Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 5578A
Superseding AMS 5578
Issued 11-1-69
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UNS S45500

STEEL TUBING, WELDED, CORROSION AND MODERATE HEAT RESISTANT
12Cr - 8.5Ni - 0.30(Cb+Ta) - 1.1Ti - 2.0Cu
Vacuum Induction Plus Vacuum Consumable Electrode Melted
Solution Heat Treated

1. SCOPE:

1.1 Form: This specification covers a premium-quality, precipitation-hardenable, corrosion and moderate heat resistant steel in the form of welded tubing.

1.2 Application: Primarily for parts requiring corrosion resistance and high strength up to 800° F (425° C) after precipitation heat treatment.

1.2.1 Certain design and processing procedures may cause this tubing to be susceptible to stress-corrosion cracking after precipitation heat treatment; ARP 1110 recommends practices to minimize such conditions.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications (AMS) and Aerospace Recommended Practices (ARP) shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2243 - Tolerances, Corrosion and Heat Resistant Steel Tubing
AMS 2248 - Chemical Check Analysis Limits, Wrought Heat and Corrosion Resistant Steels and Alloys
AMS 2350 - Standards and Test Methods
AMS 2371 - Quality Assurance Sampling of Corrosion and Heat Resistant Alloys, Wrought Products Except Forgings

2.1.2 Aerospace Recommended Practices:

ARP 1110 - Minimizing Stress Corrosion Cracking in Heat Treatable Wrought Low Alloy and Martensitic Corrosion Resistant Steels

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

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 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	--	0.05
Manganese	--	0.50
Silicon	--	0.50
Phosphorus	--	0.015
Sulfur	--	0.015
Chromium	11.00	12.50
Nickel	7.50	9.50
Columbium + Tantalum	0.10	0.50
Titanium	0.80	1.40
Copper	1.50	2.50
Molybdenum	--	0.50

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 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 Solution Heat Treatment: Tubing shall be solution heat treated by heating to 1525° F ± 25 (830° C ± 15), holding at heat for a time commensurate with wall thickness and heating equipment and procedure used but not less than 5 min., and quenching in water.

3.5 Properties: Tubing shall conform to the following requirements; hardness and tensile testing shall be performed in accordance with ASTM A370.

3.5.1 As Solution Heat Treated:

3.5.1.1 Tensile Strength: Shall be not higher than 165,000 psi (1138 MPa).

3.5.1.2 Pressure Testing: Tubing shall show no bulges, leaks, or other defects when subjected to an internal hydrostatic pressure, based on nominal dimensions, sufficient to cause a tensile stress of 20,000 psi (138 MPa) in the tubing wall.

3.5.2 After Precipitation Heat Treatment: Tubing shall meet the requirements of 3.5.2.1 and 3.5.2.2 after being precipitation heat treated by heating to 950° F ± 10 (510° C ± 5), holding at heat for 4 hr ± 0.25, and cooling in air to room temperature.

3.5.2.1 Tensile Properties:

Tensile Strength, min	220,000 psi (1517 MPa)
Yield Strength at 0.2% Offset, min	205,000 psi (1413 MPa)
Elongation in 2 in. (50 mm), min	

Nominal Wall Thickness		
Inch	(Millimetres)	
Up to 0.020, excl	(Up to 0.51, excl)	As agreed upon
0.020 to 0.062, incl	(0.51 to 1.57, incl)	4%
Over 0.062	(Over 1.57)	3%

3.5.2.2 Hardness: Should be not lower than 42 HRC or equivalent but tubing shall not be rejected on the basis of hardness if the tensile property requirements of 3.5.2.1 are met.

3.5.3 Other Precipitation Heat Treatment: Properties after precipitation heat treatment at temperatures other than 950° F ± 10 (510° C ± 5) shall be as agreed upon by purchaser and vendor.

3.6 QUALITY:

3.6.1 Steel shall be multiple melted using vacuum induction melting followed by vacuum consumable electrode melting.

3.6.2 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 tubing. It shall be smooth and free from heavy scale or oxide, burrs, seams, tears, grooves, laminations, slivers, pits, and other injurious conditions. 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 surface imperfections is not required.

3.6.3 If weld flash is present at the welds on the inner surface of the tubing, such flash shall be not thicker than 0.010 in. (0.25 mm), unless otherwise specified. The outer surface of the tubing shall be free from weld flash.

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 (1.8 - 6.1 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.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsiblity for Inspection: The vendor of tubing shall supply all samples 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 perform such confirmatory testing as he deems 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), Ø tensile properties (3.5.1.1 and 3.5.2.1), hardness (3.5.2.2), quality (3.6), and tolerances (3.8) are classified as acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Tests of tubing as solution heat treated to determine conformance to require- Ø ments for pressure test (3.5.1.2) are classified as periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

Ø 4.3 Sampling: Shall be in accordance with AMS 2371.

4.4 Reports:

4.4.1 The vendor of tubing shall furnish with each shipment three copies of a report showing the Ø results of tests for chemical composition of each heat and for tensile properties and hardness of each size from each heat. This report shall include the purchase order number, heat number, material specification number and its revision letter, size, and quantity from each heat.

4.4.2 The vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, material specification number and its revision letter, contractor or other direct supplier of tubing, part number, and quantity. When tubing for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of tubing to determine conformance to the requirements of this specification, and shall include in the report a statement that the tubing conforms, or shall include copies of laboratory reports showing the results of tests to determine conformance.

Ø 4.5 Resampling and Retesting: Shall be in accordance with AMS 2371.

5. PREPARATION FOR DELIVERY:

5.1 Identification: Tubing shall be identified as follows:

5.1.1 Straight Tubes 0.029 In. (0.74 mm) and Over in Nominal Wall Thickness and 0.500 In. (12.70 mm) and Over in Nominal OD, Minor Axis, or Least Width of Flat Surface: Shall be marked in a row of characters recurring at intervals not greater than 3 ft (914 mm) with AMS 5578A, heat number, manufacturer's identification, and nominal wall thickness. The characters shall be of such size as to be clearly legible, shall be applied using a suitable marking fluid, and shall be removable in hot alkaline cleaning solution without rubbing. The markings shall have no deleterious effect on the tubing or its performance and shall be sufficiently stable to withstand normal handling.

5.1.2 Straight Tubes Under 0.029 In. (0.74 mm) in Nominal Wall Thickness or Under 0.500 In. (12.70 mm) in Nominal OD, Minor Axis, or Least Width of Flat Surface: Shall be securely Ø bundled and identified by a durable tag marked with the information of 5.1.1 and the nominal OD and attached to each bundle or shall be boxed and the box marked with the same information.

5.1.3 Coiled Tubing: Shall be securely bundled and identified by a durable tag marked with the purchase Ø order number, AMS 5578A, heat number, nominal OD and wall thickness, and manufacturer's identification and attached to each coil or shall be boxed and the box marked with the same information.