

STANDARDS ASSOCIATION OF AUSTRALIA.

Headquarters :

Science House, Gloucester and Essex Streets, Sydney.

AUSTRALIAN STANDARD SPECIFICATION FOR AIRCRAFT MATERIAL
(Emergency Series)ALUMINIUM ALLOY ROUND SEAMLESS
TUBES

This standard forms one of a series prepared by the Standards Association of Australia at the request of Departments of the Commonwealth Government for use in relation to the supply of materials required for defence purposes. In appropriate cases these specifications will be reviewed for inclusion in the normal series of Australian standards.

This specification covers the alloy generally known as "A.A.3.S."
The specific gravity of this alloy is 2.73.

1. Quality of Material.

(a) The aluminium used in the manufacture of this alloy shall comply with the latest issue of British Standard No. L.31.

(b) No scrap shall be used in the manufacture of this alloy other than that produced in the manufacturer's own works.

2. Chemical Composition.

(a) The chemical composition of the alloy shall be :

Manganese	...	...	...	...	1.00 to 1.50%
Copper	...	...	...	...	0.20% maximum
Iron	...	...	...	...	0.70% "
Silicon	...	...	...	...	0.60% "
Zinc	...	...	...	...	0.03% "
Other metallic impurities, each	...	...	...	...	0.03% "
Other metallic impurities, total	...	...	...	...	0.10% "
Aluminium	...	...	...	...	the remainder.

(b) The analysis of not less than 5% of the casts of the alloy shall be determined. The minimum number of analyses required may be increased by the purchaser or his representative if he is not satisfied with the conditions of manufacture.

3. Manufacture. The tubes shall be solid drawn. Ends shall be cut square.

4. Condition.

(a) The tubes shall be uniform in quality and temper and shall be supplied in one of the following conditions as specified on the order :

- (i) Annealed
- (ii) Half hard
- (iii) Hard.

(b) Material in any one of the above conditions shall comply with the mechanical test requirements specified for that condition in Clause 9.

5. Freedom from Defects.

(a) The exterior and interior surfaces of the tubes shall be clean, smooth, and free from seams, slivers, laminations, grooves, cracks and other injurious defects.

(b) Any tube may be rejected for faults in manufacture notwithstanding that it has been passed previously on chemical composition and mechanical tests.

6. Dimensions.*

(a) *Diameter.* The nominal diameter of the tubes shall not differ at any point from the specified diameter by more than the following :

Nominal outside diameter		Permissible variation in diameter
in.		in.
Up to $\frac{1}{2}$		± 0.003
Above $\frac{1}{2}$ and up to 1		± 0.004
” 1	2	± 0.005
” 2	3	± 0.006
” 3	5	± 0.008
” 5	6	± 0.010
” 6	8	± 0.015

(b) *Thickness.* Unless otherwise specified by the purchaser, the wall thickness of the tubes at any point, whether due to eccentricity or other causes, shall not differ from the nominal thickness by more than the following :

Nominal wall thickness		Permissible variation in wall thickness
S.W.G.	in.	in.
22	0.028	± 0.005
20	0.036	± 0.005
18	0.048	± 0.006
16	0.064	± 0.007
14	0.080	± 0.008
12	0.104	± 0.009
10	0.128	± 0.010
8	0.160	± 0.020
6	0.192	± 0.020

7. Straightness.

(a) Tubes shall be free from kinks and sharp bends and shall be commercially straight, or alternatively

(b) if specified by the purchaser, the departure from straightness of tubes, measured over a selected length of approximately 4 ft. in any part of each tube, shall not exceed the limits given below :

Nominal outside diameter	Permissible variation in straightness
in.	
$\frac{3}{8}$ and up to 2	1 part in 200 parts of length
Above 2 and up to 6	1 ” 400 ”
Above 6	1 ” 600 ”

*NOTE.—No standard sizes of tubes are specified. The following table shows approximately the thicknesses that can be supplied for tubes of the outside diameters shown.

Nominal outside diameter	Wall thickness
in.	S.W.G.
$\frac{1}{4}$ to 1	22
$\frac{1}{4}$ to $2\frac{1}{4}$	20
$\frac{1}{4}$ to $2\frac{1}{2}$, $2\frac{3}{8}$ and $2\frac{1}{2}$	18
$\frac{1}{4}$ to 3	16
$\frac{5}{8}$ to 3	14
$1\frac{1}{2}$ to 3	12
$1\frac{7}{8}$ to 3	10

The outside diameters of the tubes increase in steps of $\frac{1}{8}$ in. except between $2\frac{1}{4}$ and 3 in. diameter where the steps increase by $\frac{1}{4}$ in.

8. Selection and Preparation of Mechanical Test Samples.

(a) Tubes of the same nominal dimensions, made from the same cast and in the same condition, shall be grouped in parcels. Each parcel shall not contain more than the following amount of material:

Nominal outside diameter	Maximum length of tubing in each parcel
in.	ft.
Up to $\frac{1}{2}$	2000
Above $\frac{1}{2}$ and up to 1	1600
Above 1 and up to 3	1200
Above 3	800

(b) One tube shall be selected from each parcel. A test sample shall be cut from this tube for the tensile test specified in Clause 9 (a).

(c) A tensile test piece, consisting of a full section of the tube, flattened or plugged sufficiently at the ends for gripping, shall be prepared from the above sample. The effective unflattened or unplugged length shall be not less than 4 in., and the elongation shall be measured on a gauge length of 2 in.

When the tube in full section exceeds the capacity of the testing machine, the test piece shall consist of a strip machined from the test sample.

(d) A sample for the flattening test specified in Clause 9 (b) shall be cut from a tube selected from each parcel of annealed material. No flattening test is specified for material in the half hard or hard conditions.

(e) A flattening test piece, consisting of a full section of the tube, and of length equal to one and a half times the outside diameter of the tube up to a maximum length of 6 in., shall be prepared from the flattening test sample. The ends of the test piece shall be normal to the longitudinal axis of the tube.

(f) All test samples shall be marked, before they are cut from the tubes, in such a manner as will ensure positive identification of each sample with the material it represents, and shall not be further heat-treated or mechanically worked before testing.

9. Tests.

(a) *Tensile Test.* The tensile test pieces, selected and prepared as specified in Clause 8, shall comply with the appropriate requirements specified below:

Condition	Nominal wall thickness		Tensile strength	Elongation % on 2 in. (min.)
	S.W.G.	in.		
ANNEALED	22 and less	.028 and less	8.5 (max.)	20
	21 to 18	.029 to .048	"	25
	17 to 6	.049 to .192	"	30
HALF HARD	22 and less	.028 and less	8.5 (min.)	4
	21 to 18	.029 to .048	"	5
	17 to 6	.049 to .192	"	7
HARD	22 and less	.028 and less	12.0 (min.)	2
	21 to 18	.029 to .048	"	3
	17 to 6	.049 to .192	"	4

For tubes tested in their unreduced section, the above tensile strengths shall be calculated on the nominal sectional area of the tube. In all other cases, the values shall be calculated on the actual dimensions of the test pieces.

The load shall be applied axially.

Should a tensile test piece break outside the middle half of its gauge length, the test may be discarded and another test made.

(b) *Flattening Test.* Each flattening test piece, selected and prepared as specified in Clause 8, shall withstand without showing signs of cracking being flattened sideways until the interior surfaces of the test piece meet. The load shall be applied gradually.

10. Re-tests.

(a) If any test piece selected in accordance with Clause 8 fails to comply with the test applied to it, two further samples shall be selected from the same parcel and shall be tested similarly.

One of the samples shall be from the tube from which the original test sample was taken, unless that tube has been withdrawn by the manufacturer.

If either of the test pieces prepared from these further samples fails to comply with the appropriate requirements specified in Clause 9, the parcel represented thereby shall be rejected.

11. Air Pressure Test. If called for on the order, every tube shall be immersed in a water bath and subjected to an internal air pressure of 5 lb. per sq. in. The tubes shall withstand this test without showing signs of leakage. Any tube which fails to pass this test may be rejected.

12. Identification.

(a) Each tube shall, unless otherwise agreed between the manufacturer and the purchaser, be colour identified in accordance with the provisions of Australian Standard No. (E)D.500.*

(b) All tubes $\frac{1}{2}$ in. outside diameter and less, from the same cast and in the same condition, shall be wired up in bundles to each of which shall be securely attached a durable tag bearing such marks as will ensure full identification of the tubes with this specification, with their particular cast and condition, and with the manufacturer.

(c) Each tube over $\frac{1}{2}$ in. outside diameter shall be marked near one end or on the colour bands in such a manner as will ensure full identification of the tube with this specification, with its particular cast and condition and with the manufacturer. The markings shall be ink-stamped or applied in a manner which will not damage the tube.

*A.S. No. (E)D.500, "Colour Identification of Metallic Materials for Aircraft."

This specification, prepared by the Special Committee on Aircraft Materials and Components, was approved on behalf of the Council of the Association on 13th October, 1942.

NOTE.

In order to keep abreast of progress in the industries concerned, Australian standards are subject to periodical review. Suggestions for improvement, addressed to the Headquarters of the Association, will be welcomed.

