



AEROSPACE MATERIAL SPECIFICATION

AMS5591™**REV. M**

Issued 1945-10
Reaffirmed 2012-10
Revised 2024-06

Superseding AMS5591L

(R) Steel, Corrosion- and Heat-Resistant, Tubing, Seamless,
12.5Cr, (410),
Annealed
(Composition similar to UNS S41000)

RATIONALE

AMS5591M is the result of a Five-Year Review and update of the specification. The revision incorporates multiple updates consistent with other tubing specifications, including updates to definitions (see 2.3.1), additions to composition requirements (see 3.1.1), changes and additions to condition and fabrication requirements (see 3.2 and 3.3) which includes addition of passivation requirements, adds pyrometry controls (see 3.4.1.1), updates ndt methods (see 3.5.3), clarifies tolerance and identification requirements (see 3.6 and 5.2), updates cleanliness and NDT requirements (see 3.5.1, 3.5.2, 4.2.1, 4.2.1.1, 4.3.2, and 4.4), and revises the prohibition on unauthorized exceptions (see 4.4.1 and 8.5).

1. SCOPE

1.1 Form

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

1.2 Application

This tubing has been used typically for parts requiring corrosion resistance and oxidation resistance up to 1000 °F (538 °C) but useful at the higher temperatures only when stresses are low, 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 heat treatment; ARP1110 recommends practices to minimize such conditions.

2. APPLICABLE DOCUMENTS

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

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Full document details: SAE AMS5591M

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Documents

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2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS2243	Tolerances, Corrosion and Heat-Resistant Steel Tubing
AMS2248	Chemical Check Analysis Limits, Corrosion- and Heat-Resistant Steels and Alloys, Maraging and Other Highly Alloyed Steels, and Iron Alloys
AMS2371	Quality Assurance Sampling and Testing, Corrosion and Heat-Resistant Steels and Alloys, Wrought Products and Forging Stock
AMS2634	Ultrasonic Inspection, Thin Wall Metal Tubing
AMS2700	Passivation of Corrosion Resistant Steels
AMS2750	Pyrometry
AMS2807	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
AS7766	Terms Used in Aerospace Metals Specifications

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM A1016/A1016M	Ferritic Alloy Steel, Austenitic Alloy Steel, and Stainless Steel Tubes
ASTM A370	Mechanical Testing of Steel Products
ASTM A751	Chemical Analysis of Steel Products
ASTM E426	Electromagnetic (Eddy-Current) Examination of Seamless and Welded Tubular Products, Austenitic Stainless Steel and Similar Alloys
ASTM E1417/E1417M	Liquid Penetrant Examination

2.3 Definitions

Terms used in AMS are defined in AS7766 and the following:

- 2.3.1 Bore conditioning is any mechanical cleaning method that is used in the bore of tubing to improve the final surface appearance, with no resultant change in tubing size beyond the allowable tolerances.

3. TECHNICAL REQUIREMENTS

3.1 Composition

Shall conform to the percentages by weight shown in Table 1, determined in accordance with ASTM A751, or by other analytical methods acceptable to the purchaser.

Table 1 - Composition

Element	Min	Max
Carbon	--	0.15
Manganese	--	1.00
Silicon	--	1.00
Phosphorus	--	0.040
Sulfur	--	0.030
Chromium	11.50	13.50
Nickel	--	0.75
Molybdenum	--	0.60
Aluminum	--	0.05
Nitrogen (see 3.1.1)	--	0.08
Copper	--	0.50
Tin	--	0.05

3.1.1 Determination is not required for routine acceptance.

3.1.2 The producer may test for any element not listed in Table 1 and include this analysis in the report of 4.4. Reporting of any element not listed in the composition table is not a basis for rejection unless limits of acceptability are specified by the purchaser.

3.1.3 Check Analysis

Composition variations shall meet the applicable requirements of AMS2248.

3.2 Condition

Tubing shall be cold drawn and annealed. The annealing heat treatment shall be performed in an atmosphere yielding a bright finish. Alternately, product shall be passivated in accordance with AMS2700 to produce a uniform finish. It is permissible to pickle prior to passivation. Passivation shall be performed after final finishing (see 3.3.2).

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 anneal. A light polish to improve external surface appearance may be employed after the anneal.

3.3.1 Bore conditioning is permitted after final anneal providing the tubing is not sized by metal removal methods beyond the allowable tolerances. If bore conditioning is used, 100% visual inspection of each tube shall be performed. The tube ID shall be uniformly shiny with no evidence of metallic or nonmetallic remnant material.

3.3.2 Tubing shall be passivated in accordance with AMS2700 after any ID or OD finishing that occurs after solution heat treatment.