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400 COMMONWEALTH DRIVE WARRENDALE PA 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 5585C
Superseding AMS 5585B

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ALLOY TUBING, WELDED, CORROSION AND HEAT RESISTANT
32Fe - 21Cr - 20Ni - 20Co - 3Mo - 2.5W - 1.0(Cb + Ta) - 0.15N
Solution Heat Treated UNS R30155

1. SCOPE:

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

1.2 Application: Primarily for parts requiring high strength up to 1500°F (815°C) and oxidation resistance up to 1800°F (980°C).

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 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

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

ASTM E8 - Tension Testing of Metallic Materials
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 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:

	min	max
Carbon	0.08	0.16
Manganese	1.00	2.00
Silicon	--	1.00
Phosphorus	--	0.030
Sulfur	--	0.030
Chromium	20.00	22.50
Nickel	19.00	21.00
Cobalt	18.50	21.00
Molybdenum	2.50	3.50
Tungsten	2.00	3.00
Columbium + Tantalum	0.75	1.25
Nitrogen	0.10	0.20
Copper	--	0.50
Iron	remainder	

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

3.2 Condition: Solution heat treated and descaled.

3.3 Fabrication: Tubing shall be produced by a welded and drawn 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 shall follow any polishing treatment.

3.4 Solution Heat Treatment: Tubing shall be solution heat treated by heating to 2150°F ± 25 (1175°C ± 15) in a suitable protective atmosphere, holding at heat for not less than 15 min., and cooling in air.

3.5 Properties: Tubing shall conform to the following requirements:

3.5.1 Tensile Properties: Shall be as follows, determined in accordance with ASTM E8:

Tensile Strength	100,000 - 140,000 psi (690 - 965 MPa)
Elongation in 2 in. (50 mm)	
Strip	35%
Full Section, tubing OD 0.625 in. (15.75 mm) and over	40%
Full Section, tubing OD under 0.625 in. (15.75 mm)	30%

3.5.2 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 deg included angle, to produce a flare having a permanent expanded OD not less than specified in Table I.

TABLE I

Nominal OD Inches	Expanded OD Inches	Nominal OD Inches	Expanded OD Inches
0.188	0.290	0.750	0.937
0.250	0.359	1.000	1.187
0.312	0.421	1.250	1.500
0.375	0.484	1.500	1.721
0.500	0.656	1.750	2.106
0.625	0.781	2.000	2.356

TABLE I (SI)

Nominal OD Millimetres	Expanded OD Millimetres	Nominal OD Millimetres	Expanded OD Millimetres
4.75	7.25	18.75	23.42
6.25	8.98	25.00	29.68
7.75	10.52	31.25	37.50
9.50	12.13	37.50	43.00
12.50	16.40	43.75	52.65
15.50	19.50	50.00	58.90

3.5.2.1 Tubing with nominal OD between any two standard sizes given in 3.5.2 shall take the same percentage flare as shown for the larger of the two sizes.

3.5.2.2 Flarability requirements for tubing over 2.000 in. (50.00 mm) or under 0.188 in. (4.75 mm) in nominal OD shall be as agreed upon by purchaser and vendor.

3.5.3 Pressure Testing: Tubing shall show no bulges, leaks, pin holes, cracks, ø or other defects when subjected to an internal hydrostatic pressure (P), based on nominal dimensions, sufficient to cause a tensile stress of 20,000 psi (140 MPa) in the tubing wall. The hydrostatic pressure (P) shall be calculated from the equation:

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

where, S = 20,000 psi (140 MPa) tensile stress
T = Minimum wall thickness (nominal thickness minus maximum negative tolerance)
D = Nominal OD

3.6 Quality:

3.6.1 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 ø 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.

3.6.2 If beads are present at the welds on the inner surface of the tubing, such beads shall be not thicker than 0.010 in. (0.25 mm), unless otherwise specified. The outer surfaces of the tubing shall be free from beads.

3.7 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).

3.8 Tolerances: Unless otherwise specified, 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 Ø 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 Ø composition (3.1), tensile properties (3.5.1), pressure test (3.5.3), quality (3.6), and tolerances (3.8) are classified as acceptance tests and shall be performed on such heat or lot as applicable.

4.2.2 Periodic Tests: Tests to determine conformance to requirements for Ø flarability (3.5.2) 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 the following; a lot shall be all Ø tubing of the same shape and nominal dimensions from a single heat of alloy, solution heat treated as a batch or sequentially heat treated in a continuous furnace, and presented for vendor's inspection at one time:

4.3.1 Composition and Tensile Properties: AMS 2371.

4.3.2 Flarability: As agreed upon by purchaser and vendor. Ø

4.3.2.1 Specimens for flarability test shall be full tubes or sections cut from tubes. The end of the specimen to be flared shall be cut square, with the cut end smooth and free from burrs, but not rounded.

4.3.3 Pressure Test: Three samples from each lot. Ø