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EMERGENCY STANDARD
No. (E) D. 534—1942
(S.A.E. 4140)

STANDARDS ASSOCIATION OF AUSTRALIA.
Headquarters :
Science House, Gloucester and Essex Streets, Sydney.

AUSTRALIAN STANDARD SPECIFICATION FOR AIRCRAFT MATERIAL
(Emergency Series)

CHROME-MOLYBDENUM STEEL FOR FORGINGS.

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	0·35 to 0·45%
Manganese	0·60 to 0·90%
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, billets or bars which might produce defects in the bars or forgings made therefrom shall be removed by rough machining, chipping, grinding, or scarfing.

4. Condition. All bars and billets shall be delivered in the " as rolled " condition, and forgings in the condition as specified on the order.

5. Mechanical Properties. Test pieces, selected and prepared in accordance with Clauses 6, 9 and 15, shall comply with the following tests :

(*a*)	(i) Ultimate Tensile Strength	not less than 56 tons per sq. in.
	(ii) 0·1% Proof Stress	not less than 43 tons per sq. in.
	(iii) Elongation on gauge length $4\sqrt{A}$ ...	not less than 18%
	(iv) Izod value*	
	(v) Nicked fracture test	see Clause 17.

(*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 17) shall be substituted for the Izod test.

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

Price 1/–, *post free* 1/2.

6. Preparation of Mechanical Test Pieces. (*a*) Test pieces shall be prepared from the samples specified in Clauses 9 and 15 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.

(E) D. 534-A. Bars and Billets for Forgings.

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*) From each cast two bars or billets shall be selected for testing.

(*b*) (i) One test sample shall be taken from each bar or billet selected. 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. The test samples shall be heat-treated to give the properties specified in Clause 5.

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

(ii) For large bars and billets 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 or billets from which they are taken.

10. Identification. (*a*) Each bar and billet 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 and billet 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 and billets with this specification, with the cast and heat-treatment batch numbers and with the manufacturer.

SECTION III.

(No Specification).

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

SECTION IV.

(E) D. 534-C. Forgings.

11. Material. The bars or billets for the manufacture of forgings shall comply with Sections I and II of this specification.

12. Margins of Manufacture. The dimensions of the forgings shall be within the limits specified on the relevant drawings.

13. Surface Treatment. The forgings shall be descaled by an approved process and subsequently treated to prevent corrosion.

14. Heat-Treatment. (*a*) All forgings shall be hardened and tempered to give the properties specified in Clause 5.

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

15. Selection and Preparation of Test Samples. (*a*) One test sample, unless more are specified on the order, shall be selected to represent each half ton or less of forgings to the same drawing number, from the same cast and heat-treated together.

(*b*) (i) The test sample shall, where possible, be cut from the actual forging or from a prolongation forged integrally and heat-treated with the forging. Test samples integral with forgings should preferably not be cut off until after final heat-treatment.

(ii) Where samples cannot be cut from forgings they shall be taken from the bars or billets from which the forgings were made and shall be heat-treated with the forgings they represent.

(iii) The test samples may be heat-treated in the size as cut from the bars or billets, or they may be reduced to the ruling thickness of the forgings and heat-treated in that size. Where it is necessary to remove the surface, it shall be done with the minimum reduction of section.

(iv) 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.

All test samples shall be heat-treated with the forgings, or rough machined parts they represent, to give the properties specified in Clause 5.

(*c*) Test samples shall be marked in such a way as will positively identify them with the forgings they represent.

16. Hardness Test. (*a*) All finally heat-treated forgings, or machined parts made therefrom, shall be tested for hardness by an approved method and in such a position (as indicated on the drawing) that the serviceability of the part is not affected.

(*b*) The hardness numbers shall be between 248 and 302 Brinell (3·85 mm. and 3·50 mm.) or equivalent on the scale of the method adopted.

17. Nicked Fracture Test. 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.

18. Identification. (*a*) All forgings under 10 lb. weight of the same part number, from the same cast and heat-treated together, shall be made up into parcels to each of which shall be securely attached a durable tag bearing the part number and such other marks as will ensure identification of the forgings with this specification, with the cast and heat-treatment batch numbers and with the manufacturer.

(*b*) All forgings of 10 lb. weight or over shall be stamped, in the position indicated on the relevant drawing, with the part number and such other marks as will ensure identification of the forging with this specification, with the cast and heat-treatment batch numbers and with the manufacturer.

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.

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