

AUGUST, 1942

Inspector-in-Charge A.I.D.  
Commercial Steels & Forge Pty. Ltd.  
Lidcombe.

EMERGENCY STANDARD  
No. (E)D.536—1942

(C.A. 104B)

STANDARDS ASSOCIATION OF AUSTRALIA.

Headquarters :

Science House, Gloucester and Essex Streets, Sydney.

AUSTRALIAN STANDARD SPECIFICATION FOR AIRCRAFT MATERIAL  
(Emergency Series)

CHROME-MOLYBDENUM STEEL SHEETS  
(Suitable for Welding)

*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.*

1. **Chemical Composition.**

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

Carbon	-	-	-	-	0.25 to 0.35%
Manganese	-	-	-	-	0.40 to 0.80%
Phosphorus	-	-	-	-	0.05% maximum
Sulphur	-	-	-	-	0.05% „
Chromium	-	-	-	-	0.80 to 1.10%
Molybdenum	-	-	-	-	0.15 to 0.25%
Silicon	-	-	-	-	0.15 to 0.30%

(b) The complete analysis of every cast shall be supplied by the steel-maker.

2. **Inspection of Blooms.** Every bloom shall be inspected at both ends and any showing signs of pipe shall be rejected or cut back to sound metal. One of the top end blooms so passed shall be examined by sulphur-printing or deep etching and if any harmful segregation is noticed, all of the top end blooms in the heat shall be similarly examined.

3. **Manufacture.** All surface defects in the blooms, billets or bars which might produce defects in the sheets made therefrom shall be removed by rough machining, chipping, grinding or scarfing.

4. **Condition.** The sheets shall be delivered in the normalised condition, unless otherwise specified on the order.\*

5. **Freedom from Defects.**

(a) The sheets shall be free from defects.

(b) The sheets shall be so free from curvature that when laid out flat no part of their edges shall be distant from a 6 ft. chord by more than  $\frac{1}{16}$  in.

\* Material delivered in the annealed condition shall comply with the requirements of Clause 9, after normalising.

Price 1/-, post free 1/2.

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6. **Margins of Manufacture.** The margins of manufacture shall be as follows :

(a) *Tolerance on Thickness of Sheets.*

Nominal Thickness.	Tolerance.
In.	In.
0.250 to 0.220	+0.016 —0
0.219 to 0.190	+0.016 —0
0.189 to 0.160	+0.016 —0
0.159 to 0.140	+0.016 —0
0.139 to 0.120	+0.016 —0
0.119 to 0.100	+0.016 —0
0.099 to 0.080	+0.016 —0
0.079 to 0.070	+0.012 —0
0.069 to 0.060	+0.012 —0
0.059 to 0.050	+0.008 —0
0.049 to 0.040	+0.008 —0
0.039 to 0.030	+0.006 —0
0.029 to 0.020	+0.004 —0
0.019 and thinner	+0.004 —0

(b) *Tolerance on Nominal Length and Width.* The sheets shall be not less than the nominal dimensions ordered.

#### 7. Selection and Preparation of Test Samples.

(a) Sheets from the same cast and heat-treated together shall be grouped in parcels.

(b) Each sheet 12 S.W.G. (0.104 in.) and thinner shall be subjected to a single bend test on a corner as specified in Clause 9 (b) and one sheet of the thickest gauge shall be selected from each parcel; test samples shall be cut from the selected sheets for the mechanical tests as specified in Clause 9.

(c) Each sheet thicker than 12 S.W.G. (0.104 in.) shall be subjected to the Brinell (or other approved) hardness test. Two sheets shall be selected from each parcel, one giving the highest and the other the lowest hardness number; test samples shall be cut from the selected sheets for the tensile test specified in Clause 9 (a).

(d) All tensile test samples shall be cut from the selected sheets so that the longitudinal axis of the test piece is at right angles to the direction of final rolling. The tensile test pieces shall have a width of 0.5 in. in the parallel test portion and the elongation shall be measured on a gauge length of 2 in.

(e) All bend test pieces shall be 0.5 in. wide. Two test pieces shall be taken from each selected sheet, one at right angles and the other parallel to the direction of final rolling. Test pieces should be rounded at the edges in such a way that the cross section has approximately semi-circular ends.

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

(g) All test samples shall be marked in such a way as will positively identify them with the sheets from which they are taken.

#### 8. Methods of Testing.

(a) *Tensile Test.* 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.

Proof stress determinations shall be carried out as follows :

- (i) One test sample shall be taken from a sheet from each cast of steel; the sample shall be tested in the normalised condition and the proof stress shall be obtained from an accurately determined load-elongation diagram. The proof stress is defined as that stress at which the stress-strain curve departs by 0.1% of the gauge length from the line of proportionality. This sample shall be broken in tension and the ultimate tensile stress recorded on the diagram.
- (ii) On all remaining tensile test samples proof stress determinations shall be carried out by an approved method.

(b) *Single Bend Test (12 S.W.G. (0.104 in.) and thinner).* The test piece shall be bent through 180° by steadily applied pressure round the end of a former of the specified radius. Bending may be effected by pressing the test piece into lead by means of an appropriate former, and in cases of dispute this method shall be used.

Where the specified radius is less than 0.012 in. the test piece shall first be bent round a radius of 0.012 in. and the U-piece thus formed shall be subsequently closed in a vice until the inner surfaces of the bend are twice the specified radius apart.

9. **Mechanical Properties.** Test pieces selected and prepared in accordance with Clause 7 shall comply with the following tests :

(a) *Tensile Test.*

- (i) Ultimate Tensile Strength - - - - not less than 40 tons per sq. in.
- (ii) 0.1% Proof Stress - - - - not less than 30 tons per sq. in.
- (iii) Elongation (on 2 in. gauge length) :
  - Over  $\frac{3}{16}$  in. thick - - - - not less than 20%
  - 0.128 in. to  $\frac{3}{16}$  in. thick - - - - " " 15%
  - 0.064 in. to 0.127 in. thick - - - - " " 12%
  - 0.063 in. and thinner - - - - " " 10%

(b) *Bend Tests (12 S.W.G. (0.104 in.) and thinner).* A corner of each sheet, and single bend test samples selected and prepared as specified in Clause 7, shall withstand a bend through 180° over a radius equal to half the thickness of the sheet without showing signs of cracking.

Notwithstanding Clause 10 below, all sheets failing in the corner bend test shall be rejected.

10. **Re-tests and Rejection of Material.**

- (a) If any test piece fails to meet the requirements of Clause 9 :
  - (i) the manufacturer may withdraw the parcel represented by the test piece, or
  - (ii) two further samples from the same parcel may be selected, one sample of which shall be from the sheet from which the original test piece was taken unless that sheet has been withdrawn by the manufacturer ; if either sample fails to meet the requirements of Clause 9, the parcel shall be rejected, or
  - (iii) the manufacturer may re-heat-treat and re-submit the parcel for inspection and testing.
- (b) Any sheet may be rejected for faults in manufacture notwithstanding that it has been passed previously for chemical composition and physical properties.

11. **Identification.**

- (a) All sheets 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) In addition, all sheets shall be stamped on or near the colour bands in such a manner as will ensure identification of the sheets 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 ", in course of preparation.

This specification, prepared by the Special Committee on Aircraft Materials and Components, was approved on behalf of the Council of the Association on 21st July, 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.

