SAE Aerospace
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# AEROSPACE MATERIAL SPECIFICATION

SAE AMS6371 REV. K

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Superseding AMS6371J

## Steel, Mechanical Tubing
## 0.95Cr - 0.20Mo (0.28 - 0.33C) (SAE 4130)
## (Composition similar to UNS G41300)

RATIONALE

AMS6371K results from a Five Year Review and update of this document.

1. SCOPE

1.1 Form

This specification covers an aircraft-quality, low-alloy steel in the form of mechanical tubing.

1.2 Application

This tubing has been used typically for parts, 0.375 inch (9.52 mm) and under in nominal wall thickness at time of heat treatment requiring a through-hardening steel capable of developing hardness as high as 40 HRC when properly hardened and tempered and for parts of greater wall thickness but requiring proportionately lower hardness, but usage is not limited to such applications.

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 supplied 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.

2.1 SAE Publications

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

AMS2253 Tolerances, Carbon and Alloy Steel Tubing

AMS2259 Chemical Check Analysis Limits, Wrought Low-Alloy and Carbon Steels

AMS2301 Steel Cleanliness, Aircraft Quality, Magnetic Particle Inspection Procedure

AMS2370 Quality Assurance Sampling and Testing, Carbon and Low-Alloy Steel Wrought Products and Forging Stock





**TO PLACE A DOCUMENT ORDER:** **Tel: 877-606-7323 (inside USA and Canada)**
**Tel: +1 724-776-4970 (outside USA)**
**Fax: 724-776-0790**
**Email: CustomerService@sae.org**
**SAE WEB ADDRESS:** **http://www.sae.org**

**SAE values your input. To provide feedback on this Technical Report, please visit**
**http://www.sae.org/technical/standards/AMS6371K**

AMS2806 Identification, Bars, Wire, Mechanical Tubing, and Extrusions, Carbon and Alloy Steels and Corrosion and Heat-Resistant Steels and Alloys

AS1182 Standard Stock Removal Allowance, Aircraft Quality and Premium Aircraft-Quality Steel Bars and Mechanical Tubing

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, or www.astm.org.

ASTM A 255 Determining Hardenability of Steel

ASTM A 370 Mechanical Testing of Steel Products

ASTM E 112 Determining Average Grain Size

ASTM E 350 Chemical Analysis of Carbon Steel, Low-Alloy Steel, Silicon Electrical Steel, Ingot Iron, and Wrought Iron

ASTM E 384 Knoop and Vickers Hardness of Materials

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 350, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

TABLE 1 – COMPOSITION

| Element | min | max |
|---|---|---|
| Carbon | 0.28 | 0.33 |
| Manganese | 0.40 | 0.60 |
| Silicon | 0.15 | 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 applicable requirements of AMS2259.

3.2 Condition

Cold finished unless otherwise ordered, having hardness not higher than 25 HRC, or equivalent (See 8.2). Tubing ordered hot finished and annealed or tempered shall have hardness not higher than 99 HRB, or equivalent (See 8.2). Hardness shall be determined in accordance with ASTM A 370.

3.3 Properties

Tubing shall conform to the following requirements:

3.3.1 Grain Size

Shall be ASTM No. 5 or finer, determined in accordance with ASTM E 112.

3.3.2 Hardenability

Shall be J 5/16 inch (7.9 mm) = 35 HRC minimum and J 8/16 inch (13 mm) = 28 HRC minimum, determined on the standard end-quench test specimen in accordance with ASTM A 255 except that the steel shall be normalized at 1700 °F ± 10 (927 °C ± 6) and the test specimen austenitized at 1600 °F ± 10 (871 °C ± 6).

3.3.3 Decarburization

3.3.3.1 Tubing ordered ground, turned, or polished shall be free from decarburization on the ground, turned, or polished surfaces.

3.3.3.2 Decarburization of tubing to which 3.3.3.1 is not applicable shall be not greater than shown in Table 2.

TABLE 2A - MAXIMUM DEPTH OF DECARBURIZATION, INCH/POUND UNITS

| Nominal Wall Thickness Inches | Total Depth of Decarburization Inch ID | Total Depth of Decarburization Inch OD |
|---|---|---|
| Up to 0.109, incl | 0.008 | 0.015 |
| Over 0.109 to 0.203, incl | 0.010 | 0.020 |
| Over 0.203 to 0.400, incl | 0.012 | 0.025 |
| Over 0.400 to 0.600, incl | 0.015 | 0.030 |
| Over 0.600 to 1.000, incl | 0.017 | 0.035 |
| Over 1.000 | 0.020 | 0.040 |

TABLE 2B - MAXIMUM DEPTH OF DECARBURIZATION, SI UNITS

| Nominal Wall Thickness Millimeters | Total Depth of Decarburization Millimeter ID | Total Depth of Decarburization Millimeters OD |
|---|---|---|
| Up to 2.77, incl | 0.20 | 0.38 |
| Over 2.77 to 5.16, incl | 0.25 | 0.51 |
| Over 5.16 to 10.16, incl | 0.30 | 0.64 |
| Over 10.16 to 15.24, incl | 0.38 | 0.76 |
| Over 15.24 to 25.40, incl | 0.43 | 0.89 |
| Over 25.40 | 0.51 | 1.02 |



3.3.3.3 Decarburization shall be measured by the metallographic method, by the HR30N scale hardness testing method, or by a traverse method using microhardness testing in accordance with ASTM E 384. The hardness method(s) shall be conducted on a hardened but untempered specimen 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 on the adjacent surface. In case of dispute, the depth of decarburization determined using the microhardness traverse method shall govern.

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

3.4 Quality

Tubing, as received by purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from imperfections detrimental to usage of the tubing.

3.4.1 Steel shall be aircraft quality conforming to AMS2301.

3.4.2 Tubing ordered hot rolled or cold drawn or ground, turned, or polished shall, after removal of the standard stock removal allowance in accordance with AS1182, be free from seams, laps, tears, and cracks open to the machined, ground, turned, or polished surface.

3.5 Tolerances

Shall conform to all applicable requirements of AMS2253.

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 the performance of all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the tubing conforms to specified requirements.

4.2 Classification of Tests

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

4.3 Sampling and Testing

In accordance with AMS2370.

4.4 Reports

The vendor of tubing shall furnish with each shipment a report showing the results of composition, hardenability, and frequency-severity rating for each heat and for hardness and average grain size for each lot, and stating that the product conforms to the other technical requirements. This report shall include the purchase order number, heat and lot numbers, AMS6371K, size, and quantity.

4.5 Resampling and Retesting

In accordance with AMS2370.

5. PREPARATION FOR DELIVERY

5.1 Sizes

Except when exact lengths or multiples of exact lengths are ordered, straight tubing will be acceptable in mill lengths of 6 to 20 feet (1.8 to 6.1 m) but not more than 10% of any shipment shall be supplied in lengths shorter than 10 feet (3 m).

5.2 Identification

In accordance with AMS2806.

5.3 Protective Treatment

Tubing ordered cold drawn, cold rolled, ground, turned, or polished shall be protected from corrosion prior to shipment.