



AEROSPACE MATERIAL

Society of Automotive Engineers, Inc.

400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

SPECIFICATION

AMS 5773A

Superseding AMS 5773

Issued 7-1-76

Revised 1-15-79

UNS S45000

STEEL BARS, FORGINGS, TUBING, AND RINGS, CORROSION RESISTANT

15Cr - 6.5Ni - 0.75Mo - 0.30(Cb + Ta) - 1.5Cu

Consumable Electrode Melted, Solution Heat Treated

1. SCOPE:

- 1.1 **Form:** This specification covers a premium-quality, precipitation-hardenable, corrosion-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:** Primarily for parts requiring corrosion resistance approximating that of steels of the 18-8 types and high strength exceeding that of the 12Cr martensitic type up to 700° F (370° C). This steel can be used in the solution heat treated condition and is capable of being precipitation heat treated to tensile strengths as high as 180,000 psi (1241 MPa) with good ductility and strength in the transverse directions in large section sizes. Although this steel is relatively immune to stress-corrosion cracking, reference should be made to ARP 1110 for recommended practices to minimize such conditions.

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) and Aerospace Recommended Practices (ARP) 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 2243 - Tolerances, Corrosion and Heat Resistant Steel Tubing
AMS 2248 - Chemical Check Analysis Limits, Wrought Heat and Corrosion Resistant Steels and Alloys
AMS 2300 - Premium Aircraft-Quality Steel Cleanliness, Magnetic Particle Inspection Procedure
AMS 2350 - Standards and Test Methods
AMS 2371 - Quality Assurance Sampling of Corrosion and Heat Resistant Alloys, Wrought Products Except Forgings
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
AMS 7490 - Rings, Flash Welded, Corrosion and Heat Resistant Austenitic Steels and Austenitic-Type Alloys

2.1.2 Aerospace Recommended Practices:

ARP 1110 - Minimizing Stress Corrosion Cracking in Heat Treatable Wrought Low Alloy and Martensitic Corrosion Resistant Steels

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- 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 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 analytical methods approved by purchaser:

Ø	min	max
Carbon	--	0.05
Manganese	--	1.00
Silicon	--	1.00
Phosphorus	--	0.020
Sulfur	--	0.015
Chromium	14.00 - 16.00	
Nickel	6.00 - 7.00	
Molybdenum	0.50 - 1.00	
Columbium + Tantalum	8xC	--
Copper	1.25 - 1.75	

- 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, Wire, Mechanical Tubing, Forgings, and Flash Welded Rings: Solution heat treated.

3.2.1.1 Bars:

- 3.2.1.1.1 Rounds: Centerless ground after solution heat treatment.

- 3.2.1.1.2 Squares, Hexagons, and Flats: Hot finished before solution heat treatment and descaled, or cold drawn after solution heat treatment or descaling, as ordered.

- 3.2.1.2 Wire: Cold drawn after solution heat treatment.

- 3.2.1.3 Mechanical Tubing: Cold finished and solution heat treated.

- 3.2.1.4 Flash Welded Rings: Shall not be supplied unless specified or permitted on purchaser's part drawing. When supplied, they shall be manufactured in accordance with AMS 7490.
- 3.2.2 Stock for Forging or Flash Welded Rings: As ordered by the forging or flash welded ring manufacturer.
- 3.3 Solution Heat Treatment: Bars, wire, forgings, mechanical tubing, and flash welded rings shall be solution heat treated by heating to $1900^{\circ}\text{F} \pm 25$ ($1040^{\circ}\text{C} \pm 15$), holding at heat for not less than 1 hr, and cooling rapidly.
- 3.4 Properties: The product shall conform to the following requirements; hardness and tensile testing shall be performed in accordance with ASTM A370:
- 3.4.1 Bars, Wire, Forgings, Mechanical Tubing, and Flash Welded Rings:
- 3.4.1.1 As Solution Treated:
- 3.4.1.1.1 Tensile Properties:
- 3.4.1.1.1.1 Bars, Forgings, Tubing, and Flash Welded Rings:
- | | |
|------------------------------------|-----------------------|
| Tensile Strength, min | 125,000 psi (862 MPa) |
| Yield Strength at 0.2% Offset, min | 95,000 psi (655 MPa) |
| Elongation in 4D, min | 10% |
| Reduction of Area, min | 40% |
- 3.4.1.1.1.2 Wire: Not higher than 165,000 psi (1138 MPa) or equivalent hardness.
- 3.4.1.1.2 Hardness:
- 3.4.1.1.2.1 Bars: Not higher than 311 HB or equivalent, determined midway between surface and center.
- 3.4.1.1.2.2 Tubing, Flash Welded Rings, and Forgings: Not higher than 311 HB or equivalent.
- 3.4.1.2 After Precipitation Heat Treatment: The solution heat treated product, precipitation heat treated to a particular condition by heating to the corresponding temperature shown in Table I, holding at heat for not less than 4 hr, and cooling in air, shall conform to the mechanical properties shown in Table II and Table III for that particular condition. Tensile and hardness tests shall be made in only one precipitation heat treated condition. Unless otherwise specified, the precipitation heat treated condition for acceptance testing as in 4.2.1 shall be H1050.

TABLE I

Condition	Temperature
H 900	$900^{\circ}\text{F} \pm 15$ ($482^{\circ}\text{C} \pm 8$)
H 950	$950^{\circ}\text{F} \pm 15$ ($510^{\circ}\text{C} \pm 8$)
H1000	$1000^{\circ}\text{F} \pm 15$ ($538^{\circ}\text{C} \pm 8$)
H1050	$1050^{\circ}\text{F} \pm 15$ ($565^{\circ}\text{C} \pm 8$)
H1100	$1100^{\circ}\text{F} \pm 15$ ($593^{\circ}\text{C} \pm 8$)
H1150	$1150^{\circ}\text{F} \pm 15$ ($620^{\circ}\text{C} \pm 8$)

- 3.4.1.2.1 **Tensile Properties:** The following properties apply to product up to 12.00 in. (304.8 mm), incl, in nominal diameter or distance between parallel sides; tensile property requirements for product over 12.00 in. (304.8 mm) in nominal diameter or distance between parallel sides shall be as agreed upon by purchaser and vendor.

TABLE II

Condition	Specimen Orientation	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation in 4D %, min	Reduction of Area %, min
H 900	Longitudinal	180,000	170,000	10	40
	Transverse	180,000	170,000	6	20
H 950	Longitudinal	170,000	160,000	10	40
	Transverse	170,000	160,000	7	22
H1000	Longitudinal	160,000	150,000	12	45
	Transverse	160,000	150,000	8	27
H1050	Longitudinal	145,000	135,000	12	45
	Transverse	145,000	135,000	9	30
H1100	Longitudinal	130,000	105,000	16	50
	Transverse	130,000	105,000	11	30
H1150	Longitudinal	125,000	75,000	18	55
	Transverse	125,000	75,000	12	35

TABLE II (SI)

Condition	Specimen Orientation	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, min	Elongation in 4D %, min	Reduction of Area %, min
H 900	Longitudinal	1241	1172	10	40
	Transverse	1241	1172	6	20
H 950	Longitudinal	1172	1103	10	40
	Transverse	1172	1103	7	22
H1000	Longitudinal	1103	1034	12	45
	Transverse	1103	1034	8	27
H1050	Longitudinal	1000	931	12	45
	Transverse	1000	931	9	30
H1100	Longitudinal	896	724	16	50
	Transverse	896	724	11	30
H1150	Longitudinal	862	517	18	55
	Transverse	862	517	12	55

- 3.4.1.2.1.1 Longitudinal test requirements apply to specimens taken in the longitudinal direction from bars and wire, to specimens taken from forgings with axis of specimen in the area of gage length within 15 deg of parallel to the forging flow lines, and to specimens taken in the circumferential direction from parent metal of flash welded rings; transverse tests requirements apply to all other specimens.
- 3.4.1.2.2 Hardness: Should be not lower than shown in Table III for the corresponding precipitation heat treatment condition but the product shall not be rejected on the basis of hardness if the tensile property requirements of Table II for that condition are met.

TABLE III

Condition	Hardness, Brinell min
H 900	363
H 950	341
H1000	331
H1050	321
H1100	285
H1150	262

- 3.4.2 Stock for Forging or Flash Welded Rings: When a sample of stock is forged to a test coupon and heat treated as in 3.3 and 3.4.1.2, specimens taken from the heat treated coupon shall conform to the requirements of 3.4.1.2.1 and 3.4.1.2.2. If specimens taken from the stock after heat treatment as in 3.3 and 3.4.1.2 conform to the requirements of 3.4.1.2.1 and 3.4.1.2.2, the tests shall be accepted as equivalent to tests of a forged coupon.

3.5 Quality:

- 3.5.1 Steel shall be premium aircraft-quality conforming to AMS 2300; it shall be multiple melted using consumable electrode practice in the remelt cycle.
- 3.5.2 The product, as received by purchaser, shall be uniform in quality and condition, 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, wire, and tubing 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 shall conform to all applicable requirements of the following:

3.7.1 Bars and Wire: AMS 2241.

3.7.2 Mechanical Tubing: AMS 2243.

4. QUALITY ASSURANCE PROVISIONS:

- 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 4.5. 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.