Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

# AEROSPACE MATERIAL SPECIFICATION

AMS 5053E
Superseding AMS 5053D
Issued 6-1-42
Revised 7-15-77

UNS G10100

## STEEL TUBING, WELDED
Low Carbon
Annealed



1. SCOPE:

1.1 Type: This specification covers a low-carbon steel in the form of welded tubing.

1.2 Application: Primarily for oil lines and other parts requiring superior quality welded tubing suitable for severe forming and for welding or brazing.

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 2253 - Tolerances, Carbon and Alloy Steel Tubing
AMS 2259 - Chemical Check Analysis Limits, Wrought Low-Alloy and Carbon Steels
AMS 2350 - Standards and Test Methods
AMS 2370 - Quality Assurance Sampling of Carbon and Low-Alloy Steels, Wrought Products Except Forgings and Forging Stock

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

ASTM E8 - Tension Testing of Metallic Materials
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, 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 E350, by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other approved analytical methods:

| | min | max |
|---|---|---|
| Carbon | -- | 0.13 |
| Manganese | -- | 0.60 |
| Phosphorus | -- | 0.04 |
| Sulfur | -- | 0.05 |

3.1.1 Check Analysis: Composition variations shall meet the applicable requirements of AMS 2259.

3.2 Condition: Normalized or annealed.

3.2.1 Fabrication:

3.2.1.1 Tubing shall be produced by electrical-resistance, shielded-metal arc, or gas welding the edges of formed sheet or strip.

3.2.1.2 Any surface finishing operation applied to remove objectionable pits and surface blemishes shall be performed prior to the last annealing. A light polish to improve surface appearance may be employed after annealing.

3.3 Properties: Tubing shall conform to the following requirements:

3.3.1 Tensile Properties: Shall be as follows, determined in accordance with ASTM E8:

| Nominal OD | | Elongation in 2 in. (50.8 mm), %, min | |
|---|---|---|---|
| Inches | (Millimetres) | Full Tube | Strip |
| Up to 0.50, incl | (Up to 12.7, incl) | 32 | -- |
| Over 0.50 to 5.50, incl | (Over 12.7 to 139.7, incl) | 35 | 25 |

3.3.2 Crushing Test: Specimens as in 4.3.1 shall withstand, without failure of the weld, crushing lengthwise under a gradually applied load until the cross-sectional dimension is increased in one zone by 20%, or until one complete fold is formed, or until the specimen is reduced in length to 2/3 of the original length.

3.3.3 Flarability: Specimens as in 4.3.2 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 included angle to produce a flare having a permanent expanded OD not less than shown below. After flaring, the inside surface of the tubing shall be smooth and shall show no evidence of a bead that might prevent the assembly of pressure tight joints.

| Nominal Wall Thickness % of OD | OD Increase % |
|---|---|
| Up to 7, incl | 35 |
| Over 7 | 45 |

3.4 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 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.

3.4.1 Nondestructive Test: Each length of tubing shall be subjected to a nondestructive test by the tube manufacturer for the detection of injurious imperfections. The method of testing shall be capable of detecting all imperfections, interior and exterior, having a length greater than 1/16 in. (1.6 mm) and a total depth equivalent to half the nominal wall thickness of the tube.

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

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

3.6.1 The outside surface shall be free from welding flash and the maximum height of the inside flash shall not exceed 0.007 in. (0.18 mm).

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: Tests to determine conformance to all technical requirements of this specification are classified as acceptance tests.

4.3 Sampling: Shall be in accordance with AMS 2370 and the following:

4.3.1 At least one sample for crushing tests shall be selected from each 1000 ft (305 m) or less from each lot of tubing in the shipment. Test specimens shall have a length equal to approximately 1-1/2 times the nominal OD.

4.3.2 Specimens for flarability test shall be full tubes or sections cut from tubes. The end of the specimen to be flared shall be cut square, with the cut end smooth and free from burrs, but not rounded. The number of specimens shall be as agreed upon by purchaser and vendor.

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 and stating that the tubing conforms to the other technical requirements of this specification. This report shall include the purchase order number, material specification number and its revision letter, size, and quantity.

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.