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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 5773D

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Superseding AMS 5773C

Steel, Corrosion Resistant, Bars, Wire, Forgings, Tubing, and Rings
15Cr - 6.5Ni - 0.75Mo - 0.30 (Cb + Ta) - 1.5Cu
Consumable Electrode Melted, Solution Heat Treated
Precipitation Hardenable

S45000

1. SCOPE:

1.1 Form:

This specification covers a premium aircraft-quality 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 18-8 type steels and high strength exceeding that of 12Cr martensitic type steels up to 700 °F (371 °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.

1.2.1 Although this steel is relatively immune to stress-corrosion cracking, reference should be made to ARP1110 for recommended practices to minimize such conditions.

1.3 Classification:

Steels covered by this specification are classified as follows:

Type 1 - Multiple melted using electroslag process in the remelt cycle.
Type 2 - Multiple melted using consumable electrode vacuum practice in the remelt cycle.

1.3.1 Type 1 shall be supplied unless Type 2 is permitted by purchaser.

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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 canceled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 2241	Tolerances, Corrosion and Heat Resistant Steel, Iron Alloy, Titanium, and Titanium Alloy Bars and Wire
MAM 2241	Tolerances, Metric, Corrosion and Heat Resistant Steel, Iron Alloy, Titanium, and Titanium Alloy Bars and Wire
AMS 2243	Tolerances, Corrosion and Heat Resistant Steel Tubing
MAM 2243	Tolerances, Metric, Corrosion and Heat Resistant Steel Tubing
AMS 2248	Chemical Check Analysis Limits, Corrosion and Heat Resistant Steels and Alloys, Maraging and Other Highly Alloyed Steels, and Iron Alloys
AMS 2300	Premium Aircraft-Quality Steel Cleanliness, Magnetic Particle Inspection Procedure
MAM 2300	Premium Aircraft-Quality Steel Cleanliness, Magnetic Particle Inspection Procedure, Metric (SI) Measurement
AMS 2371	Quality Assurance Sampling and Testing, Corrosion and Heat Resistant Steels and Alloys, Wrought Products and Forging Stock
AMS 2374	Quality Assurance Sampling and Testing, Corrosion and Heat Resistant Steel Forgings
AMS 2750	Pyrometry
AMS 2806	Identification, Bars, Wire, Mechanical Tubing, and Extrusions, Carbon and Alloy Steels and Corrosion and Heat Resistant Steels and Alloys
AMS 2808	Identification, Forgings
AMS 7490	Rings, Flash Welded, Corrosion and Heat Resistant Austenitic Steels and Austenitic-Type Iron, Nickel, or Cobalt Alloys, or Precipitation-Hardenable Alloys
AS1182	Standard Machining Allowance, Aircraft-Quality and Premium Aircraft-Quality Steel Bars and Mechanical Tubing
ARP1110	Minimizing Stress Corrosion Cracking in Wrought Forms of Steels and Corrosion Resistant Steels and Alloys

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM A 370	Mechanical Testing of Steel Products
ASTM A 604	Macroetch Testing of Consumable Electrode Remelted Steel Bars and Billets
ASTM E 353	Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys

3. TECHNICAL REQUIREMENTS:

3.1 Composition:

Shall conform to the percentages by weight shown in Table 1, determined by wet chemical methods in accordance with ASTM E 353, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

TABLE 1 - Composition

Element	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	8xC	--
Copper	1.25	1.75

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

3.2 Melting Practice:

Shall be multiple melted using either electroslag process or consumable electrode vacuum practice in the remelt cycle (See 1.3).

3.3 Condition:

The product shall be supplied in the following condition:

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

3.3.1.1 Bars:

3.3.1.1.1 Rounds: Centerless ground after solution heat treatment.

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

3.3.1.2 Wire: Cold drawn after solution heat treatment.

3.3.1.3 Mechanical Tubing: Cold finished and solution heat treated.

3.3.1.4 Flash Welded Rings: Shall not be supplied unless specified or permitted on purchaser's part drawing. When supplied, rings shall be manufactured in accordance with AMS 7490.

3.3.2 Stock for Forging or Flash Welded Rings: As ordered by the forging or flash welded ring manufacturer.

3.4 Solution Heat Treatment:

Bars, wire over 0.187 inch (4.8 mm) in nominal diameter, forgings, mechanical tubing, and flash welded rings shall be solution heat treated by heating to 1900 °F ± 25 (1038 °C ± 14), holding at heat for not less than one hour, and cooling rapidly. Pyrometry shall be in accordance with AMS 2750.

3.4.1 Wire 0.187 inch (4.8 mm) and under in nominal diameter shall be solution heat treated by heating to 1900 °F ± 25 (1038 °C ± 14), holding at heat for a time commensurate with the wire size, and cooling rapidly.

3.5 Properties:

The product shall conform to the following requirements; hardness and tensile testing shall be performed in accordance with ASTM A 370:

3.5.1 All Products:

3.5.1.1 Macrostructure: Visual examination of transverse sections from bars, billets, extrusions, and stock for forging or flash welded rings, etched in hot hydrochloric acid in accordance with ASTM A 604, shall show no pipe or cracks. Porosity, segregation, inclusions, and other imperfections for product 80 square inches (516 cm^2) and under in nominal cross-sectional area shall be no worse than the macrographs of ASTM A 604 shown in Table 2.

TABLE 2 - Macrostructure Limits

Class	Condition	Severity
1	Freckles	A
2	White Spots	A
3	Radial Segregation	B
4	Ring Pattern	B

3.5.2 Bars, Wire, Forgings, Mechanical Tubing, and Flash Welded Rings:

3.5.2.1 As Solution Treated:

3.5.2.1.1 Tensile Properties:

3.5.2.1.1.1 Bars, Forgings, Tubing, and Flash Welded Rings: Shall be as shown in Table 3.

TABLE 3 - Minimum Tensile Properties

Property	Value
Tensile Strength	125,000 psi (862 MPa)
Yield Strength at 0.2% Offset	95,000 psi (655 MPa)
Elongation in 4D	10%
Reduction of Area	40%

3.5.2.1.1.2 Wire: Not higher than 165,000 psi (1138 MPa), or equivalent hardness (See 8.2).

3.5.2.1.2 Hardness:

3.5.2.1.2.1 Bars: Not higher than 311 HB, or equivalent (See 8.3), determined midway between surface and center.

3.5.2.1.2.2 Tubing, Flash Welded Rings, and Forgings: Not higher than 311 HB, or equivalent (See 8.3).

3.5.2.2 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 4, holding at heat for not less than 4 hours, and cooling in air, shall have the mechanical properties shown in Table 5 and Table 6 for that particular condition. Tensile and hardness tests shall be made in only the H900 precipitation heat treated condition, unless a different condition for testing is specified by purchaser.

TABLE 4 - Precipitation Heat Treatment

Condition	Temperature
H 900	900 °F ± 15 (482 °C ± 8)
H 950	950 °F ± 15 (510 °C ± 8)
H1000	1000 °F ± 15 (538 °C ± 8)
H1050	1050 °F ± 15 (566 °C ± 8)
H1100	1100 °F ± 15 (593 °C ± 8)
H1150	1150 °F ± 15 (621 °C ± 8)

3.5.2.2.1 Tensile Properties: The following properties apply to product 12.0 inches (305 mm) and under, in nominal diameter or least distance between parallel sides.

TABLE 5A - Minimum Tensile Properties, Inch/Pound Units

Condition	Specimen Orientation	Tensile Strength psi	Yield Strength at 0.2% Offset psi	Elongation in 4D %	Reduction of Area %
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 5B - Minimum Tensile Properties, SI Units

Condition	Specimen Orientation	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 4D %	Reduction of Area %
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	35

3.5.2.2.1.1 Longitudinal tensile 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 degrees of parallel to the forging flow lines, and to specimens taken in the circumferential direction from parent metal of flash welded rings; transverse tensile requirements apply to all other specimens.

3.5.2.2.2 Hardness: Should be not lower than shown in Table 6 for the corresponding precipitation heat treatment condition. The product shall not be rejected on the basis of hardness if the tensile property requirements of Table 5 for that condition are acceptable, determined on specimens taken from the same sample as that with nonconforming hardness, or from another sample with similar nonconforming hardness.

TABLE 6 - Minimum Hardness

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

3.5.3 Forging Stock: When a sample of stock is forged to a test coupon and heat treated as in 3.4 and 3.5.2.2, specimens taken from the heat treated coupon shall conform to the requirements of 3.5.2.2.1 and 3.5.2.2.2. If specimens taken from the stock after heat treatment as in 3.3 and 3.5.2.2 conform to the requirements of 3.4.2.2.1 and 3.4.2.2.2, the tests shall be accepted as equivalent to tests of a forged coupon.

3.5.4 Stock for Flash Welded Rings: Specimens taken from the stock after heat treatment as in 3.4 and 3.5.2.2 shall conform to the requirements of 3.5.2.2.1 and 3.5.2.2.2.

3.6 Quality:

3.6.1 Steel shall be premium aircraft-quality conforming to AMS 2300 or MAM 2300.

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

3.6.3 Bars ordered hot rolled or cold drawn, or ground, turned, or polished, shall, after removal of the standard machining allowance in accordance with AS1182, be free from seams, laps, tears, and cracks open to the ground, turned, or polished surface.

3.6.4 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.

3.7 Tolerances:

Shall be as follows:

3.7.1 Bars and Wire: In accordance with AMS 2241 or MAM 2241.

3.7.2 Mechanical Tubing: In accordance with AMS 2243 or MAM 2243.