AERONAUTICAL MATERIAL SPECIFICATION

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STEEL TUBING (WELDED)
.55 Ni-.5 Cr .2 Mo (.27-.33C)

1. ACKNOWLEDGMENT: Vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.

2. TYPE: Electric-resistance-welded or gas-welded tubing.

3. COMPOSITION:

		Individual Tube Check Analysis Over or Under
Carbon	0.27 - 0.33	0.02 (under only)
Manganese	0.70 - 0.90	0.03
Phosphorus	0.040 max	0.005
Sulphur	0.040 max	0.005
Silicon	0.20 - 0.35	0.02
Nickel	0.40 - 0.70	0.03
Chromium	0.40 - 0.60	0.03
Molybdenum	0.15 - 0.25	0.03

4. GRAIN SIZE: 5 or finer as determined on the billet, ASTM E19-39T, method a, unless otherwise ordered. A heat of steel predominantly 5 or finer with grains as large as 3 is permissible.

5. CONDITION: After the last cold draw pass, the tubing shall be normalized, stress relieved, or otherwise heat treated to develop the minimum physical properties specified in the following table, unless otherwise specified.

Nominal Outside Diameter	Nominal Wall Thickness	Tensile Strength	Yield Strength at 0.2% Offset or at Extension Indicated	Extension Under Load	Elongation in 2" Full Tube Strip	
Inch	Inch	lb per sq in.	lb per sq in.	Inch in 2"	%	%
Up to 0.500	0.188 & under	95,000	75,000	0.0090	10	5
Up to 0.500	Over 0.188	90,000	70,000	0.0087	10	5
0.500 & Over	0.188 & under	95,000	75,000	0.0090	12	7
0.500 & Over	Over 0.188	90,000	70,000	0.0087	15	10

6. QUALITY: (a) The tubing shall be suitable for use in aircraft, uniform in temper and must not reveal defects during the fabrication processes.

6. QUALITY: (continued)

(b) The tubing shall have a good workmanlike finish conforming to the best practice for high quality aircraft material. It shall be smooth, clean, and free from heavy scale or oxide, burrs, seams, tears, grooves, laminations, slivers, pits, and other injurious defects. Surface imperfections such as handling marks, straightening marks, light mandrel and die marks, shallow pits, and scale pattern will not be considered as injurious defects, provided the imperfections are removable within the tolerances specified herein for diameter and wall thickness. The removal of surface imperfections is not required.

(c) The steel used for the manufacture of the tubing shall be of a quality satisfactory for the fabrication of parts which may be subjected to a method of inspection which will disclose injurious tubing defects as defined in paragraph (b).

(d) Decarburization.- The average depth of total decarburization(1) determined from cross section samples cut at least 3/4" from the mill end and metallographically prepared for examination at 100 diameters after etching in 5% Nital shall not exceed the following:

Nominal Wall Thickness Inches		Allowable Total Decarburization (ID + OD) Inches	Max Total (2) Decarburization (OD) Inches
Up to	0.040	0.010	0.008
0.041	0.050	0.012	0.009
0.051	0.070	0.014	0.011
0.071	0.080	0.016	0.012
0.081	0.090	0.018	0.014
0.091	0.100	0.020	0.015
0.101	0.150	0.022	0.017
0.151	0.200	0.026	0.020

Note: (1) The depth of total decarburization is the sum of complete and partial decarburization.

(2) The depth of total decarburization allowed on the outer surface is approximately 75% of the amount allowed on both the inner and outer surfaces.

(e) When tubing is furnished ground, turned, or polished, there shall be no decarburization.

(f) The maximum height of the inside welding flash shall not exceed 60% of the nominal wall thickness and in no case shall it be greater than 3/64 inch.

7. TOLERANCES: (a) The following variations in nominal outside diameter for the available standard sizes listed are permissible; all dimensions are in inches:

Nominal Outside Diameter	Wall Thickness	Tolerance, plus or minus
Up to 3/8, incl.	0.028 to 0.083, incl.	0.003
1/2	0.028 to 0.095, incl.	0.004
5/8	0.028 to 0.065, incl.	0.005
3/4 to 1, incl.	0.028 to 0.049, incl.	0.005
3/4 to 1, incl.	0.065 to 0.109, incl.	0.004
1-1/8 to 2, incl.	0.065 to 0.109, incl.	0.005
1-1/8 to 2, incl.	0.035 to 0.049, incl.	0.006
2-1/8 to 2-1/2, incl.	0.035 to 0.109, incl.	0.007
2-5/8 to 3, incl.	0.049 to 0.109, incl.	0.010

(b) The following variations in nominal wall thickness for the outside diameter ranges indicated are permissible; all dimensions are in inches:

Nominal Wall Thickness	Outside Diameter	Tolerance, plus or minus
0.028 to 0.049, incl.	3/8 to 7/8, incl.	0.003
0.058 to 0.083, incl.	3/8 to 7/8, incl.	0.004
0.028 to 0.035, incl.	1 to 2, incl.	0.003
0.049 to 0.083, incl.	1 to 2, incl.	0.004
0.095 to 0.109, incl.	1 to 2, incl.	0.005
0.095 to 0.109, incl.	2 to 3, incl.	0.006
0.035 to 0.083, incl.	2 to 3, incl.	0.004

Note: These tolerances are exclusive of the inside welding flash.

(c) In no portion of any piece of tubing shall the departure from straightness exceed one part in 800 parts of length.

8. TESTS: (a) Each length of tubing shall be subjected to a non-destructive 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, with a length greater than 1/16 inch and a total depth equivalent to half the wall thickness of the tube.

(b) At least one crushing test sample shall be selected from each 1000 feet or less or each lot of tubing in the shipment. Test specimens shall have a length equal to 1-1/2 times the outside diameter and shall withstand crushing under a gradually applied load until the cross sectional dimension is increased in one zone by 20 percent, or until one complete fold is formed, or until the specimen is reduced in length to 2/3 of the original length, without failure of the weld occurring.

9. REPORTS: (a) Unless otherwise specified, the supplier of raw material shall furnish three copies of a notarized report of the chemical composition, grain size, physical properties and the results of the non-destructive test required by a paragraph 8(a) of each size and heat in each shipment. This report shall include the purchase order number, material specification number, heat number, size and quantity.