

AEROSPACE MATERIAL SPECIFICATION

AMS 5579D

Issued JUL 1961
Revised JAN 1987
Noncurrent JUL 1992
Reaf. Noncur. NOV 2000
Cancelled APR 2007

Superseding AMS 5579C

Steel, Corrosion and Heat Resistant, Tubing Welded
19.5Cr - 9.5Ni - 1.4Mo - 1.4W - 0.42(Cb + Ta) - 0.22Ti
Thin Wall

(Composition similar to UNS S63198)

RATIONALE

AMS 5579C has been cancelled because survey of aerospace users and producers indicated that this product is not produced to this specification.

CANCELLATION NOTICE

This specification has been declared "CANCELLED" by the Aerospace Materials Division, SAE, as of April, 2007. By this action, this document will remain listed in the Numerical Section of the Index of Aerospace Material Specifications, indicating that it has been "CANCELLED".

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Steel, Corrosion and Heat Resistant, Tubing Welded
19.5Cr - 9.5Ni - 1.4Mo - 1.4W - 0.42(Cb + Ta) - 0.22Ti
Thin Wall

UNS S63198

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1. SCOPE:

1.1 Form:

This specification covers a corrosion and heat resistant steel in the form of welded tubing.

1.2 Application:

Primarily for high-pressure air ducting requiring both corrosion and heat resistance wherein the wall thickness is approximately 2% of the nominal OD or less.

2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications 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 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 2635	Radiographic Inspection

2.2 ASTM Publications:

Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia PA 19103.

ASTM A262	Detecting Susceptibility to Intergranular Attack in Austenitic 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

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 or by spectrographic or other analytical methods approved by purchaser:

	min	max
Carbon	0.28	0.35
Manganese	0.75	1.50
Silicon	0.30	0.80
Phosphorus	--	0.040
Sulfur	--	0.030
Chromium	18.00	21.00
Nickel	8.00	11.00
Molybdenum	1.00	1.75
Tungsten	1.00	1.75
Columbium + Tantalum	0.25	0.60
Titanium	0.10	0.35
Copper	--	0.50

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

3.2 Condition:

As welded, descaled, and passivated. Tubing shall have been rolled only enough to ensure proper weld bead height and roundness in the weld bead area.

3.3 Fabrication:

Tubing shall be fabricated from solution heat treated sheet or strip, shall be machine fusion welded by gas-metal-arc process, shall contain not more than one longitudinal weld, and shall contain no circumferential welds. Tube ends shall be cut square and deburred. Tubing, except for the weld bead, shall have a surface appearance comparable to a commercial corrosion-resistant steel No. 2D sheet finish.

3.4 Properties:

Tubing shall conform to the following requirements; tensile and bend testing shall be performed in accordance with ASTM A370:

3.4.1 Tensile Properties: Shall be as follows:

Tensile Strength	95,000 - 125,000 psi (655 - 860 MPa)
Yield Strength at 0.2% Offset, min	45,000 psi (310 MPa)
Elongation in 2 in. (50 mm), min	
Strip (See 4.3.1)	30%
Full Section	35%

3.4.2 Bending: A specimen as in 4.3.2 shall withstand, without evidence of cracks or other imperfections when examined at 10X magnification, bending at room temperature 180 deg around a diameter equal to two times the nominal wall thickness of the tubing with axis of bend perpendicular to axis of weld and with outside of tube on inside of bend.

3.4.3 Weld Crack Susceptibility: A specimen as in 4.3.3 shall withstand, without evidence of cracks occurring in, or adjacent to, the weld bead when examined at 10X magnification, being pulled parallel to the direction of the weld bead until rupture occurs.

3.4.4 Embrittlement: Specimens of tubing taken to include the weld, after sensitization treatment, shall pass the copper/copper sulfate/sulfuric acid test performed in accordance with ASTM A262, Practice E, without evidence of intercrystalline surface attack. After exposure, specimens shall withstand, without cracking, bending at room temperature through an angle of 180 deg around a diameter equal to two times the nominal thickness of the specimen with axis of bend perpendicular to the axis of the tubing.

3.4.5 Pressure Test: After all fabricating and sizing operations, each length of tubing shall withstand for 1 min., without leakage or developing bulges, permanent set, or other imperfections which exceed the allowable tolerances for the finished tubing, a gradually applied internal hydrostatic pressure (P), calculated from the following equation:

$$P = \frac{2St}{D}$$

where,

P = Test pressure in psi (MPa)

S = 20,000 psi (140 MPa) tensile stress

t = Nominal wall thickness

D = Nominal OD

3.4.6 Weld Strength: Shall be as follows, determined in accordance with 3.4.6.1 or 3.4.6.2.

3.4.6.1 Hydrostatic Pressure Tests: A specimen as in 4.3.4 shall withstand an internal hydrostatic pressure of 95,000 psi (655 MPa) for not less than 60 sec without rupture. Hydrostatic pressure (P) shall be calculated from the equation of 3.4.5 and shall be applied gradually in 30 - 60 sec at not lower than 60°F (15°C).

3.4.6.2 Tensile Strength: Shall be not lower than 95,000 psi (655 MPa), determined on specimens as in 4.3.5.

3.5 Quality:

3.5.1 Tubing, as received by purchaser, shall be uniform in contour, quality, and condition and shall have a finish conforming to the best practice for high quality aircraft tubing. It shall be clean, sound, and free from grease, oil, and other foreign matter. It shall be free from burrs, cracks, tears, grooves, seams, laminations, dents, crimps, and other imperfections detrimental to usage of the tubing.

3.5.2 The weld in each length of tubing shall, prior to rolling, be subjected to radiographic inspection in accordance with AMS 2635 and shall conform to acceptance standards agreed upon by purchaser and vendor to guarantee against the shipment of tubing with any of the following imperfections in or adjacent to the weld: porosity, pinholes, entrapped slag, cracks, mismatches, lack of fusion, undercutting, or other imperfections which cause sharp notches or a reduction of thickness greater than 10% of parent metal wall thickness.

3.5.2.1 Metal thinning in, or adjacent to, the weld shall be permissible if not greater than 10% of parent metal wall thickness provided also that it presents only gradual transitions.

3.5.2.2 Individual lengths of tubing which contain no weld imperfections other than metal thinning in excess of 10% of parent metal wall thickness may be reinspected radiographically after rolling. If rolling has reduced the metal thinning to less than 10% of parent metal wall thickness, the thinning indicated by the first radiograph will not be cause for rejection.

3.5.2.3 Each length of tubing in a shipment shall be accompanied by its radiographs.

3.5.3 Mechanical imperfections, such as light handling marks and light tool marks, are acceptable provided they have not dented the wall of the tube and are gradual in contour to a maximum depth of 10% of parent metal wall thickness.

3.5.4 The weld flash shall not extend in height beyond the contour of the adjacent metal more than 0.0025 in. (0.062 mm) on either outside or inside of the tubing and the sum of both outside and inside weld flash heights shall not exceed 0.004 in. (0.10 mm).

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 ft (2 - 6 m) but not more than 10% of any shipment shall be supplied in lengths shorter than 10 ft (3 m).

3.7 Tolerances:

Shall be as follows:

3.7.1 Diameter:

TABLE I

Nominal OD Inches	Tolerance, Inch Minus Only
1.000 to 2.500, incl	0.005
Over 2.500 to 3.500, incl	0.007
Over 3.500 to 4.500, incl	0.009
Over 4.500 to 7.000, incl	0.012

TABLE I (SI)

Nominal OD Millimetres	Tolerance, Millimetre Minus Only
25.00 to 62.50, incl	0.12
Over 62.50 to 87.50, incl	0.18
Over 87.50 to 112.50, incl	0.22
Over 112.50 to 175.00, incl	0.30

3.7.1.1 Outside diameter shall be measured using a periphery or PI tape.

3.7.2 Wall Thickness:

TABLE II

Nominal Wall Thickness Inch	Tolerance, Inch Plus and Minus
0.010 to 0.016, incl	0.002
Over 0.016 to 0.026, incl	0.003
Over 0.026 to 0.040, incl	0.004
Over 0.040 to 0.058, incl	0.005
Over 0.058 to 0.072, incl	0.006

TABLE II (SI)

Nominal Wall Thickness Millimetres	Tolerance, Millimetre Plus and Minus
0.25 to 0.40, incl	0.05
Over 0.40 to 0.65, incl	0.08
Over 0.65 to 1.00, incl	0.10
Over 1.00 to 1.45, incl	0.12
Over 1.45 to 1.80, incl	0.15

- 3.7.3 Ovality: For tubing having nominal wall thickness of 0.040 in. (1.00 mm) and under, ovality shall not exceed 6% of the nominal OD. For tubing having nominal wall thickness over 0.040 in. (1.00 mm), tolerances in Table III shall apply.

TABLE III

Nominal OD		Tolerance % of OD
Inches	Millimetres	
1.000 to 1.250, incl	25.00 to 31.25, incl	5.0
Over 1.250 to 1.500, incl	Over 31.25 to 37.50, incl	4.0
Over 1.500 to 1.750, incl	Over 37.50 to 43.75, incl	3.5
Over 1.750 to 2.000, incl	Over 43.75 to 50.00, incl	3.0
Over 2.000 to 2.500, incl	Over 50.00 to 62.50, incl	2.5
Over 2.500 to 7.000, incl	Over 62.50 to 125.00, incl	2.0

- 3.7.3.1 Ovality is obtained by dividing the difference between the maximum and minimum OD of any one station along the tube by the nominal OD and multiplying by 100.
- 3.7.4 Length: Cut-to-length tubing shall not vary from the length ordered by more than +1/8 in. (+3 mm), -0.
- 3.7.5 Straightness: When measured using a 3-ft (900-mm) straight edge touching the tube at two points, the perpendicular distance from the straight edge to the tube at any point between the two points of contact, shall not exceed $0.030 \times L/3$ in., where "L" is the distance in feet between points of contact or shall not exceed $0.83 \times L$ mm, where "L" is the distance in metres between points of contact.