

STANDARDS ASSOCIATION OF AUSTRALIA.

Headquarters :
Science House, Gloucester and Essex Streets, Sydney.

AUSTRALIAN STANDARD SPECIFICATION FOR AIRCRAFT MATERIAL
(Emergency Series)

ALUMINIUM COATED ALUMINIUM ALLOY
SHEETS AND STRIPS.

(Specific gravity not greater than 2.85)

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 "Alclad A.A.24S."

1. Quality of Material.

(a) The sheets and strips shall consist of a core of the alloy specified in Clause 2 (a) coated uniformly on both sides with aluminium of the quality specified in Clause 2 (b).

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

(c) The copper used in the manufacture of the core shall be of a standard of purity equal to that of electrolytic copper.

(d) 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 comprising the core of the sheets and strips shall be :

Copper	...	...	...	...	...	3.60 to 4.70%
Magnesium	...	...	...	...	...	1.25 to 1.75%
Manganese	...	...	...	...	...	0.30 to 0.90%
Iron	...	...	...	...	...	0.40% maximum
Silicon	...	...	...	...	...	0.50% "
Aluminium	not less than 92%.

(b) The composition of the coating shall be :

Aluminium	99.5% minimum.
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(c) The complete analysis of every cast from which the core of the material has been prepared shall be supplied to the inspector.

3. Heat-Treatment.

(a) The sheets and strips shall be supplied in one of the following conditions, as specified on the order :

- (i) Annealed.
- (ii) Quenched and aged.
- (iii) Quenched, aged and work hardened.

(b) Material in any one of the above conditions shall comply with the mechanical test requirements specified for that condition in Clause 7.

(c) Sheets and strips required in the quenched and aged condition shall be heated uniformly at a temperature of $490^{\circ}\text{C.} \pm 10^{\circ}\text{C.}$ and quenched in water or oil. They shall then be aged at room temperature for five days.

NOTE.—Under no circumstances should the temperature of the material be allowed to exceed 500°C. , owing to the danger of overheating and rendering it brittle in consequence.

4. Freedom from Defects.

(a) The sheets and strips shall be uniform in quality and temper, clean, smooth, commercially flat and free from severe buckles and other defects of manufacture.

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

5. Margins of Manufacture.

(a) The margins of manufacture on the nominal thickness of the sheets and strips shall not exceed those given in Tables 1 and 2 respectively of the Appendix.

(b) The margins of manufacture on the nominal width of the sheared strips shall not exceed those given in Tables 3 or 4 of the Appendix. The class of tolerance required shall be stated on the order.

(c) Unless otherwise agreed between the purchaser and the manufacturer, each strip, unless ordered in short lengths, shall be so free from lateral curvature that when laid out flat no part of its edge shall be distant from a 10 ft. chord by more than the following amount :

Class A	...	...	$\frac{1}{4}$ in.
Class B	...	...	1 in.

The class of tolerance required shall be stated on the order.

6. Selection and Preparation of Mechanical Test Samples.

(a) Sheets or strips of the same nominal thickness, made from the same cast and in the same condition, shall be grouped in parcels not exceeding 300 lb. in weight.

(b) One tensile and one bend test sample shall be cut from one sheet or strip selected from each parcel by the inspector. When annealed material is ordered, an additional equal number of tensile and bend test samples shall be taken from the selected sheet or strip for tests in the quenched and aged condition. These latter samples shall be heat-treated and aged in accordance with Clause 3 (c) before being submitted to the tests specified for quenched and aged material.

(c) All test samples shall be marked as directed by the inspector before they are cut from the sheets or strips, and shall not be further mechanically worked before testing, and unless the material is ordered in the annealed condition, shall not be further heat-treated.

(d) One test piece shall be cut from each tensile test sample selected.

(e) The tensile test samples from all material over 12 in. wide shall be cut so that the longitudinal axis of the test piece is at right angles to the direction of final rolling. The tensile test samples from material 12 in. wide and under shall be cut so that the longitudinal axis of the test piece is parallel to the direction of final rolling.

The width of the tensile test piece, where possible, shall be not less than $\frac{1}{2}$ in. and the elongation shall be measured on a gauge length of 2 in.*

(f) All bend test pieces shall be $\frac{1}{2}$ in. wide. Two test pieces shall be taken from each bend test sample selected in accordance with Clause 6 (b), one at right angles and the other parallel to the direction of final rolling.

(g) All test pieces representing material in the quenched and aged condition shall be aged for five days before testing.

*A suitable test piece is shown in B.S. No. 485, "Tests on Thin Metal Sheet and Strip."

7. Mechanical Tests. The mechanical properties of test pieces machined from the samples selected and prepared as specified in Clause 6 shall comply with the following requirements to the satisfaction of the inspector.

(a) *Tensile Test.* The selected tensile test pieces shall comply with the appropriate requirements specified below :

Condition	Tensile Strength (min.)	0.1% Proof Stress (min.)	Elongation % on 2 in. (min.)				
			Less than 0.020 in. thick	.020 to .031 in. thick	.032 to .040 in. thick	.041 to .064 in. thick	.065 in. thick & over
ANNEALED	tons per sq. in. 13.5 (max.)	—	8	8	10	10	12
QUENCHED AND AGED	25	16	12	15	15	15	15
QUENCHED, AGED AND WORK HARDENED	26	20	—	8	9	10	10

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) *Single Bend Test.* Each bend test piece shall withstand without cracking being bent by steadily applied pressure through 180° round a radius equal to N times the nominal thickness of the sheet or strip, care being taken to ensure continued contact between the test piece and the former. The value of N is as follows :

Thickness of material	Bend Test Factor N		
	Annealed material	Quenched and aged material	Quenched, aged and work hardened material
in. less than .020	0	4	—
.020 to .031	0	4	4
.032 to .040	1	4	4
.041 to .064	1	5	5
.065 and over	2	5	6

8. Re-tests. If any test piece fails to comply with the mechanical tests specified in Clause 7, the inspector may reject the parcel represented by that test piece, or at the request of the manufacturer adopt either of the following procedures :

- (i) Select two further tensile test samples and two bend test samples from the relevant parcel, one of each of which shall be taken from the sheet or strip from which the rejected test piece was taken, unless that sheet or strip has been withdrawn by the manufacturer.

One tensile test piece shall be prepared from each tensile test sample in accordance with Clause 6 (e), and two bend test pieces from each bend test sample in accordance with Clause 6 (f).

If all test pieces fulfil the requirements specified in Clause 7 the parcel may be accepted.

- (ii) Allow the parcel to be re-heat-treated in accordance with Clause 3 and re-tested in accordance with Clauses 6 and 7.

9. Identification.

(a) Each sheet and strip 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) Each sheet and strip shall be ink-stamped on one corner or on the colour bands in such a manner as will ensure full identification of the sheets and strips with this specification, with the cast and heat-treatment batch numbers and with the manufacturer.

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

APPENDIX

MARGINS OF MANUFACTURE.

Table 1.—Sheets.

Nominal thickness.							Tolerance on thickness.
in.				S.W.G.			in.
Thinner than 0.028	...	...	...	Thinner than 22	...	...	+0.004-0
0.028 to thinner than 0.048	...	...	...	22 to thinner than 18	...	...	+0.006-0
0.048	''	''	0.092	18	''	13	+0.008-0
0.092	''	''	0.144	13	''	9	+0.010-0
0.144 to 0.192	...	...	...	9 to 6	...	...	+0.012-0

For sheets over 3 ft. wide an additional plus tolerance of 0.002 in. will be accepted. For sheets thicker than 6 S.W.G. (0.192 in.) the tolerance on thickness shall be plus 10%, minus 0, of the nominal thickness.

Table 2.—Strips.

Nominal thickness.				Tolerance on thickness.		
				Maximum width of strip.		
				12 in.	16 in.	20 in.
in.				in.	in.	in.
				S.W.G.		
0.008	...	...	...	+0.002-0	—	—
0.012	...	...	...	+0.002-0	—	—
0.016	...	...	...	+0.002-0	—	—
0.020	...	...	...	+0.002-0	+0.002-0	+0.003-0
0.022	...	...	...	+0.002-0	+0.003-0	+0.003-0
0.024	...	...	...	+0.003-0	+0.003-0	+0.003-0
0.028	...	...	...	+0.003-0	+0.003-0	+0.003-0
0.032	...	...	...	+0.004-0	+0.004-0	+0.004-0
0.036	...	...	...	+0.004-0	+0.004-0	+0.004-0
0.040	...	...	...	+0.004-0	+0.004-0	+0.004-0
Thicker than 0.040 to 0.080	...	...	...	+0.005-0	+0.005-0	+0.005-0
'' '' 0.080 to 0.104	...	...	...	+0.007-0	+0.007-0	+0.007-0
'' '' 0.104 to 0.144	...	...	...	+0.008-0	+0.008-0	+0.008-0
'' '' 0.144 to 0.192	...	...	...	+0.010-0	+0.010-0	+0.010-0

Table 3.—Ordinary Tolerances, on Width of Sheared Strips.

Nominal width of strip.	Nominal thickness of sheared strip.	Tolerance on width of sheared strip.
1/4 in. to 4 in. ...	in.	
	— Up to and including 0.036 (20 S.W.G.)	+0 - 1/32 in.
	— Over 0.036 (20 S.W.G.) and under 0.160 (8 S.W.G.)	+0 - 1/16 ''
	— 0.160 (8 S.W.G.) and thicker	+0 - 3/32 ''
Over 4 in. and up to 16 in.	— Under 0.128 (10 S.W.G.)	+0 - 1/16 in.
	— 0.128 (10 S.W.G.) and thicker	+0 - 3/32 ''

For strips over 16 in. wide, the tolerances shall be determined by agreement between the purchaser and the manufacturer.

Table 4.—Special Tolerances, on Width of Sheared Strips.

1	2	3
Nominal width of strip.	Nominal thickness of strip.	Tolerance on width of sheared strip.
in. Under 4	in. Under 0.020 0.020 to 0.031 0.032 to 0.047 0.048 to 0.063 0.064 to 0.091 0.092 to 0.127 0.128 to 0.159 0.160 to 0.191 0.192 to 0.232	in. +0-0.012 +0-0.012 +0-0.015 +0-0.015 +0-0.020 +0-0.032 +0-0.032 +0-0.064 +0-0.064
4 and under 6	Under 0.020 0.020 to 0.031 0.032 to 0.047 0.048 to 0.063 0.064 to 0.091 0.092 to 0.127 0.128 to 0.159 0.160 to 0.191 0.192 to 0.232	+0-0.012 +0-0.015 +0-0.020 +0-0.020 +0-0.025 +0-0.032 +0-0.032 +0-0.064 +0-0.064
6 and under 10	Under 0.020 0.020 to 0.031 0.032 to 0.047 0.048 to 0.063 0.064 to 0.091 0.092 to 0.127 0.128 to 0.159 0.160 to 0.191 0.192 to 0.232	+0-0.015 +0-0.020 +0-0.025 +0-0.025 +0-0.030 +0-0.035 +0-0.035 +0-0.064 +0-0.064
10 and under 16	Under 0.020 0.020 to 0.031 0.032 to 0.047 0.048 to 0.063 0.064 to 0.091 0.092 to 0.127 0.128 to 0.159 0.160 to 0.191 0.192 to 0.232	+0-0.020 +0-0.025 +0-0.030 +0-0.030 +0-0.035 +0-0.035 +0-0.040 +0-0.064 +0-0.064

For strips over 16 in. wide, the tolerances shall be determined by agreement between the purchaser and the manufacturer.

For the purposes of this specification the term "Inspector" shall be interpreted in the manner directed by the Australian Airworthiness Authority concerned.

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