SAE The Engineering Society For Advancing Mobility Land Sea Air and Space®
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

AMS 5583B

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Superseding AMS 5583A

ALLOY TUBING, SEAMLESS, CORROSION AND HEAT RESISTANT
72Ni - 15.5Cr - 0.95(Cb + Ta) - 2.6Ti - 0.70Al - 7.0Fe
Solution Heat Treated

UNS N07750

1. SCOPE:

1.1 Form: This specification covers a corrosion and heat resistant nickel alloy in the form of seamless tubing.

1.2 Application: Primarily for fluid-conducting lines requiring high strength up to 1100°F (593°C) where parts may be formed, welded or brazed if required, and heat treated to improve strength at elevated temperatures.

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

2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2263 - Tolerances, Nickel, Nickel Alloy, and Cobalt Alloy Tubing
MAM 2263 - Tolerances, Metric, Nickel, Nickel Alloy, and Cobalt Alloy Tubing
AMS 2269 - Chemical Check Analysis Limits, Wrought Nickel Alloys and Cobalt 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 2750 - Pyrometry

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2.2 ASTM Publications: Available from ASTM, 1916 Race Street, Philadelphia, PA 19103.

ASTM E 8 - Tension Testing of Metallic Materials
ASTM E 8M - Tension Testing of Metallic Materials (Metric)
ASTM E 18 - Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials
ASTM E 112 - Determining Average Grain Size
ASTM E 354 - Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt 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 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, Ø determined by wet chemical methods in accordance with ASTM E 351, by spectrochemical methods, or by other analytical methods acceptable to purchaser:

	min	max
Carbon	--	0.08
Manganese	--	0.35
Silicon	--	0.35
Phosphorus	--	0.015
Sulfur	--	0.010
Chromium	14.00	17.00
Nickel + Cobalt	70.00	--
Columbium + Tantalum	0.70	1.20
Titanium	2.25	2.75
Aluminum	0.40	1.00
Iron	5.00	9.00
Cobalt	--	1.00
Copper	--	0.50

3.1.1 Check Analysis: Composition variations shall meet the requirements of AMS 2269.

3.2 Condition: Solution heat treated and descaled.

3.3 Heat Treatment: Tubing shall be solution heat treated by heating to a Ø temperature not lower than 1800°F (982°C), holding at the selected temperature within ±25°F (±14°C) for sufficient time to complete the reaction, and cooling at a rate equivalent to an air cool or faster. Pyrometry shall be in accordance with AMS 2750.

3.4 Properties: Tubing shall conform to the following requirements:

3.4.1 As Solution Heat Treated:

3.4.1.1 Tensile Properties: Shall be as follows, determined in accordance with ASTM E 8 or ASTM E 8M:

Tensile Strength, maximum	140,000 psi (965 MPa)
Yield Strength at 0.2% Offset, maximum	80,000 psi (552 MPa)
Elongation in 2 inches (50.8 mm), minimum	
Strip Specimen	30%
Full Tube	35%

3.4.1.2 Grain Size: Shall average 0.0025 inch (0.0635 mm) or smaller in diameter (Grain Size No. 5), determined by comparison of a polished and etched specimen with the chart in ASTM E 112.

3.4.1.3 Flarability: Specimens as in 4.3.1 from tubing 0.188 - 2.000 inches (4.78 - 50.80 mm), incl, in nominal OD shall withstand flaring at room temperature, without formation of cracks or other visible defects, by being forced axially with steady pressure over a hardened and polished tapered steel pin having a 74 degree included angle to produce a permanent expanded OD not less than 1.20 times the original nominal OD.

3.4.1.3.1 Flarability requirements for tubing over 2.000 inches (50.80 mm) or under 0.188 inch (4.78 mm) in nominal OD shall be as agreed upon by purchaser and vendor.

3.4.1.4 Pressure Test: Tubing shall show no bulges, leaks, pin holes, cracks, or other defects when subjected to an internal hydrostatic pressure (P) sufficient to cause a tensile stress of 20,000 psi (138 MPa) in the tubing wall. The hydrostatic pressure (P) shall be calculated from the equation:

$$P = S \frac{D^2 - d^2}{D^2 + d^2}$$

where,

P = Test pressure in psi (MPa)
S = 20,000 psi (138 MPa)
D = Nominal OD in inches (mm)
d = Nominal ID in inches (mm)

3.4.2 After Precipitation Heat Treatment: Tubing shall have the following properties after being precipitation heat treated by heating to 1350°F ± 25 (732°C ± 14), holding at heat for not less than 8 hours, cooling at a rate of 100 F (56 C) degrees per hour to 1150°F ± 25 (621°C ± 14), holding at 1150°F ± 25 (621°C ± 14) for 8 hours ± 0.5, and air cooling. Instead of the 100 F (56 C) degrees per hour cooling rate to 1150°F ± 25 (621°C ± 14), tubing may be furnace cooled at any rate provided the time at 1150°F ± 25 (621°C ± 14) is adjusted to give a total precipitation heat treatment time of not less than 18 hours.

3.4.2.1 Tensile Properties: Shall be as follows, determined in accordance with ASTM E 8 or ASTM E8 M:

Tensile Strength, minimum	170,000 psi (1172 MPa)
Yield Strength at 0.2% Offset, minimum	115,000 psi (793 MPa)
Elongation in 2 inches (50.8 mm), minimum	
Strip Specimen	12%
Full Tube	15%

3.4.2.2 Hardness: Should be not lower than 30 HRC, or equivalent, determined in accordance with ASTM E18 but tubing shall not be rejected on the basis of hardness if the tensile property requirements of 3.4.2.1 are met.

3.5 Quality:

3.5.1 Alloy shall be produced by multiple melting using consumable electrode practice in the remelt cycle. If consumable electrode remelting is not performed in vacuum, electrodes which have been produced by vacuum induction melting shall be used.

3.5.2 Tubing, as received by purchaser, shall be uniform in quality and condition and shall have a finish conforming to the best practice for high quality aircraft tubing. It shall be smooth and free from heavy scale or oxide, burrs, seams, tears, grooves, laminations, slivers, pits, and other imperfections detrimental to usage of the tubing. Surface imperfections such as handling marks, straightening marks, light mandrel and die marks, shallow pits, and scale pattern will not be considered injurious if the imperfections are removable within the tolerances specified for wall thickness but removal of such imperfections is not required.

3.6 Sizes: Except when exact lengths or multiples of exact lengths are ordered, tubing will be acceptable in mill lengths of 6 - 24 feet (1.8 - 7.3 m) but not more than 25% of any shipment shall be supplied in lengths of 6 - 9 feet (1.8 - 2.7 m).

3.7 Tolerances: Shall conform to all applicable requirements of AMS 2263 or MAM 2263.