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EMERGENCY STANDARD  
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STANDARDS ASSOCIATION OF AUSTRALIA.

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

AUSTRALIAN STANDARD SPECIFICATION FOR AIRCRAFT MATERIAL  
(Emergency Series)

## CHROME-MOLYBDENUM STEEL BARS FOR MACHINING.

- Section I. Provisions Applicable to all Sections of this Specification.  
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*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.*

### SECTION I.

Provisions Applicable to all Sections of this Specification.

1. **Chemical Composition.** (a) The chemical composition of the steel 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 0.35%

- (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 or billets which might produce defects in the bars made therefrom shall be removed by rough machining, chipping, grinding or scarfing.

4. **Heat-Treatment.** (a) All bars  $1\frac{1}{2}$  in. nominal dimension and under shall be normalised or hardened\* and tempered to give the mechanical properties specified in Clause 5, and shall be delivered in this condition.

(b) All bars over  $1\frac{1}{2}$  in. nominal dimension shall be delivered in the "as rolled" or normalised conditions, as stated on the order, and parts made therefrom shall be subsequently heat-treated to give the mechanical properties specified in Clause 5.

(c) All bright bars shall be heat-treated before or after the bars are cold rolled, drawn or ground to size.

(d) Details of the heat-treatment given shall be supplied by the manufacturer.

\*All bars up to and including  $\frac{3}{4}$  in. nominal dimension shall be quenched in oil, but water quenching may be necessary with bars of heavier section to obtain satisfactory Izod figures.

**5. Mechanical Properties.** Test pieces selected and prepared in accordance with Clauses 6 and 9 shall comply with the following tests:

- (a) (i) Ultimate Tensile Strength ... .. not less than 45 tons per sq. in.
- (ii) 0.1% Proof Stress ... .. not less than 35 tons per sq. in.
- (iii) Elongation on gauge length  $4\sqrt{A}$  ... not less than 20%
- (iv) Izod value\*
- (v) Nicked fracture test ... .. see Clause 11.

(b) When the dimension of the test sample for the notched bar test is too small to make one of the B.S. Izod test pieces, the nicked fracture test (Clause 11) shall be substituted for the Izod test.

**6. Preparation of Mechanical Test Pieces.** (a) Test pieces shall be prepared from the samples specified in Clause 9 to the dimensions shown in the latest issue of British Standard No. A. 4, and shall not be further heat-treated or mechanically worked before testing.

(b) For bars up to and including  $1\frac{1}{2}$  in. diameter or width across flats, the tensile and Izod test pieces shall be machined concentrically from the test sample.

(c) For bars over  $1\frac{1}{2}$  in. diameter or width across flats, the longitudinal axes of the tensile and Izod test pieces shall coincide with a position halfway between the centre and surface of the test sample.

(d) Should any test piece break outside the middle half of the gauge length, the test may be discarded and another test made.

(e) All test pieces shall be marked in such a way as will positively identify them with the parcel of material they represent.

**7. Re-tests and Rejection of Material.** (a) If the material fails to meet the requirements of Clause 5, the manufacturer may:

- (i) withdraw the parcel represented by the test piece, or
- (ii) re-heat-treat the whole parcel and re-submit it for inspection and testing. If the material again fails to meet the requirements of Clause 5, the parcel shall be rejected.

(b) Any material may be rejected for faults in manufacture notwithstanding that it has been passed previously for chemical composition and physical properties.

## SECTION II.

(No Specification).

## SECTION III.

### (E)D. 535-B. Bars for Machining.

NOTE.—It is desired to draw attention to the undesirability of using heat-treated bars of large diameter for the production of machined parts, owing to the difficulty of obtaining the specified mechanical properties, particularly the Izod value, from such bars.

Where bars over  $1\frac{1}{2}$  in. nominal dimension are required for the manufacture of machined parts of primary structural importance, users of this material shall heat-treat the parts after rough machining. The ruling thickness of such machined parts should, in regions of structural importance, not exceed  $\frac{1}{4}$  in.

**8. Margins of Manufacture.** (a) The margins of manufacture shall be in accordance with the order to the steel-maker.

(b) All bars shall be commercially straight.

**9. Selection and Preparation of Test Samples.** (a) Bars of the same size from the same cast and heat-treated together shall be grouped in parcels of not more than one ton weight.

- (b) (i) For bars of  $\frac{1}{2}$  in. nominal dimension and over, each bar shall be tested for hardness.
- (ii) For bars under  $\frac{1}{2}$  in. nominal dimension, 10% of each parcel shall be tested for hardness.
- (iii) Two test samples representing each parcel shall be selected, one from the hardest bar and one from the softest bar as determined in (i) and (ii) of this sub-clause. The test samples shall be of sufficient size to enable the tensile and notched bar test pieces both to be machined from the one sample.
- (iv) For large bars the test samples may be reduced by forging or machining to  $1\frac{1}{2}$  in. diameter before heat-treatment.

(c) Test samples shall be marked in such a way as will positively identify them with the bars from which they are taken.

\*Investigations are in progress to determine a suitable Izod value for inclusion in this specification.

**10. Hardness.** The hardness numbers of all bars tested in accordance with Clause 9 (b) above shall be between 197 and 255 Brinell (4.30 mm. and 3.80 mm.) or equivalent on the scale of the method adopted.

**11. Nicked Fracture Test.** (a) Ten per cent. of all bars for machining shall be subjected to the nicked fracture test. If any bars are found unsatisfactory, all bars of that parcel shall be tested, or the parcel may be re-heat-treated and re-submitted for inspection and testing.

(b) The test piece, nicked or sawn so that the area of the portion to be fractured is not less than one half of the sectional area of the sample, shall show a fibrous structure and be free from defects when broken by a minimum number of blows.

**12. Identification.** (a) Each bar 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 under 1 in. nominal dimension shall be wired up in bundles to each of which shall be securely attached a durable tag bearing such marks as will ensure identification of the bars with this specification, with the cast and heat-treatment batch numbers and with the manufacturer.

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

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

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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.

