

MARCH, 1947

EMERGENCY STANDARD
No. (E)2D.639—1947
(Superseding No. (E)D. 639—1940)
Being British Ministry of Supply
Material Specification
No. D.T.D. 285A*
endorsed without amendment.

STANDARDS ASSOCIATION OF AUSTRALIA.

Headquarters :

Science House, Gloucester and Essex Streets, Sydney.

AUSTRALIAN STANDARD SPECIFICATION FOR AIRCRAFT MATERIAL
(Emergency Series)

MAGNESIUM ALLOY CASTINGS
(Fully Heat-Treated)

Section I. Ingots
Section II. Castings

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.

First Issued - - - August, 1940
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The double heat-treatment specified in Clause 5 (b) of this specification has the effect of increasing the proof stress of the material.

SECTION I.

Ingots.

1. **Quality of Material.** Ingots for the manufacture of castings to Section II of this specification shall comply in all respects with Clauses 1 to 4 of Section I of Specification D.T.D. 136B,† the chemical composition requirements of which are:

Aluminium	- - -	Not less than 9.0% nor more than 10.5%
Zinc	- - -	Not more than 1.0%
Manganese	- - -	Not less than 0.2% nor more than 0.4%
<i>Impurities:</i>		
Copper	- - -	Not more than 0.15%
Silicon	- - -	Not more than 0.20%
Iron	- - -	Not more than 0.03%
Nickel	- - -	Not more than 0.01%
Total of above impurities	- - -	Not more than 0.35%
Tin	- - -	Not more than 0.10%
Magnesium	- - -	The remainder:-

2. **Provision of Tensile Test Samples.** Tensile tests are required in accordance with Clause 2 of D.T.D. 136B.† The purchaser may also require additional samples to be heat-treated. The appropriate heat-treatment is given in Clause 5 (b) below, and the samples shall then comply with the tests specified in Clause 10 below. When tests on heat-treated samples are required this shall be stated on the order.

* In order to avoid confusion it is recommended that this specification be referred to by its British Ministry of Supply classification No. D.T.D. 285A, by which it is already well known.

† Endorsed without amendment as A.S. No. (E)2D. 639—1947.

SECTION II.

Castings.

3. **Manufacture.** Castings shall be manufactured either from ingots which comply with Section I of this specification or from material whose compliance has not been verified. When ingots complying with Section I are used, the founder's own scrap from material which complies with the chemical composition of this specification may be included. The segregation and storage of such scrap shall be to the satisfaction of the Inspector.

4. **Chemical Composition.**

(a) The chemical composition of the material of the castings shall be :

Aluminium	- - -	Not less than 9.0% nor more than 10.5%
Zinc	- - -	Not more than 1.0%
Manganese	- - -	Not less than 0.15% nor more than 0.4%
<i>Impurities :</i>		
Copper	- - -	Not more than 0.15%
Silicon	- - -	Not more than 0.30%
Iron	- - -	Not more than 0.05%
Nickel	- - -	Not more than 0.01%
Total of above impurities		Not more than 0.40%
Tin	- - -	Not more than 0.10%
Magnesium	- - -	The remainder.

(b) The manufacturer shall supply the complete analysis of the castings to the Inspector as follows :

- (i) Where ingots which comply with Section I of this specification have been used, with or without the addition of the founder's scrap as defined in Clause 3, a minimum of 5% of the casts of alloy shall be subjected to complete analysis for the above specified elements, with an overriding minimum of one complete analysis per week. The minimum number of analyses required may be increased by the Inspector if he is not satisfied with the conditions of manufacture.
- (ii) Where material, whose compliance with Section I of this specification has not been verified, has been used, an analysis of each cast will normally be required.
- (c) A cast shall be defined as :
 - (i) The product of one furnace melt.
 - (ii) The product of one crucible melt.
 - (iii) The product of a number of crucible or furnace melts where such are aggregated and mixed prior to casting.
 - (iv) The amount of metal tapped from the furnace without any further additions of metal having been made, where a continuous melting process is employed, or
 - (v) As may be otherwise defined from time to time.

5. **Heat-Treatment.**

- (a) The castings shall be delivered in the fully heat-treated condition.
- (b) The castings and test samples shall be heated together at a temperature not greater than 435° for not less than 16 hours and cooled in air or quenched in oil or water at the option of the manufacturer. They shall then be re-heated to a temperature not greater than 210° for not less than eight hours and cooled in air or quenched in oil or water at the option of the manufacturer.

6. **Dimensions.** The castings shall be made to the dimensions specified within the limits given in Clause 7 and be capable of being machined where required to the finished dimensions without leaving evidence of the cast surface.

7. **Margins of Manufacture.** The thickness of the castings, where not machined, shall be not less than the nominal thickness and shall not exceed it by more than 10%, unless otherwise agreed between the purchaser and the manufacturer.

8. **Freedom from Defects.**

- (a) The castings shall be clean and sound. They shall be capable of being machined satisfactorily and of taking a good finish.
- (b) Any castings may be rejected for faults of manufacture, defects or incorrectness of dimensions whether discovered during inspection or subsequently during machining, notwithstanding that the casting has been previously passed as conforming to the chemical composition and the mechanical tests of this specification.

9. Provision and Preparation of Tensile Test Samples.

(a) General Procedure.

- (i) The metal for the test samples shall be taken from the crucible or ladle from which the castings are poured, and shall not be subjected to refluxing or to any treatment other than adjusting the temperature to that suitable for pouring.
- (ii) The test samples shall be cast in a dry sand mould which shall have internal dimensions of the form shown in Fig. 1, Fig. 2 or Fig. 3. The mould shall be inclined at an angle of approximately 30° from the vertical at the commencement of pouring and the metal shall be poured into the top of the mould. The sand of the mould may be rammed into any convenient container (such as a steel tube), provided that the portion of the bar tapering from 1 in. to $\frac{3}{16}$ in. is separated from the container walls by not less than $\frac{1}{16}$ in. of sand for moulds made according to Fig. 1 or by not less than $1\frac{1}{16}$ in. of sand for moulds made according to Fig. 2 or Fig. 3.

NOTE.—The temperature of the mould immediately prior to casting should be between 10° and 40° C.

- (iii) The test samples shall be heat-treated with the castings they represent as specified in Clause 5 (b) and then machined to the dimensions shown in Fig. 4. The test samples shall not be further heat-treated or mechanically worked before they are tested.
- (b) Test samples representing castings made from ingots which comply with Section I of this specification, with or without the addition of the founder's own scrap as defined in Clause 3.
 - (i) When a single cast of less than 500 lb. is employed, at least one test sample shall be cast and tested to represent the cast. When a series of casts, each less than 500 lb., is employed, at least one test sample shall be cast and tested to represent each 500 lb. of metal poured or 200 lb. of fettled castings at the option of the manufacturer. When one or more casts of 500 lb. or over are employed at least one test sample shall be cast and tested to represent each cast.
 - (ii) At least one tensile test sample shall be cast and tested to represent each day's production of castings.
 - (iii) For large castings the purchaser may specify at the time of ordering that one test sample shall be cast and tested to represent each casting.
 - (iv) The preparation of test samples shall be in accordance with Clause 9 (a) above.
- (c) Test samples representing castings made from material whose compliance with Section I of this specification has not been verified.
 - (i) At least one test sample shall be cast and tested to represent each cast or 250 lb. of metal poured, whichever is the lesser weight.
 - (ii) At least one test sample shall be cast and tested to represent each day's production of castings.
 - (iii) For large castings the purchaser may specify at the time of ordering that one test sample shall be cast and tested to represent each casting.
 - (iv) The preparation of test samples shall be in accordance with Clause 9 (a) above.

10. **Tensile Test.*** The test pieces prepared as specified in Clause 9 shall comply with the following test to the satisfaction of the Inspector:

Ultimate tensile stress - Not less than 13 tons per sq. in.

The load shall be applied axially.

11. **Re-tests.** If any test piece fails to comply with the tensile test specified in Clause 10, the Inspector may reject the casting or castings represented by that test piece or he may permit, at the request of the manufacturer, the adoption of one of the following alternative re-test procedures:

- (a) Select for test not more than two further samples representing the same casting or castings. Provided that one of these samples when tested complies with the test specified in Clause 10, the casting or castings shall be accepted.
- (b) Select for test two castings from those represented by the test piece which failed. One test sample shall be cut from each casting, and the largest practicable size of test piece shown in B.S. Specification 2A.4 shall be prepared from each of these test samples. Both these samples are required to comply with the test specified in Clause 10.

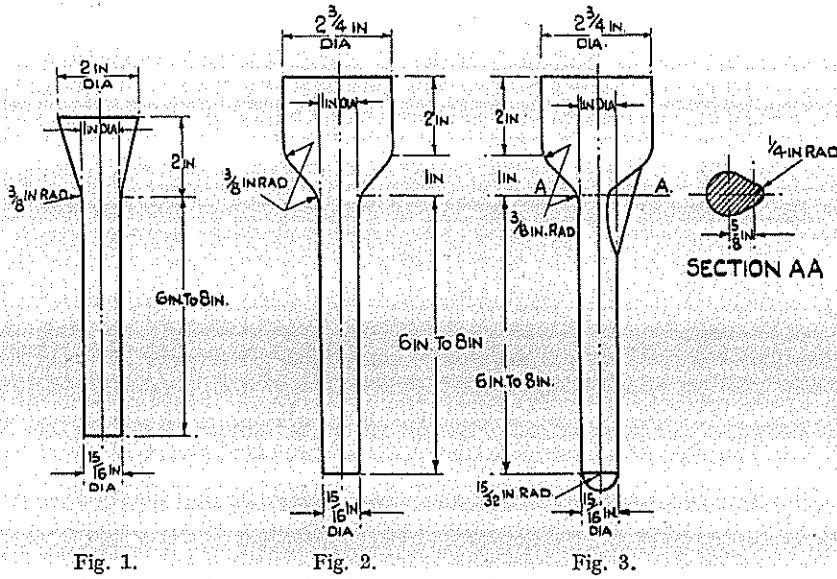
12. **Protection against Corrosion.** Unless otherwise specified by the purchaser, all castings shall be protected against corrosion, before delivery, by chromate treatment in accordance with one of the methods given in Process Specification D.T.D. 911.

13. **Identification.** All castings passed by the Inspector shall be stamped with the mark of the Inspector and such other marking as will ensure full identification of the material. All stamping shall be done wherever it is least liable to be detrimental to the casting. At the discretion of the Inspector, small castings may be made into bundles which shall be labelled with the mark of the Inspector and such other marking as will ensure full identification of the castings; normally, castings under 3 lb. in weight may be so identified.

* The following particulars are given for information only:

- (a) The 0.1% proof stress of these sand cast test bars may be expected to be not less than 6.5 tons per sq. in.
- (b) Material which complies with the tensile test given in Clause 10 may be expected to give the following results if cast in chill moulds:

0.1% proof stress	-	-	-	-	Not less than 7 tons per sq. in.
Ultimate tensile stress	-	-	-	-	Not less than 14 tons per sq. in.
Elongation	-	-	-	-	Not less than 2%.
- (c) The mechanical properties specified in Clause 10 and those indicated in notes (a) and (b) above are intended as a test of quality of the metal only and are not necessarily realised in certain portions of castings.



Tensile Test Samples.

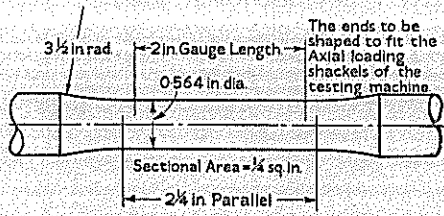


Fig. 4. Tensile Test Piece.

For the purposes of this specification as an Australian standard 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 February, 1947.

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.