Society of Automotive Engineers, Inc.
TWO PENNSYLVANIA PLAZA, NEW YORK, N.Y. 10001

AEROSPACE MATERIAL SPECIFICATION

AMS 5642D
Superseding AMS 5642C
Issued 9-1-47
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STEEL BARS AND FORGINGS, CORROSION AND HEAT RESISTANT
18Cr - 10.5Ni (303 + Cb)
Free-Machining

1. SCOPE:

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

1.2 Application: Primarily for parts on which the amount of machining warrants use of a free-machining grade of steel, requiring corrosion resistance similar to the 18-8 type of steel and which will be subjected to high temperatures during fabrication or in service, except that it is not intended for parts to be brazed at temperatures higher than 1350 F (732 C) or to be fusion welded.

1.3 Classification: The steels covered by this specification are classified as follows:

Type 1 - 18Cr - 10.5Ni - 0.26S - (Cb + Ta).
Type 2 - 18Cr - 10.5Ni - 0.14P - 0.25Se - (Cb + Ta).

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

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., Two Pennsylvania Plaza, New York, New York 10001.

2.1.1 Aerospace Material Specifications:

AMS 2241 - Tolerances, Corrosion and Heat Resistant Steel Bars and Wire 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 2808 - Identification, Forgings

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

ASTM A370 - Mechanical Testing of Steel Products
ASTM A393 - Conducting Acidified Copper Sulfate Test for Intergranular Attack in Austenitic Stainless Steel
ASTM E353 - Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys

2.3 Government Publications: Available from Superintendent of Documents, Government Printing Office, Washington, D. C. 20402.

2.3.1 Federal Standards:

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

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.

	Type 1		Type 2	
	min	max	min	max
Carbon	--	0.08	--	0.08
Manganese	--	2.00	--	2.00
Silicon	--	1.00	--	1.00
Phosphorus	--	0.040	0.11 -	0.17
Sulfur	0.18 -	0.35	--	0.30
Chromium	17.00 -	19.00	17.00 -	19.00
Nickel	9.00 -	12.00	9.00 -	12.00
Columbium + Tantalum	10 x C -	1.10	10 x C -	1.10
Selenium	--	--	0.15 -	0.35
Molybdenum	--	0.75	--	0.75
Copper	--	0.50	--	0.50

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

3.2 Condition:

3.2.1 Bars, Wire, and Forgings: Solution heat treated free from continuous carbide network.

3.2.1.1 Bars and Wire: All hexagons, other bars 2.75 in. (69.85 mm) and under in diameter or distance between parallel sides, and wire shall be cold finished.

3.2.2 Forging Stock: As ordered by the forging 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 100,000 psi (690 MN/m^2) or equivalent.

3.3.2 Hardness:

3.3.2.1 Bars: Shall be as follows, or equivalent, determined approximately midway between outer surface and center:

Nominal Diameter or Distance Between Parallel Sides		Brinell Hardness
Inches	(Millimeters)	
Up to 0.75, incl	(Up to 19.05, incl)	170 - 255
Over 0.75	(Over 19.05)	140 - 241

3.3.2.2 Forgings: Shall be not higher than 187 HB or equivalent.

3.3.3 Embrittlement: The product, after sensitizing treatment, shall be capable of being exposed to acidified copper sulfate in accordance with ASTM A393 without evidence of intercrystalline surface attack. After exposure, specimens shall not crack when bent 180 deg (3.14 rad) around a diameter equal to the thickness or diameter of the specimen.

3.4 Quality: The product shall be uniform in quality and condition, sound, and free from foreign materials and from internal and external imperfections detrimental to fabrication or to performance of parts.

3.5 Sizes: Except when exact lengths or multiples of exact lengths are ordered, bars and straight wire 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 PROVISIONS:

4.1 Responsibility for Inspection: The vendor 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 assure that material conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Routine Control Tests: Tests to determine conformance to composition (3.1), condition (3.2), tensile properties (3.3.1), hardness (3.3.2), and tolerance (3.6) requirements are classified as routine control tests.

4.2.2 Periodic Control Tests: Tests to determine conformance to embrittlement requirements (3.3.3) are classified as qualification and/or periodic control tests.

4.3 Sampling: Bars and wire shall be sampled in accordance with AMS 2371. Forgings and forging stock shall be sampled 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 of the results of tests for chemical composition of each heat in the shipment and the results of tests on each size from each heat to determine conformance to the tensile property and hardness requirements. 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 size 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 testing of 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 material represented and no additional testing shall be permitted. Results of all tests shall be reported.

5. PREPARATION FOR DELIVERY:

5.1 Identification: The product shall be identified as follows:

5.1.1 Bars and Wire: