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EMERGENCY STANDARD
No. (E) D. 649—1942

STANDARDS ASSOCIATION OF AUSTRALIA.

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

AUSTRALIAN STANDARD SPECIFICATION FOR AIRCRAFT MATERIAL
(Emergency Series)

ALUMINIUM ALLOY BARS AND SECTIONS

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.24S."

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) The copper used for making this alloy shall be of a standard of purity equal to that of electrolytic copper.
- (c) 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 :

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 92.0%

(b) The complete analysis of every cast shall be supplied to the inspector.

3. Condition.

- (a) Material shall be supplied in either of the following conditions as specified on the order :
 - (i) Fully annealed.
 - (ii) Heat-treated and aged. ✓
- (b) Material in either of the above conditions shall comply with the mechanical test requirements specified for that condition in Clause 8.

4. Freedom from Defects.

- (a) The material shall be uniform in quality and temper, clean, sound, smooth and free from defects of manufacture. Extruded shapes shall be free from harmful die scores and marks, and other extruding defects.
- (b) Any material may be rejected for faults in manufacture, notwithstanding that it has been passed previously on chemical composition and mechanical tests.

5. **Straightness.** All bars and sections shall be straight.

6. **Margins of Manufacture.**

(a) The margins of manufacture for extruded or rolled bars up to 4 in. diameter or width across flats shall be in accordance with Table 1 for round, square and rectangular bars, and Table 2 for hexagonal bars.

The margins of manufacture for extruded or rolled bars greater than 4 in. diameter or width across flats shall be not greater than plus or minus one per cent of the nominal diameter or width across flats.

(b) The margins of manufacture for hammered bars shall not exceed plus or minus $\frac{1}{8}$ in.

(c) Unless otherwise agreed between the purchaser and manufacturer the margins of manufacture for extruded sections shall not depart from the sectional dimensions specified by more than the tolerances prescribed in Table 3.

NOTE:—For Tables 1, 2 and 3 see Appendix.

7. **Selection and Preparation of Mechanical Test Samples.**

(a) Bars of the same size or extrusions of the same sectional form, from the same cast and heat-treated together, shall be grouped in parcels and the inspector shall select one test sample from a bar or section in each parcel for the tensile test specified in Clause 8.

(b) The test samples shall be marked as directed by the inspector and shall then be removed from the bars by nicking and breaking off, or they may be sawn and, after separation from the bar, fractured. The fractured surfaces shall show freedom from pipe or other defect. Test samples shall be removed from extruded sections by sawing.

(c) For bars up to and including $1\frac{1}{8}$ in. diameter or width across flats, the tensile test piece shall be machined concentrically from the test sample.

For bars over $1\frac{1}{8}$ in. diameter or width across flats the longitudinal axis of the tensile test piece shall be not less than $\frac{9}{16}$ in. from the surface of the test sample.

(d) The test samples shall not be further heat-treated or mechanically worked before testing.

(e) The tensile test pieces shall be machined to the dimensions of the largest possible size of British standard tensile test piece, Fig. 1, 2, 3 or 4 of B.S. No. 2A.4.

The parallel portion of any test piece may be increased in length to accommodate the extensometer employed.

8. **Tensile Test.**

(a) The mechanical properties of the test pieces machined from the samples selected and prepared as specified in Clause 7 shall comply with the appropriate requirements specified below, to the satisfaction of the inspector :

Condition	Tensile Strength (min.)		0.1% Proof Stress (min.)		Elongation % on 2 in. (min.)		
	Rolled bars	Shapes and extrusions	Rolled bars	Shapes and extrusions	Rect-angles	Rounds, squares, hexagons, and octagons	Extruded shapes
FULLY ANNEALED	tons per sq. in. 15 (max.)	tons per sq. in. 15 (max.)	—	—	16	16	—
HEAT-TREATED AND AGED	28	26	17	18	14	16	12

(b) 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.

9. **Hardness Test.** A hardness test shall be carried out by an approved method on all the bars or sections in each parcel specified in Clause 7 (a) and on the test sample selected from that parcel. In any parcel the hardness value on each bar or section shall be not more than $7\frac{1}{2}\%$ greater nor $7\frac{1}{2}\%$ less than the mean hardness of all the bars or sections of that size in the parcel, and furthermore the hardness value of each bar or section in the parcel shall be not more than 10% below that obtained on the test sample representing that parcel. All hardness determinations made on test samples, bars or sections shall be made under the same conditions of testing.

10. Re-tests.

(a) If any test piece fails to comply with the tensile test specified in Clause 8, 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 for test from the same parcel two further samples one of which must be from the bar or section from which the original test sample was taken unless that bar or section has been withdrawn by the manufacturer. Test pieces prepared from these two samples as specified in Clause 7 shall comply with the tensile test specified in Clause 8, or
- (ii) allow the parcel to be re-heat-treated and re-tested in accordance with Clauses 7, 8, and 9.

(b) If any bars or sections fail to comply with the hardness test specified in Clause 9, they may be rejected or be re-heat-treated and re-tested in accordance with Clauses 7, 8, and 9.

11. Identification.

(a) Each bar and section 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 bars and sections under 1 in. nominal dimension, from the same cast and heat-treated together, 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 bars and sections with this specification, with the cast and heat-treatment batch numbers and with the manufacturer.

(c) Each bar and section 1 in. and over in any sectional dimension shall be stamped near one end or on the colour bands with such marks as will ensure full identification of the bars and sections with this specification, with the cast and heat-treatment batch numbers and with the manufacturer.

APPENDIX
MARGINS OF MANUFACTURE
TABLE 1
Round, Square and Rectangular* Bars

1	2	
Nominal size of bar (diameter or width across flats)	Margin of manufacture	
in.	in.	
$\frac{1}{16}$ (0.25)	±0.002	
$\frac{5}{16}$ (0.3125)		
$\frac{3}{8}$ (0.375)		
$\frac{7}{16}$ (0.4375)		
$\frac{1}{2}$ (0.5)		
$\frac{9}{16}$ (0.5625)	±0.003	
$\frac{5}{8}$ (0.625)		
$\frac{3}{4}$ (0.75)		
$\frac{7}{8}$ (0.875)		
1		
$1\frac{1}{16}$ (1.125)	±0.004	
$1\frac{1}{8}$ (1.25)		
$1\frac{3}{16}$ (1.375)		
$1\frac{1}{2}$ (1.5)		
$1\frac{5}{8}$ (1.625)		
$1\frac{3}{4}$ (1.75)	±0.005	
$1\frac{7}{8}$ (1.875)		
2		
Over 2 to $2\frac{5}{8}$		±0.008
Over $2\frac{5}{8}$ to 3		±0.010
Over 3	± 1%	

*In the case of rectangular bars the margins of manufacture for the two widths across flats shall be those given for the corresponding dimensions in Column 1 of the above table.

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

TABLE 2
Hexagon Bars

Width across flats		Margin of manufacture
Max. in.	Min. in.	in.
0-193	0-189	0-004
0-248	0-244	0-004
0-324	0-320	0-004
0-413	0-409	0-004
0-445	0-441	0-004
0-525	0-521	0-004
0-600	0-596	0-004
0-710	0-706	0-004
0-820	0-815	0-005
0-920	0-915	0-005
1-010	1-005	0-005
1-100	1-095	0-005
1-200	1-195	0-005
1-300	1-295	0-005
1-480	1-474	0-006
1-670	1-664	0-006
1-860	1-854	0-006
2-050	2-042	0-008
2-220	2-212	0-008
2-410	2-402	0-008
2-580	2-570	0-010
2-760	2-750	0-010

TABLE 3
Extruded Sections

Nominal Size	Margin of Manufacture
in.	in.
$\frac{1}{8}$ and less	$\pm 0-007$
Over $\frac{1}{8}$ to $\frac{1}{4}$	$\pm 0-010$
Over $\frac{1}{4}$ to 1	$\pm 0-015$
Over 1 to 2	$\pm 0-017$
Over 2 to 3	$\pm 0-020$
Over 3 to 4	$\pm 0-025$
Over 4 to 5	$\pm 0-030$
Over 5	$\pm 0-035$

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 4th September, 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.