



AEROSPACE MATERIAL

Society of Automotive Engineers, Inc.

400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

SPECIFICATION

AMS 5745B

Superseding AMS 5745A

Issued 1-15-59

Revised 4-1-81

UNS S35000

STEEL BARS AND FORGINGS, CORROSION AND MODERATE HEAT RESISTANT

16.5Cr - 4.5Ni - 2.9Mo - 0.10N

Equalized and Over-tempered

1. SCOPE:

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

1.2 Application: Primarily for parts requiring oxidation resistance and high strength up to 800°F (425°C) and which may require welding during fabrication.

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, Iron Alloy, 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 Steels and Alloys, Wrought Products Except Forgings and Forging Stock

AMS 2374 - Quality Assurance Sampling of Corrosion and Heat Resistant Steels and Alloys, Forgings and Forging Stock

AMS 2375 - Control of Forgings Requiring First Article Approval

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 E353 - Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys

2.3 U.S. 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

SAE Technical Board rules provide that: "All technical reports, including standards approved and practices recommended, are advisory only. Their use by anyone engaged in industry or trade or their use by governmental agencies is entirely voluntary. There is no agreement to adhere to any SAE standard or recommended practice, and no commitment to conform to or be guided by any technical report. In formulating and approving technical reports, the Board and its Committees will not investigate or consider patents which may apply to the subject matter. Prospective users of the report are responsible for protecting themselves against liability for infringement of patents."

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 analytical methods approved by purchaser:

	min	max
Carbon	0.07	0.11
Manganese	0.50	1.25
Silicon	--	0.50
Phosphorus	--	0.040
Sulfur	--	0.030
Chromium	16.00	17.00
Nickel	4.00	5.00
Molybdenum	2.50	3.25
Nitrogen	0.07	0.13

- 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:

3.2.1 Bars:

- Ø 3.2.1.1 Rounds: Equalized, overtempered, and ground, turned, or polished.

- Ø 3.2.1.2 Shapes: Cold drawn, equalized, overtempered, and descaled.

- Ø 3.2.1.3 Flats: Hot finished, equalized, overtempered, and descaled.

- Ø 3.2.2 Forgings: Equalized, overtempered, and descaled.

- 3.2.3 Forging Stock: As ordered by the forging manufacturer.

- 3.3 Heat Treatment: Bars and forgings shall be equalized by heating to $1400^{\circ}\text{F} \pm 50$ ($760^{\circ}\text{C} \pm 30$), holding at heat for not less than 3 hr, and cooling in air to 90°F (30°C) or lower, reheating to $1100^{\circ}\text{F} \pm 25$ ($595^{\circ}\text{C} \pm 15$), holding at heat for not less than 3 hr, and cooling in air.

- 3.4 Properties: Bars and forgings shall conform to the following requirements; hardness and tensile testing shall be performed in accordance with ASTM A370:

3.4.1 As Equalized and Overtempered:

- 3.4.1.1 Hardness: Not higher than 363 HB or equivalent except that bars 0.625 in. (15.88 mm) and under in nominal diameter may have hardness as high as 375 HB or equivalent.

3.4.2 After Solution Heat Treatment, Sub-Zero Cooling, Austenite Conditioning, Sub-Zero Cooling, and Tempering: Bars and forgings shall have the following properties after being solution heat treated by heating to $1900^{\circ}\text{F} \pm 25$ ($1040^{\circ}\text{C} \pm 15$), holding at heat for 1 - 3 hr, and quenching in water; cooling to -100°F (-73°C) or colder, holding at this temperature for not less than 3 hr, and warming in air to room temperature; austenite conditioning by heating to $1750^{\circ}\text{F} \pm 25$ ($955^{\circ}\text{C} \pm 15$), holding at heat for 10 - 60 min., and quenching in water; cooling to -100°F (-75°C) or colder, holding at this temperature for not less than 3 hr, and warming in air to room temperature; and tempering by heating to $1000^{\circ}\text{F} \pm 25$ ($540^{\circ}\text{C} \pm 15$), holding at heat for not less than 3 hr, and cooling in air:

3.4.2.1 Tensile Properties:

Tensile Strength, min	165,000 psi	(1138 MPa)
Yield Strength at 0.2% Offset, min	140,000 psi	(965 MPa)
Elongation in 4D, min	10%	
Reduction of Area, min	20%	

3.4.2.2 Hardness: Should be 38 - 48 HRC or equivalent but the product shall not be rejected on the basis of hardness if the tensile property requirements are met.

3.5 Quality:

3.5.1 Steel shall be multiple melted using consumable electrode practice in the remelt cycle, unless otherwise permitted by purchaser.

3.5.2 The product, as received by purchaser, shall be uniform in quality and condition, essentially free of grain boundary carbides, sound, and free from foreign materials and from internal and external imperfections detrimental to usage of the product.

3.6 Sizes: Except when exact lengths or multiples of exact lengths are ordered, straight bars 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).

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

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 performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.5. Purchaser reserves the right to sample and 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:

4.2.1 Acceptance Tests: Tests of bars and forgings to determine conformance to all technical requirements of this specification are classified as acceptance tests and shall be performed on each heat or lot as applicable.

4.2.2 Preproduction Tests: Tests of forgings to determine conformance to all technical requirements of this specification when AMS 2375 is specified are classified as preproduction tests and shall be performed on the first-article shipment of a forging to a purchaser, when a change in material or processing requires reapproval as in 4.4, and when purchaser deems confirmatory testing to be required.

4.2.2.1 For direct U.S. Military procurement of forgings, substantiating test data and, when requested, preproduction forgings shall be submitted to the cognizant agency as directed by the procuring activity, the contracting officer, or the request for procurement.

4.3 Sampling: Shall be in accordance with the following; a heat shall be the consumable electrode ingots produced from steel originally melted as a single furnace charge.

4.3.1 Bars: AMS 2371.

4.3.2 Forgings and Forging Stock: AMS 2374.

4.4 Approval: When specified, approval and control of forgings shall be in accordance with AMS 2375.

4.5 Reports:

4.5.1 The vendor of the product shall furnish with each shipment three copies of a report showing the results of tests for chemical composition of each heat and the results of tests on each lot to determine conformance to the other technical requirements of this specification. This report shall include the purchase order number, heat number, AMS 5745B, 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.

4.5.2 The vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, AMS 5745B, 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.

4.6 Resampling and Retesting: Shall be in accordance with the following:

4.6.1 Bars: AMS 2371.

4.6.2 Forgings and Forging Stock: AMS 2374.

5. PREPARATION FOR DELIVERY:

5.1 Identification: The product shall be identified as follows:

5.1.1 Bars: 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.

5.2 Packaging:

5.2.1 The product shall be prepared for shipment in accordance with commercial practice and in compliance with applicable rules and regulations pertaining to the handling, packaging, and transportation of the product to ensure carrier acceptance and safe delivery. Packaging shall conform to carrier rules and regulations applicable to the mode of transportation.