AEROSPACE MATERIAL SPECIFICATION

AMS4554	REV. B

Issued 1990-07
Revised 2009-02
Reaffirmed 2014-10

Superseding AMS4554A

Brass Tubing, Seamless
66.5Cu - 33Zn - 0.45Pb
Annealed
(Composition similar to UNS C33000)

RATIONALE

AMS4554B has been reaffirmed to comply with the SAE five year review policy.

1. SCOPE

1.1 Form

This specification covers one grade of brass in the form of seamless tubing.

1.2 Application

This tubing has been used typically for parts requiring a combination of moderate strength and ductility and resistance to corrosion by salt water, salt air, or gases, but usage is not limited to such applications.

1.3 Classification

Tubing is classified by types as follows:

Type 1 - 100 psi (689 kPa) nominal working pressure
Type 2 - 200 psi (1379 kPa) nominal working pressure
Type 3 - 300 psi (2068 kPa) nominal working pressure
Type 4 - 450 psi (3103 kPa) nominal working pressure

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.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
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SAE values your input. To provide feedback on this Technical Report, please visit
http://www.sae.org/technical/standards/AMS4554B

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.

AMS2223 Tolerances, Copper and Copper Alloy Seamless 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, www.astm.org.

ASTM B 154 Mercurous Nitrate Test for Copper and Copper Alloys
ASTM B 251 General Requirements for Wrought Seamless Copper and Copper-Alloy Tube
ASTM B 251M General Requirements for Wrought Seamless Copper and Copper-Alloy Tube (Metric)
ASTM B 858 Determination of Susceptibility to Stress Corrosion Cracking in Copper Alloys Using an Ammonia Vapor Test
ASTM E 8/8M Tension Testing of Metallic Materials
ASTM E 478 Chemical Analysis of Copper Alloys

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

TABLE 1 - COMPOSITION

Element (3.1.1)	min	max
Copper	65.0	68.0
Lead (3.1.2)	0.25	0.7
Iron	--	0.07
Zinc (3.1.3)	--	(See 3.1.3) --
Sum of Named Elements (3.1.4)	99.6	

3.1.1 These composition limits do not preclude the presence of other elements. Limits may be established and analysis required for unnamed elements by agreement between the manufacturer or supplier and purchaser.

3.1.2 For tubing over 5 inches (127 mm) in OD, the lead content may be less than 0.20%.

3.1.3 Zinc may be reported as “remainder”, or as the difference between the sum of results for all elements and 100%, or as the result of direct analysis.

3.1.4 When all named elements in Table 1 are analyzed, the sum shall be 99.6% minimum, but such determination is not required for routine acceptance of each lot.

3.2 Condition

Fully recrystallized in light annealed (050) temper (See 8.3). Tubing shall be acid cleaned after final annealing procedure.

3.3 Fabrication

Tubing shall be produced by a seamless process. The external and internal surface finishes shall be produced by any method which will result in surfaces free from laps, folds, tears, and extraneous materials and which show no oxide discoloration. Processing shall not affect limits of wall thickness or corrosion resistance.

3.4 Properties

Tubing shall conform to the following requirements:

3.4.1 Tensile Properties

Shall be shown in Table 2, determined in accordance with ASTM E 8/8M on specimens as in 4.4.1.

TABLE 2 - MINIMUM TENSILE PROPERTIES

Property	Value
Tensile Strength	35.0 ksi (241 MPa)
Elongation in 8 Inches (203 mm)	30%

3.4.2 Flattening

Tubing shall withstand flattening and develop no flaws, determined in accordance with 4.4.2.

3.4.3 Bending

Tubing shall show no signs of fracture on the outer surface, determined in accordance with 4.4.3.

3.4.4 Pressure Test

Tubing shall show no bulges, leaks, pinholes, cracks, porous places, or other imperfections when subjected to an internal hydrostatic pressure (P), calculated from equation 1:

$$P = \frac{2St}{D - 0.8t} \quad \text{(Eq. 1)}$$

where:

P = Internal pressure at minimum yield, ksi (MPa)
S = Allowable yield stress [7.0 ksi (48.3 MPa)]
t = Wall thickness, inches (mm)
D = Nominal OD, inches (mm)

3.4.5 Embrittlement

Specimens of tubing, approximately 6 inches (152 mm) in length or twice the diameter, whichever is greater, shall withstand, without cracking, the mercurous nitrate test performed in accordance with ASTM B 154, Procedure A or the Ammonia Vapor Test performed in accordance with ASTM B 858.

3.4.6 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 specified in Table 3.

TABLE 3 - FLARING REQUIREMENTS

Nominal OD Inches	Nominal OD Millimeters	Expanded OD
Up to 0.750, incl	Up to 19.05, incl	1.20 X nominal OD
Over 0.750 to 4.000, incl	Over 19.05 to 101.60, incl	1.15 X nominal OD

3.5 Quality

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

3.6 Tolerances

3.6.1 Diameter, Wall Thickness, and Length

Shall be in accordance with AMS2223.

3.6.2 Weight

For any lot of tubing, the tolerance for overweight is 10%. For calculating weight, the density shall be 0.306 pound per cubic inch (8470 kg/m^3).

3.7 Sizes and Weights

Shall be shown in Tables 4 through 7.

TABLE 4A - SIZES AND WEIGHTS - TYPE I TUBING, INCH/POUND UNITS

Nominal OD Inches	Wall Thickness Inch, min	Nominal ID Inches	Nominal Weight Pounds/Foot	Test Pressure psi, min
2.875	0.065	2.745	2.114	310
3.500	0.065	3.370	2.584	260
4.000	0.065	3.870	2.960	220
4.500	0.065	4.370	3.336	200
5.563	0.068	5.427	4.325	170
6.625	0.081	6.463	6.135	170
8.625	0.105	8.145	10.354	170
10.750	0.131	10.488	16.101	170

TABLE 4B - SIZES AND WEIGHTS - TYPE I TUBING, SI UNITS

Nominal OD Millimeters	Wall Thickness mm, min	Nominal ID Millimeters	Nominal Weight kg/m	Test Pressure kPa, min
73.02	1.65	69.72	3.15	2137
88.90	1.65	85.60	3.85	1793
101.60	1.65	98.30	4.40	1517
114.30	1.65	111.00	4.96	1379
141.30	1.73	137.85	6.44	1172
168.28	2.06	164.16	9.13	1172
219.08	2.67	206.88	15.41	1172
273.05	3.03	266.40	23.96	1172

TABLE 5A - SIZES AND WEIGHTS - TYPE 2 TUBING, INCH/POUND UNITS

Nominal OD Inches	Wall Thickness Inch, min	Nominal ID Inches	Nominal Weight Pounds/Foot	Test Pressure psi, min
1.900	0.065	1.770	1.380	470
2.375	0.065	2.245	1.738	380
2.875	0.068	2.739	2.209	330
3.500	0.083	3.334	3.282	330
4.000	0.095	3.810	4.294	330
4.500	0.107	4.286	5.440	330
5.563	0.132	5.299	8.297	330
6.625	0.158	6.309	11.826	330
8.625	0.205	8.215	19.977	330
10.750	0.256	10.238	31.093	330

TABLE 5B - SIZES AND WEIGHTS - TYPE 2 TUBING, SI UNITS

Nominal OD Millimeters	Wall Thickness mm, min	Nominal ID Millimeters	Nominal Weight kg/m	Test Pressure kPa, min
48.26	1.65	44.96	2.05	3241
60.32	1.65	57.02	2.59	2620
73.02	1.73	69.57	3.29	2275
88.90	2.11	84.68	4.88	2275
101.60	2.41	96.77	6.39	2275
114.30	2.72	108.86	8.10	2275
141.30	3.35	134.59	12.35	2275
168.28	4.01	160.25	17.60	2275
219.08	5.21	208.66	29.73	2275
273.05	6.50	260.05	46.27	2275

TABLE 6A - SIZES AND WEIGHTS - TYPE 3 TUBING, INCH/POUND UNITS

Nominal OD Inches	Wall Thickness Inch, min	Nominal ID Inches	Nominal Weight Pounds/Foot	Test Pressure psi, min
1.375	0.065	1.185	0.940	660
1.660	0.065	1.530	1.200	540
1.900	0.066	1.768	1.401	480
2.375	0.083	2.209	2.202	480
2.875	0.100	2.675	3.212	480
3.500	0.122	3.256	4.770	480
4.000	0.140	3.720	6.254	490
4.500	0.157	4.186	7.891	480
5.563	0.194	5.175	12.055	480
6.625	0.231	6.163	17.094	480
8.625	0.301	8.023	28.998	480
10.750	0.375	10.000	45.030	480

TABLE 6B - SIZES AND WEIGHTS - TYPE 3 TUBING, SI UNITS

Nominal OD Millimeters	Wall Thickness mm, min	Nominal ID Millimeters	Nominal Weight kg/m	Test Pressure kPa, min
34.92	1.65	30.10	1.40	4551
42.16	1.65	38.86	1.79	3723
48.26	1.68	44.91	2.08	3309
60.32	2.11	56.11	3.28	3309
73.02	2.54	67.94	4.78	3309
88.90	3.10	82.70	7.10	3309
101.60	3.56	94.49	9.31	3378
114.30	3.99	106.32	11.74	3309
141.30	4.93	131.44	17.94	3309
168.28	5.87	156.54	25.44	3309
219.08	7.65	203.78	43.15	3309
273.05	9.52	254.00	67.01	3309

TABLE 7A - SIZES AND WEIGHTS - TYPE 4 TUBING, INCH/POUND UNITS

Nominal OD Inches	Wall Thickness Inch, min	Nominal ID Inches	Nominal Weight Pounds/Foot	Test Pressure psi, min
0.405	0.062	0.281	0.246	2140
0.540	0.065	0.410	0.357	1680
0.675	0.065	0.545	0.459	1340
0.840	0.065	0.710	0.583	1080
1.050	0.065	0.920	0.741	860
1.315	0.066	1.183	0.954	700
1.660	0.084	1.492	1.532	700
1.900	0.096	1.709	1.995	700
2.375	0.120	2.135	3.132	700
2.875	0.145	2.585	4.581	700
3.500	0.177	3.146	6.807	700
4.000	0.202	3.596	8.879	700
4.500	0.228	4.044	11.273	700
5.563	0.281	5.001	17.178	700
6.625	0.335	5.955	24.387	700
8.625	0.436	7.753	41.323	700
10.750	0.544	9.662	64.259	700

TABLE 7B - SIZES AND WEIGHTS - TYPE 4 TUBING, SI UNITS

Nominal OD Millimeters	Wall Thickness mm, min	Nominal ID Millimeters	Nominal Weight kg/m	Test Pressure kPa, min
10.29	1.57	7.14	0.37	14755
13.72	1.65	10.41	0.53	11583
17.14	1.65	13.84	0.68	9239
21.34	1.65	18.03	0.87	7446
26.67	1.65	23.37	1.10	5929
33.40	1.68	30.05	1.42	4826
42.16	2.13	37.90	2.28	4826
48.26	2.44	43.41	2.97	4826
60.32	3.05	54.23	4.66	4826
73.02	3.68	65.66	6.82	4826
88.90	4.50	79.91	10.13	4826
101.60	5.13	91.34	13.21	4826
114.30	5.79	102.72	16.78	4826
141.30	7.14	127.02	25.56	4826
168.28	8.51	151.26	36.29	4826
219.08	11.07	196.93	61.50	4826
273.05	13.82	245.41	95.63	4826

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), pressure test (3.4.4), flarability (3.4.6), and tolerances (3.6) are acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests

Flattening (3.4.2), bending (3.4.3), and embrittlement (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.

4.3 Sampling and Testing

Shall be in accordance with ASTM B 251 or ASTM B 251M and as follows:

4.3.1 An inspection lot shall consist of 1000 tubes or 5000 pounds (2268 kg), whichever constitutes the greater mass, of tubes of the same size, type, and temper.

4.3.2 Samples selected in accordance with Table 8 shall be examined for conformance to sizes and weights, tolerances, identification marking, and preparation for delivery requirements.

TABLE 8 - SAMPLE SIZE

Lost Size Number of Tubes	Sample Size Number of Tubes	Rejection Number
1 to 110, incl	5	0
Over 110 to 500, incl	7	0
Over 500 to 800, incl	10	0
Over 800 to 1200, incl	15	0
Over 1200	25	0

4.4 Test Methods

4.4.1 Tensile Tests

Shall be performed on tubing 2 inches (51 mm) and over in nominal ID. One specimen from each tube selected shall be tested to represent the lot. For an ID of 2 to 6 inches (51 to 152 mm), specimens shall be cut longitudinally; for ID over 6 inches (152 mm), specimens shall be cut circumferentially. Specimens shall be heated to a cherry red and straightened when hot, annealed, and machined to the plate-type standard specimen with an 8 inch (203 mm) gage length, in accordance with ASTM E 8/8M. For wall thickness up to 1/4 inch (6.4 mm), incl, the width of the narrow part of the specimen shall be approximately 1-1/2 inches (38 mm). For thicker pieces, the width shall be such as to give a cross-section of 0.5 square inch (322 mm^2), but the breadth shall not in any case be less than the thickness. The surfaces shall not be machined but shall be left in their original condition.