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| Superseding AMS5567D |         |

Steel, Corrosion Resistant, Seamless or Welded Hydraulic Tubing  
19Cr - 10Ni (SAE 30304)  
Solution Heat Treated

(Composition similar to UNS S30400)

RATIONALE

AMS5567E has been reaffirmed to comply with the SAE five-year review policy.

1. SCOPE:

1.1 Form:

This specification covers a corrosion-resistant steel in the form of seamless or welded tubing.

1.2 Application:

This tubing has been used typically for parts, such as fluid lines, subject to medium high pressures and requiring corrosion resistance, but usage is not limited to such applications. Welding, brazing, or other exposure to temperatures over 800 °F (427 °C) during fabrication may impair corrosion resistance.

1.3 Classification:

The tubing covered by this specification is classified as follows:

Type 1 - Seamless

Type 2 - Welded and drawn

1.3.1 Unless a specific type is specified, either Type 1 or Type 2 may be supplied.

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## 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.

### 2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001 or [www.sae.org](http://www.sae.org).

|          |                                                                                                                                           |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------|
| 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, Corrosion and Heat-Resistant Steels and Alloys, Maraging and Other Highly-Alloyed Steels, and Iron Alloys |
| AMS 2371 | Quality Assurance Sampling and Testing, Corrosion and Heat-Resistant Steels and Alloys, Wrought Products and Forging Stock                |
| AMS 2634 | Ultrasonic Inspection, Thin Wall Metal Tubing                                                                                             |
| AMS 2807 | Identification, Carbon and Low-Alloy Steels, Corrosion and Heat-Resistant Steels and Alloys, Sheet, Strip, Plate, and Aircraft Tubing     |

### 2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959 or [www.astm.org](http://www.astm.org).

|             |                                                                                                                                   |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------|
| ASTM A 262  | Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels                                                   |
| ASTM A 370  | Mechanical Testing of Steel Products                                                                                              |
| ASTM E 112  | Determining Average Grain Size                                                                                                    |
| ASTM E 353  | Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys                           |
| ASTM E 426  | Electromagnetic (Eddy-Current) Examination of Seamless and Welded Tubular Products, Austenitic Stainless Steel and Similar Alloys |
| ASTM E 1417 | Liquid Penetrant Examination                                                                                                      |

### 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     | --    | 0.08  |
| Manganese  | --    | 2.00  |
| Silicon    | --    | 0.75  |
| Phosphorus | --    | 0.040 |
| Sulfur     | --    | 0.030 |
| Chromium   | 18.00 | 20.00 |
| Nickel     | 8.00  | 12.00 |
| Molybdenum | --    | 0.75  |
| Copper     | --    | 0.75  |

3.1.1 Check Analysis: Composition variations shall meet the applicable requirements of AMS 2248.

#### 3.2 Condition:

Annealed and pickled as required or passivated.

#### 3.3 Fabrication:

Tubing shall be produced by either a seamless or a welded and drawn process. Any finishing operation applied to remove objectionable pits and surface blemishes shall be performed prior to final annealing heat treatment. A light polish to improve external surface appearance may be employed after solution heat treatment.

3.3.1 Welded (Type 2) tubing shall be sufficiently cold reduced after welding to remove any dimensional indication of the presence of the weld.

#### 3.4 Properties:

Tubing shall conform to the following requirements, determined in accordance with ASTM A 370:

3.4.1 Tensile Properties: Shall be as shown in Table 2, except that yield strength requirements do not apply to tubing 0.188 inch (4.78 mm) and under in OD with wall thickness 0.010 inch (0.25 mm) and under.

TABLE 2A – Tensile Properties, Inch/Pound Units

| Nominal OD<br>Inches       | Nominal Wall<br>Thickness<br>Inch | Tensile<br>Strength<br>ksi, max | Yield Strength<br>at 0.2% Offset<br>ksi, min | Elongation<br>in 2 Inches<br>(Strip)<br>%, min | Elongation<br>in 2 Inches<br>(Full Tube)<br>%, min |
|----------------------------|-----------------------------------|---------------------------------|----------------------------------------------|------------------------------------------------|----------------------------------------------------|
| Up to 0.188, incl          | Up to 0.016, incl                 | 115                             | 30.0                                         | --                                             | 35                                                 |
|                            | Over 0.016                        | 100                             | 30.0                                         | --                                             | 40                                                 |
| Over 0.188 t o 0.500, incl | Up to 0.010, incl                 | 110                             | --                                           | --                                             | 37                                                 |
|                            | Over 0.010                        | 100                             | 30.0                                         | --                                             | 40                                                 |
| Over 0.500                 | Over 0.010                        | 100                             | 30.0                                         | 35                                             | 40                                                 |

TABLE 2B - Tensile Properties, SI Units

| Nominal OD<br>Millimeters | Nominal Wall<br>Thickness<br>Millimeters | Tensile<br>Strength<br>MPa, max | Yield Strength<br>at 0.2% Off set<br>MPa, min | Elongation<br>in 50.8 mm<br>(Strip)<br>%, min | Elongation<br>in 50.8 mm<br>(Full Tube)<br>%, min |
|---------------------------|------------------------------------------|---------------------------------|-----------------------------------------------|-----------------------------------------------|---------------------------------------------------|
| Up to 4.78, incl          | Up to 0.41, incl                         | 793                             | 207                                           | --                                            | 35                                                |
|                           | Over 0.41                                | 689                             | 207                                           | --                                            | 40                                                |
| Over 4.78 t o 12.70, incl | Up to 0.25, incl                         | 758                             | --                                            | --                                            | 37                                                |
|                           | Over 0.25                                | 689                             | 207                                           | --                                            | 40                                                |
| Over 12.70                | Over 0.25                                | 689                             | 207                                           | 35                                            | 40                                                |

- 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-degree included angle to produce a flare having a permanent expanded OD not less than shown in Table 3.

TABLE 3A - Minimum Flarability, Inch/Pound Units

| Nominal OD<br>Inches | Expanded OD<br>Inches | Nominal OD<br>Inches | Expanded OD<br>Inches |
|----------------------|-----------------------|----------------------|-----------------------|
| 0.125                | 0.200                 | 0.750                | 0.937                 |
| 0.188                | 0.302                 | 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                 | 2.500                | 2.856                 |
|                      |                       | 3.000                | 3.356                 |

TABLE 3B - Minimum Flarability, SI Units

| Nominal OD<br>Millimeters | Expanded OD<br>Millimeters | Nominal OD<br>Millimeters | Expanded OD<br>Millimeters |
|---------------------------|----------------------------|---------------------------|----------------------------|
| 3.18                      | 5.08                       | 19.05                     | 23.80                      |
| 4.78                      | 7.67                       | 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                      | 63.50                     | 72.54                      |
|                           |                            | 76.20                     | 85.24                      |

- 3.4.2.1 Tubing with nominal OD between any two standard sizes shown in Table 3 shall take the same percentage flare as shown for the larger of the two sizes.
- 3.4.3 Pressure Test: The tubing shall show no bulges, leaks, pinholes, cracks, or other defects when subjected to an internal hydrostatic pressure (P), except that a diametric permanent set of 0.002 inch per inch (0.002 mm/mm) of diameter is acceptable. The hydrostatic pressure (P) shall be determined using Equation 1:

$$P = S \frac{D^2 - d^2}{D^2 + d^2} \quad (\text{Eq. 1})$$

where:

P = Test pressure in ksi (MPa)

S = 30.0 ksi (207 MPa)

D = Nominal OD in inches (mm) (nominal OD plus tolerance)

d = Nominal ID in inches (mm) (nominal OD minus twice the minimum wall thickness)

- 3.4.4 Susceptibility to Intergranular Attack: Specimens from tubing, as shipped, shall pass the intergranular corrosion test performed in accordance with ASTM A 262, Practice E.
- 3.4.5 Corrosion Rate: Specimens from tubing shall exhibit a general corrosion rate of less than 0.0015 inch (0.038 mm) penetration per month, determined from a boiling nitric acid test conducted in accordance with ASTM A 262, Practice C.
- 3.4.6 Average Grain Size: Shall be ASTM No. 5 or finer, determined in accordance with ASTM E 112 on a transverse section polished and electrolytically etched in a 10% oxalic acid solution.

### 3.5 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, 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 imperfections is not required.

- 3.5.1 Tubing shall be free from grease or other foreign matter. Metallic flakes or particles shall not be collected by a clean cloth drawn through the length of the bore of a test sample. Discoloration of the cloth, without the presence of flakes or particles, is acceptable.
- 3.5.2 When specified by purchaser, tubing shall be subjected to fluorescent penetrant inspection in accordance with ASTM E 1417, to ultrasonic inspection in accordance with AMS 2634, to electromagnetic (eddy-current) testing in accordance with ASTM E 426, or to any combination thereof. Tubing shall meet acceptance criteria established by the cognizant engineering organization.

### 3.6 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 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:

- 4.2.1 Acceptance Tests: Composition (3.1), tensile properties (3.4.1), average grain size (3.4.6), and tolerances (3.6) are acceptance tests and shall be performed on each heat or lot as applicable.
- 4.2.2 Periodic Tests: Flarability (3.4.2), pressure test (3.4.3), susceptibility to intergranular attack (3.4.4), and corrosion rate (3.4.5) are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.