis Limits, Wrought Heat and Corrosion Resistant Steels and Alloys
AMS 2350 - Standards and Test Methods
AMS 2371 - Quality Assurance Sampling of Corrosion and Heat Resistant Alloys, Wrought Products Except Forgings
AMS 2806 - Identification, Bars, Wire, Mechanical Tubing, and Extrusions, Carbon and Alloy Steels and Heat and Corrosion Resistant Steels and Alloys
AMS 2808 - Identification, Forgings

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM A370 - Mechanical Testing of Steel Products
ASTM E340 - Macroetching Metals and Alloys
ASTM E353 - Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys

2.3 Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.3.1 Federal Standards:

Federal Test Method Standard No. 151 - Metals; Test Methods

2.3.2 Military Standards:

MIL-STD-163 - Steel Mill Products, Preparation for Shipment and Storage

3. TECHNICAL REQUIREMENTS:

3.1 Composition: Shall conform to the following percentages by weight, determined by wet chemical methods in accordance with ASTM E353, by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other approved analytical methods:

	min	max
Carbon	0.08	0.15
Manganese	--	1.00
Silicon	--	1.00
Phosphorus	--	0.040
Sulfur	--	0.030
Chromium	11.50	13.50
Nickel	1.25	2.50
Molybdenum	--	0.60
Copper	--	0.50

Ø 3.1.1 Check Analysis: Composition variations shall meet the requirements of AMS 2248.

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

Ø 3.2.1 Bars: Annealed having hardness not higher than 269 HB or equivalent.

3.2.1.1 Bars over 0.500 to 2.750 in. (12.70 to 69.85 mm), incl, in nominal diameter or distance between parallel sides and all hexagons shall be cold finished.

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

3.2.2 Wire: Annealed and cold finished having tensile strength not higher than 130,000 psi (896 MPa) or Ø equivalent hardness.

Ø 3.2.3 Forgings: Shall have hardness not higher than 269 HB or equivalent.

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 per- Ø formed in accordance with ASTM A370:

3.3.1 Macrostructure: Visual examination of transverse sections from bars, wire, billets, and forging Ø stock, etched in accordance with ASTM E340 in hot hydrochloric acid (1:1) at 160° - 180°F (71.1° - 82.2°C) for sufficient time to develop a well-defined macrosturcture, shall show no imperfections, such as pipe, porosity, segregation, and inclusions, detrimental to fabrication or to performance of parts. Macrostructure standards shall be as agreed upon by purchaser and vendor.

3.3.2 Response to Heat Treatment: Product, 0.375 in. (9.52 mm) and under in nominal thickness and Ø 0.375 in. ± 0.010 (9.52 mm ± 0.25) thick specimens cut from larger product, shall have hardness not lower than 42 HRC after being heated to 1750°F ± 10 (954.4°C ± 5.6), held at heat for 25 - 30 min., and quenched in commercial paraffin-base oil (100 SUS at 100°F (37.8°C)) at room temperature.

3.4 Quality: The product, as received by the purchaser, shall be uniform in quality and condition, sound, Ø and free from foreign materials and from internal and external imperfections detrimental to usage of the product.

3.5 Sizes: Except when exact lengths or multiples of exact lengths are ordered, straight bars and wire Ø will be acceptable in mill lengths of 6 - 20 ft (1.8 - 6.1 m) but not more than 10% of any shipment shall be supplied in lengths shorter than 10 ft (3 m).

3.6 Tolerances: Unless otherwise specified, tolerances for bars and wire shall conform to all applicable requirements of AMS 2241.

4. QUALITY ASSURANCE PROVISION:

4.1 Responsibility for Inspection: The vendor of the product shall supply all samples and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.4. Purchaser reserves the right to perform such confirmatory testing as he deems necessary to ensure that the product conforms to the requirements of this specification.

4.2 Classification of Tests: Tests to determine conformance to all technical requirements of this specification are classified as acceptance tests.

4.3 Sampling: Shall be in accordance with the following:

4.3.1 Bars and Wire: AMS 2371.

4.3.2 Forgings and Forging Stock: As agreed upon by purchaser and vendor.

4.4 Reports:

4.4.1 The vendor of the product shall furnish with each shipment three copies of a report showing the results of tests on each heat for chemical composition and the results of tests on each size from each heat to determine conformance to other technical requirements of this specification. This report shall include the purchase order number, heat number, material specification number and its revision letter, size, and quantity from each heat. 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 finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, material specification number and its revision letter, contractor or other direct supplier of material, part number, and quantity. When material for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of material to determine conformance to the requirements of this specification, and shall include in the report a statement that the material conforms, or shall include copies of laboratory reports showing the results of tests to determine conformance.

4.5 Resampling and Retesting: If any specimen used in the above tests fails to meet the specified requirements, disposition of the product may be based on the results of testing three additional specimens for each original nonconforming specimen. Failure of any retest specimen to meet the specified requirements shall be cause for rejection of the product represented and no additional testing shall be permitted. Results of all tests shall be reported.

4.5.1 Should resampling and retesting be required for the macrostructure test, the additional specimens shall be taken from material representing the same position in each of the two available ingots most immediately adjacent in pouring sequence to that from which the failed specimen was taken and one from the original nonconforming ingot after additional discard; should the latter specimen be unacceptable, resampling and retesting of the nonconforming ingot may be repeated after as many consecutive discards as necessary and desire to obtain sound material.

5. PREPARATION FOR DELIVERY:

5.1 Identification: The product shall be identified as follows:

5.1.1 Bars and Wire: In accordance with AMS 2806.

5.1.2 Forgings: In accordance with AMS 2808.

5.1.3 Forging Stock: As agreed upon by purchaser and vendor.