



AEROSPACE MATERIAL

Society of Automotive Engineers, Inc.

400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

SPECIFICATION

AMS 5570J

Superseding AMS 5570H

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UNS S32100

STEEL TUBING, SEAMLESS, CORROSION AND HEAT RESISTANT
18.5Cr - 11Ni - 0.40Ti (SAE 30321)

1. SCOPE:

1.1 **Form:** This specification covers a corrosion and heat resistant steel in the form of seamless tubing.

1.2 **Application:** Primarily for parts and assemblies requiring both corrosion and heat resistance, especially when such parts and assemblies are welded during fabrication. Parts and assemblies requiring oxidation resistance up to approximately 1500° F (816° C) but useful at that temperature only when stresses are low.

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., 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

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

ASTM A262 - Detecting Susceptibility to Intergranular Attack in Stainless Steels

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 approved analytical methods:

| | min | max |
|------------|-------|-------|
| Carbon | -- | 0.08 |
| Manganese | -- | 2.00 |
| Silicon | 0.40 | 1.00 |
| Phosphorus | -- | 0.040 |
| Sulfur | -- | 0.030 |
| Chromium | 17.00 | 20.00 |
| Nickel | 9.00 | 13.00 |
| Titanium | 6xC | 0.70 |
| Molybdenum | -- | 0.75 |
| Copper | -- | 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 seamless process. Any surface 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 shall follow any polishing treatment.

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

3.4.1 **Tensile Properties:** Shall be as specified in Table I:

TABLE I

| Nominal OD Inches | Wall Thickness Inches | Tensile Strength psi, max | Elongation in 2 in. %, min | |
|---------------------------|--------------------------|------------------------------|-------------------------------|-----------|
| | | | Strip | Full Tube |
| Up to 0.188, incl | Up to 0.016, incl | 120,000 | -- | 33 |
| | Over 0.016 | 105,000 | -- | 35 |
| Over 0.188 to 0.500, incl | Up to 0.010, incl | 115,000 | 30 | 35 |
| | Over 0.010 | 105,000 | 30 | 35 |
| Over 0.500 | Up to 0.010, incl | 120,000 | 25 | 30 |
| | Over 0.010 | 105,000 | 30 | 35 |

TABLE I (SI)

| Nominal OD Millimetres | Nominal Wall Thickness Millimetres | Tensile Strength MPa, max | Elongation in 50.8 mm %, min | |
|---------------------------|---------------------------------------|------------------------------|---------------------------------|-----------|
| | | | Strip | Full Tube |
| Up to 4.78, incl | Up to 0.41, incl | 827 | -- | 33 |
| | Over 0.41 | 724 | -- | 35 |
| Over 4.78 to 12.70, incl | Up to 0.25, incl | 793 | 30 | 35 |
| | Over 0.25 | 724 | 30 | 35 |
| Over 12.70 | Up to 0.25, incl | 827 | 25 | 30 |
| | Over 0.25 | 724 | 30 | 35 |

3.4.2 Flarability: Tubing shall withstand flaring at room temperature, without formation of cracks or other visible defects, by being forced axially with steady pressure over a hardened and polished tapered steel pin having a 74 deg (1.29 rad) included angle to produce a flare having a permanent expanded OD not less than specified in Table II.

TABLE II

| Nominal OD Inches | Expanded OD Inches | Nominal OD Inches | Expanded OD Inches |
|----------------------|-----------------------|----------------------|-----------------------|
| 0.125 | 0.200 | 0.750 | 0.937 |
| 0.188 | 0.290 | 1.000 | 1.187 |
| 0.250 | 0.359 | 1.250 | 1.500 |
| 0.312 | 0.421 | 1.500 | 1.721 |
| 0.375 | 0.484 | 1.750 | 2.106 |
| 0.500 | 0.656 | 2.000 | 2.356 |
| 0.625 | 0.781 | | |

TABLE II (SI)

| Nominal OD Millimetres | Expanded OD Millimetres | Nominal OD Millimetres | Expanded OD Millimetres |
|---------------------------|----------------------------|---------------------------|----------------------------|
| 3.18 | 5.08 | 19.05 | 23.80 |
| 4.78 | 7.37 | 25.40 | 30.15 |
| 6.35 | 9.12 | 31.75 | 38.10 |
| 7.92 | 10.69 | 38.10 | 43.71 |
| 9.52 | 12.29 | 44.45 | 53.49 |
| 12.70 | 16.66 | 50.80 | 59.84 |
| 15.88 | 19.84 | | |

3.4.2.1 Tubing with nominal OD between any two standard sizes given in 3.4.2 shall take the same percentage flare as shown for the larger of the two sizes.

3.4.2.2 Tubing with nominal OD greater than 2.000 in. (50.80 mm) or less than 0.125 in. (3.18 mm) shall have flarability as agreed upon by purchaser and vendor.

3.4.3 Embrittlement: Tubing, after sensitizing treatment, shall pass the copper/copper sulfate/sulfuric acid test performed in accordance with ASTM A262, Practice E, without evidence of inter-crystalline surface attack. After exposure, full cross-sectional specimens of tubing 0.625 in. (15.88 mm) or less in nominal OD shall be flattened to a total thickness under load of three times the wall thickness of the tubing and 1 in. (25 mm) long specimens of tubing over 0.625 in. (15.88 mm) in nominal OD shall be split and bent 180 deg (3.14 rad), with outside surface of tube on inside of bend, around a diameter equal to the nominal wall thickness without showing cracks or other defects. In either flattening or bending, the fold shall be made parallel to the axis of the tube.

3.5 Quality: Tubing 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, 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 but removal of such surface imperfections is not required.

3.6 Sizes: Except when exact lengths or multiples of exact lengths are ordered, straight tubes 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 2243.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility 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 composition (3.1), tensile property (3.4.1), and tolerance (3.7) requirements are classified as acceptance or routine control tests.

4.2.2 Qualification Tests: Tests to determine conformance to flarability (3.4.2) and embrittlement (3.4.3) requirements are classified as qualification or periodic control tests.

4.2.2.1 For direct U.S. Military procurement, qualification test material and supporting test data shall be submitted to the cognizant qualification agency as directed by the request for procurement, the procuring activity, or the contracting officer.

4.3 Sampling: Shall be in accordance with AMS 2371 and the following:

4.3.1 Specimens for flarability test may be cut from any portion of a tube or an entire tube may be used as a specimen. The end of the specimen to be flared shall be cut square, with the cut end smooth and free from burrs, but not rounded.

4.4 Reports:

4.4.1 The vendor of tubing shall furnish with each shipment three copies of a report showing the results of tests for chemical composition of each heat in the shipment and for tensile properties of each size from each heat, and stating that the tubing conforms to the other technical requirements of this specification. 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.

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 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 5570J, 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 capable of being removed 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.