

APRIL, 1940

EMERGENCY STANDARD  
No. (E)D.511—1940  
Being British Standards Institution  
Specification for Aircraft Material  
**B.S. No. S. 70\***  
endorsed without amendment.

STANDARDS ASSOCIATION OF AUSTRALIA.

Headquarters :

Science House, Gloucester and Essex Streets, Sydney.

AUSTRALIAN STANDARD SPECIFICATION

(Emergency Series)

FOR

**“ 55 ” CARBON STEEL (NORMALISED)**  
**(PRIMARILY INTENDED FOR STEEL CYLINDERS)**

*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.*

NOTE.—The heat-treatment temperatures specified have been selected as representing an average figure for general practice for the particular class of material, and are given in the Specification as guides. Where variation from the specified figures is found to be necessary the exact temperature must be stated in the test report.

- Section I. Provisions applicable to all Sections of this Specification.  
Section II. S. 70—A. Bars and Billets for Forging and Drop Forging.  
Section III. (No Specification.)  
Section IV. S. 70—C. Forgings and Drop Forgings.  
Section V. (No Specification.)

SECTION I.

Provisions applicable to all Sections of this Specification.

1. **Chemical Analysis.** (a) The steel shall contain :—

Carbon	...	...	between 0.50 and 0.60 per cent.
Silicon	...	...	not more than 0.30 per cent.
Manganese	...	...	between 0.40 and 0.75 per cent.
Sulphur	...	...	not more than 0.05 per cent.
Phosphorus	...	...	not more than 0.05 per cent.

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

2. **Mechanical Tests.** (a) The mechanical properties obtained from test pieces selected and prepared as specified in Clause 7 or 14 shall be as follows :—

Maximum Stress	...	...	not less than 45 tons per sq. inch.
Elongation	...	...	not less than 18 per cent.
Reduction of Area	...	...	not less than 30 per cent.
Brinell Hardness Number	...	...	between 197 and 241 (4.30 mm. and 3.90 mm.).

(b) *Tensile Test.* The tensile test pieces shall be turned from the samples selected as specified in Clause 7 or 14 to the dimensions of the British Standard Tensile Test Piece, Fig. 1 of the B.S. Specification 2 A. 4, or, if the samples are too small, machined to suitable test pieces as shown in Figs. 2 to 4.

\*In order to avoid confusion it is recommended that this specification be referred to by its British classification No. S. 70, by which it is already well known.

The testing appliances shall be such that the load when applied shall be axial.

Should a tensile test piece break outside the middle half of its gauge length the test may be discarded and another test made.

(c) *Brinell Test.* (i) The test shall be made with a 10 mm. diameter ball and a load of 3,000 kg.\* which shall not be exceeded even momentarily, and shall be maintained for not less than 15 seconds. Prior to testing, the skin of the sample shall be removed by filing, grinding or machining the areas to be tested.

(ii) The diameter of the impression shall be measured to the nearest 0.05 mm.

**3. Freedom from Defects.** (a) The material shall be free from defects.

(b) Any material may be rejected at any time for faults in manufacture, notwithstanding that it has been previously passed on analysis and mechanical tests.

## SECTION II.

### S. 70—A. Bars and Billets for Forging and Drop Forging.

**4. Manufacture.** All surface defects in the bars or billets which might produce defects in the forgings or drop forgings made therefrom shall be removed by rough-machining, chipping or grinding.

**5. Margins of Manufacture.** No margins of manufacture are specified.

**6. Heat Treatment.** (a) All bars and billets for forging or drop forging shall be delivered as rolled or forged unless otherwise stated on the order to the Steelmaker.

(b) *Normalising.* The mechanical test samples shall be normalised by heating to a temperature of 830° C. to give the mechanical tests specified in Clause 2.

**7. Selection and Preparation of Mechanical Test Samples.** (a) The bars or billets of each size and from the same cast shall be grouped in parcels of not more than 100 and the Inspector shall select one sample from each parcel for mechanical testing. A mechanical test sample shall be of sufficient length to allow of the preparation of the test pieces specified in Clause 2.

(b) The portion of the bar or billet selected for the preparation of the test samples may be machined and/or forged down to test samples  $1\frac{1}{8}$  inches diameter and heat-treated in that size.

(c) The mechanical test samples shall be marked as directed by the Inspector before they are cut from the bar or billet, and shall be normalised as specified in Clause 6 (b).

**8. Mechanical Tests.** (a) The test pieces machined from the samples selected as specified in Clause 7 shall comply with the appropriate tensile and Brinell tests specified in Clause 2, which shall be carried out in the presence of the Inspector and to his satisfaction.

(b) If any test piece machined from the sample fails to give the mechanical tests specified in Clause 2 (a) the Inspector may reject the parcel represented by the test piece, or at his discretion select two other samples for test, one of which must be from the bar or billet from which the original test sample was taken. If that bar or billet has been withdrawn by the Steelmaker, one other bar or billet shall be selected. If both samples fulfil the test, the parcel from which the samples were selected will be accepted.

**9. Up-ending Test.** From each parcel of bars or billets the Inspector shall select at least one bar or billet and up to five per cent. of the bars or billets for the up-ending test. From the bars or billets so selected samples shall be cut equal in length to their diameter or width across flats and forged down at normal forging temperature to half their original length by a minimum number of blows. The samples must be tested as cut from the bars or billets and must not be further machined before testing. After testing they must not reveal the presence of any harmful defect.

**10. Sulphur-Printing Test.** The Inspector may at his discretion require the cut ends of one-half of the bars or billets from which the samples used for the up-ending test are taken to be suitably prepared for sulphur-printing and the resulting prints must not reveal the presence of any defects or harmful segregations in the material so tested.

**11. Identification.** All bars and billets shall be stamped with the number S. 70, the cast number and the Steelmaker's trade mark or symbol. All such stamping must be done at one extreme end of each bar or billet.

## SECTION III.

(No Specification.)

## SECTION IV.

### S. 70—C. Forgings and Drop Forgings.

**12. Material.** The forgings and drop forgings shall be made from bars or billets which have been inspected and passed as complying with Section II of this Specification.

\*It is recommended that the Brinell Hardness determination for small size bars be made with a suitably reduced load and/or ball in accordance with B.S. Specification No. 240.

**13. Heat Treatment.** (a) The forgings and drop forgings shall be delivered in the finally heat-treated condition unless otherwise stated on the order.

(b) The forgings and drop forgings shall preferably be rough-machined before the final heat treatment is carried out.

(c) *Normalising.* The forgings or drop forgings and the mechanical test samples selected and prepared as specified in Clause 14 shall be normalised at a temperature of 830° C. to give the mechanical tests specified in Clause 2.

(d) No forging or drop forging shall be normalised more than twice.

**14. Selection and Preparation of Mechanical Test Samples.** (a) The Contractor shall supply one test sample, unless more are specified on the order, to represent each batch of forgings or drop forgings made from the same cast and heat-treated at the same time. The test samples shall be cut from the material from which the forgings or drop forgings were made, and shall be of sufficient length to allow of the preparation of the test pieces specified in Clause 2.

(b) The portion of the bar or billet selected for the preparation of the test samples may be machined and/or forged down to  $1\frac{1}{8}$  inches diameter and heat-treated in that size.

(c) (i) If any test piece machined from the sample fails to give the mechanical tests specified in Clause 2 (a), the Inspector may reject the parcel represented by the test piece or at his discretion adopt either of the following procedures:—

(a) Select two other samples for test which have been heat-treated with the batch of forgings or drop forgings. If both samples fulfil the tests the batch from which the samples were selected will be accepted.

(b) Allow the batch to be re-heat-treated and re-tested.

(ii) Failing the provision of the necessary test samples to permit of the re-tests in paragraph (i) above, the re-tests may be made, where possible, on test samples cut from forgings or drop forgings selected by the Inspector.

**15. Mechanical Tests.** (i) The test pieces from forgings and drop forgings selected as specified in Clause 14 shall comply with the Tensile and Brinell tests specified in Clause 2. These shall be carried out in the presence of the Inspector and to his satisfaction.

(ii) Each forging or drop forging shall be brinelled and its Brinell Hardness Number must comply with the value specified in Clause 2.

#### SECTION V.

(No Specification.)

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*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 19th April, 1940.

#### 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.