

# AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

**AMS 5573H**

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Superseding AMS 5573G

## STEEL TUBING, SEAMLESS, CORROSION AND HEAT RESISTANT 17Cr - 12.5Ni - 2.5Mo (SAE 30316) Solution Heat Treated

UNS S31600

### 1. SCOPE:

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

1.2 Application: Primarily for parts requiring both corrosion and heat resistance up to 1600°F (871°C). At elevated temperatures, strength of this steel is slightly higher than, and oxidation resistance similar to, that of 18-8 type steels.

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 2243 - Tolerances, Corrosion and Heat Resistant Steel Tubing

MAM 2243 - Tolerances, Metric, Corrosion and Heat Resistant Steel Tubing

AMS 2248 - Chemical Check Analysis Limits, Wrought Corrosion and Heat Resistant Steels and Alloys, Maraging and Other Highly-Alloyed Steels, and Iron 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 2632 - Ultrasonic Inspection of Thin Materials, 0.5 Inch (13 mm) and Thinner

AMS 2645 - Fluorescent Penetrant Inspection

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

ASTM A262 - Detecting Susceptibility to Intergranular Attack in Stainless Steels

ASTM A370 - Mechanical Testing of Steel Products

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

ASTM E426 - Electromagnetic (Eddy-Current) Testing of Seamless and Welded Tubular Products, Austenitic Stainless Steel and Similar 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, determined by wet chemical methods in accordance with ASTM E353, by spectrochemical methods, or by other analytical methods acceptable to purchaser:

	min	max
Carbon	--	0.08
Manganese	1.25 -	2.00
Silicon	--	1.00
Phosphorus	--	0.04
Sulfur	--	0.03
Chromium	16.00 -	18.00
Nickel	10.00 -	14.00
Molybdenum	2.00 -	3.00
Copper	--	0.75

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

- 3.2 Condition: Solution heat treated free from continuous carbide network and descaled.

- 3.3 Fabrication: Tubing shall be produced by a seamless process. Any surface finishing operation applied to remove objectionable pits and surface blemishes shall be performed prior to final solution heat treatment. A light polish to improve surface appearance may be employed after solution heat treatment. Passivation treatment shall follow any polishing treatment.

3.4 Properties: The product shall conform to the following requirements; tensile testing shall be performed in accordance with ASTM A370:

3.4.1 Tensile Properties: Shall be as specified in Table I.

TABLE I

Nominal OD Inches	Nominal Wall Thickness Inch	Tensile Strength psi, max	Elongation in 2 Inches %, minimum	
			Strip	Full Tube
Up to 0.188, incl	Up to 0.016, incl	115,000	--	35
	Over 0.016	100,000	--	40
Over 0.188 to 0.500, incl	Up to 0.010, incl	110,000	32	37
	Over 0.010	100,000	35	40
Over 0.500	Up to 0.010, incl	100,000	27	32
	Over 0.010	100,000	30	35

TABLE I (SI)

Nominal OD Millimetres	Nominal Wall Thickness Millimetres	Tensile Strength MPa, max	Elongation in 50.8 mm %, minimum	
			Strip	Full Tube
Up to 4.78, incl	Up to 0.41, incl	793	--	35
	Over 0.41	689	--	40
Over 4.78 to 12.70, incl	Up to 0.25, incl	758	32	37
	Over 0.25	689	35	40
Over 12.70	Up to 0.25, incl	689	27	32
	Over 0.25	689	30	35

- 3.4.2 Flarability: Specimens as in 4.3.1 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 flare having a permanent expanded OD not less than specified in Table II.

TABLE II

Nominal OD Inches	Expanded OD Inches	Nominal OD Inches	Expanded OD Inches
0.125	0.200	0.750	0.937
0.188	0.302	1.000	1.187
0.250	0.359	1.250	1.500
0.312	0.421	1.500	1.721
0.375	0.484	1.750	2.106
0.500	0.656	2.000	2.356
0.625	0.781		

TABLE II (SI)

Nominal OD Millimetres	Expanded OD Millimetres	Nominal OD Millimetres	Expanded OD Millimetres
3.18	5.08	19.05	23.80
4.78	7.67	25.40	30.15
6.35	9.12	31.75	38.10
7.92	10.69	38.10	43.71
9.52	12.29	44.45	53.49
12.70	16.66	50.80	59.84
15.88	19.84		

- 3.4.2.1 Tubing with nominal OD between any two standard sizes given in 3.4.2 shall take the same percentage flare as that for the larger of the two sizes.
- 3.4.2.2 Flarability requirements for tubing over 2.000 inches (50.80 mm) or under 0.125 inch (3.18 mm) in nominal OD shall be as agreed upon by purchaser and vendor.
- 3.4.3 Susceptibility to Intergranular Attack: The product shall pass the  
 Ø intergranular corrosion acid test performed in accordance with ASTM A262, Practice E.
- 3.5 Quality: 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.

- 3.5.1 Tubing shall be free from grease or other foreign matters. Metallic flakes or particles shall not be collected by a clean white cloth when it is drawn through the length of the bore of a sample tube. Discoloration of the cloth, without the presence of flakes or particles, is acceptable.
- 3.5.2 When specified by purchaser, tubing shall be subjected to fluorescent penetrant inspection in accordance with AMS 2645, to ultrasonic inspection in accordance with AMS 2632, to electromagnetic (Eddy-Current) testing in accordance with ASTM E426, or to any combination thereof. Standards for acceptance shall be as agreed upon by purchaser and vendor.
- 3.6 Sizes: Except when exact lengths or multiples of exact lengths are ordered, straight tubing will be acceptable in mill lengths of 6 - 20 feet (1.8 - 6.1 m) but not more than 10% of any shipment shall be supplied in lengths shorter than 10 feet (3 m).
- 3.7 Tolerances: Shall conform to all applicable requirements of AMS 2243 or MAM 2243.
4. QUALITY ASSURANCE PROVISIONS:
- 4.1 Responsibility for Inspection: The vendor of tubing 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 4.4. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the tubing conforms to the requirements of this specification.
- 4.2 Classification of Tests:
- 4.2.1 Acceptance Tests: Tests to determine conformance to requirements for composition (3.1), tensile properties (3.4.1), susceptibility to intergranular attack (3.4.3), cleanliness of tubing (3.5.1), nondestructive inspection when specified (3.5.2), and tolerances (3.7) are classified as acceptance tests and shall be performed on each heat or lot as applicable.
- 4.2.2 Periodic Tests: Tests to determine conformance to requirements for flarability (3.4.2) are classified as periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.
- 4.3 Sampling: Shall be in accordance with AMS 2371 and the following:
- 4.3.1 Specimens for flarability test shall be full tubes or sections cut from a tube. The end of the specimen to be flared shall be cut square, with the cut end smooth and free from burrs, but not rounded.