



# AEROSPACE MATERIAL

Society of Automotive Engineers, Inc.

TWO PENNSYLVANIA PLAZA, NEW YORK, N.Y. 10001

## SPECIFICATION

### AMS 6362A

Superseding AMS 6362

Issued 6-1-42

Revised 5-15-72

STEEL TUBING, SEAMLESS  
0.95Cr - 0.20Mo (0.28 - 0.33C) (SAE 4130)  
150,000 psi (1034 MPa) Tensile Strength

#### 1. SCOPE:

- 1.1 Form: This specification covers an aircraft-quality low-alloy steel in the form of round, seamless tubing having a wall thickness not greater than 0.188 in. (4.78 mm).
- 1.2 Application: Primarily for general use where a minimum tensile strength of 150,000 psi (1034 MPa) is required.

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) 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., Two Pennsylvania Plaza, New York, New York 10001.

##### 2.1.1 Aerospace Material Specifications:

AMS 2253 - Tolerances, Carbon and Alloy Steel Tubing  
AMS 2259 - Chemical Check Analysis Limits, Wrought Low Alloy and Carbon Steel  
AMS 2301 - Aircraft Quality Steel Cleanliness, Magnetic Particle Inspection Procedure  
AMS 2350 - Standards and Test Methods  
AMS 2370 - Quality Assurance Sampling of Carbon and Low Alloy Steels, Wrought Products Except Forgings  
AMS 2640 - Magnetic Particle Inspection

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

ASTM A370 - Mechanical Testing of Steel Products  
ASTM E112 - Estimating Average Grain Size of Metals  
ASTM E350 - Chemical Analysis of Carbon Steel, Low-Alloy Steel, Silicon Electrical Steel, Ingot Iron, and Wrought Iron

- 2.3 Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.

##### 2.3.1 Federal Standards:

Federal Test Method Standard No. 151 - Metals; Test Methods

#### 3. TECHNICAL REQUIREMENTS:

- 3.1 Composition: Shall conform to the following percentages by weight, determined by wet chemical methods in accordance with ASTM E350, by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other suitable analytical methods:

SAE Technical Board rules provide that: "All technical reports, including standards approved and practices recommended, are advisory only. Their use by anyone engaged in industry or trade is entirely voluntary. There is no agreement to adhere to any SAE standard or recommended practice, and no commitment to conform to or be guided by any technical report. In formulating and approving technical reports, the Board and its Committees will not investigate or consider patents which may apply to the subject matter. Prospective users of the report are responsible for protecting themselves against infringement of patents."

|            | min  | max   |
|------------|------|-------|
| Carbon     | 0.28 | 0.33  |
| Manganese  | 0.40 | 0.60  |
| Silicon    | 0.20 | 0.35  |
| Phosphorus | --   | 0.025 |
| Sulfur     | --   | 0.025 |
| Chromium   | 0.80 | 1.10  |
| Molybdenum | 0.15 | 0.25  |
| Nickel     | --   | 0.25  |
| Copper     | --   | 0.35  |

3.1.1 Check Analysis: Composition variations shall meet the requirements of AMS 2259, paragraph titled "Low Alloy Steels".

3.2 Condition: Hardened by quenching from a temperature within the range 1500 - 1600 F (815.6 - 871.1 C) and tempered to conform to requirements of 3.4.1.

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 heat treatment. A light polish to improve surface appearance may be employed after final heat treatment.

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

3.4.1 Tensile Properties:

|                                    |                        |
|------------------------------------|------------------------|
| Tensile Strength, min              | 150,000 psi (1034 MPa) |
| Yield Strength at 0.2% Offset, min | 135,000 psi ( 931 MPa) |
| Elongation in 2 in. (50.8 mm), min |                        |
| Full tube                          | 10%                    |
| Strip                              | 6%                     |

3.4.2 Grain Size: Predominantly 5 or finer with occasional grains as large as 3 permissible, ASTM E112, McQuaid-Ehn test.

3.4.3 Decarburization:

3.4.3.1 Tubing ordered ground, turned, or polished shall be free from decarburization on the ground, turned, or polished surfaces. Inside decarburization of such tubing shall not exceed the maximum depth specified in Table I.

3.4.3.2 Allowable decarburization of pierced billets, of tubing for redrawing, or of tubing ordered to specified microstructural requirements shall be as agreed upon by purchaser and vendor.

3.4.3.3 Unless otherwise agreed upon between purchaser and vendor, tubing to which 3.4.3.1 or 3.4.3.2 is not applicable shall be free from complete decarburization. Partial decarburization shall be not greater than shown in Table I:

TABLE I

| Nominal Wall Thickness<br>Inch | Depth of Partial Decarburization, Inch |       |         |
|--------------------------------|----------------------------------------|-------|---------|
|                                | ID                                     | OD    | ID + OD |
| Up to 0.040, incl              | 0.008                                  | 0.008 | 0.010   |
| Over 0.040 to 0.050, incl      | 0.009                                  | 0.009 | 0.012   |
| Over 0.050 to 0.070, incl      | 0.010                                  | 0.010 | 0.014   |
| Over 0.070 to 0.080, incl      | 0.012                                  | 0.012 | 0.016   |
| Over 0.080 to 0.090, incl      | 0.014                                  | 0.014 | 0.018   |
| Over 0.090 to 0.100, incl      | 0.015                                  | 0.015 | 0.020   |
| Over 0.100 to 0.150, incl      | 0.017                                  | 0.017 | 0.022   |
| Over 0.150 to 0.188, incl      | 0.020                                  | 0.020 | 0.026   |

TABLE I (SI)

| Nominal Wall Thickness<br>Millimeters | Depth of Partial Decarburization, Millimeter |      |         |
|---------------------------------------|----------------------------------------------|------|---------|
|                                       | ID                                           | OD   | ID + OD |
| Up to 1.02, incl                      | 0.20                                         | 0.20 | 0.25    |
| Over 1.02 to 1.27, incl               | 0.23                                         | 0.23 | 0.30    |
| Over 1.27 to 1.78, incl               | 0.25                                         | 0.25 | 0.36    |
| Over 1.78 to 2.03, incl               | 0.30                                         | 0.30 | 0.41    |
| Over 2.03 to 2.29, incl               | 0.36                                         | 0.36 | 0.46    |
| Over 2.29 to 2.54, incl               | 0.38                                         | 0.38 | 0.51    |
| Over 2.54 to 3.81, incl               | 0.43                                         | 0.43 | 0.56    |
| Over 3.81 to 4.78, incl               | 0.51                                         | 0.51 | 0.66    |

3.4.3.4 Decarburization shall be measured by the microscopic method or by Rockwell Superficial 30-N scale or equivalent hardness testing method on hardened but untempered specimens protected during heat treatment to prevent changes in surface carbon content. Depth of decarburization, when measured by a hardness method, is defined as the perpendicular distance from the surface to the depth under that surface below which there is no further increase in hardness. Such measurements shall be far enough away from any adjacent surface to be uninfluenced by any decarburization or lack of decarburization thereon.

3.4.3.4.1 When determining the depth of decarburization, it is permissible to disregard local areas provided the decarburization of such areas does not exceed the limits above by more than 0.005 in. (0.13 mm) and the width is 0.065 in. (1.65 mm) or less.

3.5 Quality: Steel shall be aircraft quality conforming to AMS 2301. Tubing shall be uniform in quality and condition and shall have a good workmanlike finish conforming to the best practice for high quality material. It shall be smooth, clean, 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. The removal of surface imperfections is not required.

3.5.1 When specified, the tubing, either with or without machining of the surfaces, shall pass magnetic particle inspection in accordance with AMS 2640. Standards for acceptance shall be as agreed upon by purchaser and vendor.

3.6 Sizes: Except when exact lengths or multiples of exact lengths are ordered, 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).

3.7 Tolerances: Unless otherwise specified, tolerances shall conform to all applicable requirements of AMS 2253.

#### 4. QUALITY ASSURANCE PROVISIONS:

- 4.1 Responsibility for Inspection: The vendor 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 assure that the tubing conforms to the requirements of this specification.
- 4.2 Classification of Tests: Tests to determine conformance to all technical requirements of this specification are classified as acceptance or routine control tests.
- 4.3 Sampling: Shall be in accordance with AMS 2370.
- 4.4 Reports:
- 4.4.1 The vendor of the product shall furnish with each shipment three copies of a report of the results of tests for chemical composition, grain size, and AMS 2301 frequency-severity rating of each heat in the shipment and for tensile properties 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 material, part number, and quantity. When material for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of material to determine conformance to the requirements of this specification, and shall include in the report a statement that the material conforms, or shall include copies of laboratory reports showing the results of tests to determine conformance.
- 4.5 Resampling and Retesting: If any specimen used in the above tests fails to meet the specified requirements, disposition of the tubing may be based on the results of testing three additional specimens for each original nonconforming specimen. Failure of any retest specimen to meet the specified requirements shall be cause for rejection of the tubing represented and no additional testing shall be permitted. Results of all tests shall be reported.

#### 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 Wall Thickness and 0.500 In. (12.70 mm) and Over in 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 6362A, heat number, manufacturer's identification, and nominal wall thickness. The characters shall be such size as to be clearly legible, shall be applied using a suitable marking fluid, and shall be capable of being removed in hot alkaline cleaning solution without rubbing. The markings shall have no deleterious effect on the material 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 Wall Thickness or Under 0.500 In. (12.70 mm) in OD, Minor Axis, or Least Width of Flat Surface: Shall be securely bundled and identified by a metal or plastic tag embossed with the above information 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 metal or plastic tag embossed with the purchase order number, AMS 6362A, 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.
- 5.2 Protective Treatment: Tubing shall be coated, inside and outside, with a suitable corrosion-preventive compound prior to shipment.