ADOPTION NOTICE

SAE-AMS5578, "STEEL, CORROSION AND HEAT RESISTANT, WELDING TUBING 12CR - 8.5NI - 0.30 CB - 1.1TI - 2.0 CU VACUUM INDUCTION PLUS CONSUMABLE ELECTRODE VACUUM MELTED SOLUTION HEAT TREATED, PRECIPITATION HARDENABLE", was adopted on 20-DEC-91 for use by the Department of Defense (DoD). Proposed changes by DoD activities must be submitted to the DoD Adopting Activity: ASC/ENOI, Building 560, 2530 Loop Road West, Wright-Patterson AFB, OH 45433-7101. Copies of this document may be purchased from the Society of Automotive Engineers 400 Commonwealth Drive Warrendale, Pennsylvania, United States, 15096-0001. http://www.sae.org/

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AEROSPACE MATERIAL SPECIFICATION

SAE AMS 5578D

Issued NOV 1969
Revised MAY 1995

Superseding AMS 5578C

Submitted for recognition as an American National Standard

Steel, Corrosion and Heat Resistant, Welded Tubing
12Cr - 8.5Ni - 0.30Cb - 1.1Ti - 2.0Cu
Vacuum Induction Plus Consumable Electrode Vacuum Melted
Solution Heat Treated, Precipitation Hardenable

UNS S45500

1. SCOPE:

1.1 Form:

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

1.2 Application:

This tubing has been used typically for parts requiring corrosion resistance and high strength up to 800 °F (427 °C) after precipitation heat treatment, but usage is not limited to such applications.

1.2.1 Certain design and processing procedures may cause this tubing to become susceptible to stress-corrosion cracking after precipitation heat treatment; ARP1110 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 SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

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

QUESTIONS REGARDING THIS DOCUMENT: (724) 772-7154 FAX: (724) 776-0243
TO PLACE A DOCUMENT ORDER: (724) 776-4970 FAX: (724) 776-0790
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2.1 (Continued):

AMS 2300	Premium Aircraft-Quality Steel Cleanliness, Magnetic Particle Inspection Procedure
MAM 2300	Premium Aircraft-Quality Steel Cleanliness, Magnetic Particle Inspection Procedure, Metric (SI) Measurement
AMS 2371	Quality Assurance Sampling and Testing, Corrosion and Heat Resistant Steels and Alloys, Wrought Products and Forging Stock
AMS 2632	Ultrasonic Inspection of Thin Materials, 0.5 inch (13 mm) and Thinner
AMS 2645	Fluorescent Penetrant Inspection
AMS 2750	Pyrometry
AMS 2807	Identification, Carbon and Low-Alloy Steels, Corrosion and Heat Resistant Steels and Alloys, Sheet, Strip, Plate, and Aircraft Tubing
ARP1110	Minimizing Stress Corrosion Cracking in Wrought Forms of Steels and Corrosion Resistant Steels and Alloys

2.2 ASTM Publications:

Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM A 370	Mechanical Testing of Steel Products
ASTM E 353	Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys
ASTM E 426	Electromagnetic (Eddy-Current) Testing of Seamless and Welded Tubular Products, Austenitic Stainless Steel and Similar Alloys

2.3 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-STD-163 Steel Mill Products, Preparation for Shipment and Storage

3. TECHNICAL REQUIREMENTS:

3.1 Composition:

Shall conform to the percentages by weight shown in Table 1, determined by wet chemical methods in accordance with ASTM E 353, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

TABLE 1 - Composition

Element	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	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 Melting Practice:

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

3.3 Condition:

Solution heat treated and pickled as required or passivated.

3.4 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.

3.4.1 Tubing shall be cold reduced after welding to remove any dimensional indication of the presence of the weld.

3.5 Solution Heat Treatment:

Tubing shall be solution heat treated by heating to 1525 °F ± 25 (829 °C ± 14), holding at heat for a time commensurate with wall thickness and heating equipment and procedure used but not less than 5 minutes, and quenching in water. Pyrometry shall be in accordance with AMS 2750.

3.6 Properties:

Tubing shall conform to the following requirements; hardness and tensile testing shall be performed in accordance with ASTM A 370.

3.6.1 As Solution Heat Treated:

3.6.1.1 Tensile Strength: Shall be not higher than 165 ksi (1138 MPa).

3.6.2 After Precipitation Heat Treatment: Tubing shall meet the requirements of 3.6.2.1 and 3.6.2.2 after being precipitation heat treated by heating to 950 °F ± 10 (510 °C ± 6), holding at heat for 4 hours ± 0.25, and cooling in air to room temperature.

3.6.2.1 Tensile Properties: Shall be as shown in Table 2.

TABLE 2A - Minimum Tensile Properties, Inch/Pound Units

Nominal Wall Thickness Inch	Tensile Strength ksi	Yield Strength at 0.2% Offset ksi	Elongation %
Up to 0.020, excl	220	205	--
0.020 to 0.062, incl	220	205	4
Over 0.062	220	205	3

TABLE 2B - Minimum Tensile Properties, SI Units

Nominal Wall Thickness Millimeters	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation %
Up to 0.51, excl	1517	1413	--
0.51 to 1.57, incl	1517	1413	4
Over 1.57	1517	1413	3

3.6.2.2 Hardness: Shall be not lower than 42 HRC, or equivalent (See 8.2).

3.6.3 Other Precipitation Heat Treatment: Properties after precipitation heat treatment at temperatures other than 950 °F ± 10 (510 °C ± 6) shall be as agreed upon by purchaser and vendor.

3.7 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, 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.

3.7.1 Steel shall be premium aircraft-quality conforming to AMS 2300 or MAM 2300.

3.7.2 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) inspection in accordance with ASTM E 426, or to any combination thereof. Tubing shall meet the requirements of 3.7 and other acceptance criteria established by the cognizant engineering organization.

3.8 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. 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:

All technical requirements are acceptance tests and shall be performed on each heat or lot as applicable.

4.3 Sampling and Testing:

Shall be in accordance with AMS 2371.

4.4 Reports:

The vendor of tubing shall furnish with each shipment a report showing the results of tests for chemical composition and frequency-severity cleanliness rating of each heat and the results of tests on each lot to determine conformance to the other acceptance test requirements. This report shall include the purchase order number, heat and lot number, AMS 5578D, size, and quantity.