

NOTE.—The Association desires to call attention to the fact that this Specification is intended to include the technical provisions necessary for the supply of the material herein referred to, but does not purport to comprise all the necessary provisions of a contract.

## British Engineering Standards Association.

Incorporated by Royal Charter 1929.

*British Standard Specification for Aircraft Material.*

### 55-TON ALLOY STEEL BARS.

*(Supplied in the Heat-Treated Condition).*

**Section I. Provisions applicable to all Sections of this Specification.**

**Section II.** *(No Specification.)*

**Section III. S.2-B. Bars for Machining.**

**Section IV.** *(No Specification.)*

**Section V. S.2-D. Finished Machined Parts.**

#### SECTION I.

##### Provisions applicable to all Sections of this Specification.

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

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 8 shall be as follows:—

Maximum Stress	-	-	between 55 and 65 tons per sq. inch.
Elongation	-	-	not less than 18 per cent.
Reduction of Area	-	-	not less than 50 per cent.
Izod Value	-	-	not less than 40 ft. lb.
Brinell Hardness Number	-	-	between 241 and 293 (3.90 mm. and 3.55 mm.).
Nicked Fracture	-	-	See Clause 2 (e).

(b) *Tensile Test.* The test pieces shall be machined from the sample, selected as specified in Clause 8, to the dimensions of the British Standard Tensile Test Piece, Fig. 1 of 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.

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) *Izod Test.* The test pieces shall be machined from the samples selected as specified in Clause 8, to the dimensions of the British Standard Notched Bar Test Piece, Fig. 7 or 10 of B.S. Specification 2 A. 4, and tested in a 120 ft. lb. Izod machine.

(d) *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.

\*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.

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

(e) *Nicked Fracture Test.* A test piece or bar 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 bar, shall show a grey fibrous fracture when broken by a minimum number of blows.

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.

(No Specification.)

## SECTION III.

### S.2-B. Bars for Machining.

4. **Manufacture.** All bars for machining shall be made from rough-machined blooms or ingots.

5. **Margins of Manufacture.** The margins of manufacture shall be in accordance with the order to the Steelmaker.

6. **Straightness.** (a) All black bars shall be commercially straight.

(b) All bright bars shall be straight.

7. **Heat Treatment.** (a) The bars shall be delivered in the finally heat-treated condition.

(b) All black bars shall be hardened and tempered after rolling. All bright bars shall be hardened and tempered, which may be carried out either before or after the bars are cold rolled, drawn or ground to size.

(c) No bar shall be re-hardened more than twice.

8. **Selection and Preparation of Mechanical Test Samples.** (a) The bars of each size and from the same cast shall be grouped in parcels of not more than 25.

(b) 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.

(c) The mechanical test samples shall be marked as directed by the Inspector before they are cut from the bars and shall not be further heat-treated before testing.

9. **Mechanical Tests.** (a) (i) The test pieces machined from the samples selected as specified in Clause 8 shall comply with the Tensile and Izod tests specified in Clause 2. These tests shall be carried out in the presence of the Inspector and to his satisfaction.

(ii) When the dimension of the bar is such that one of the British Standard Notched Bar Test Pieces cannot be made from it, the Nicked Fracture Test shall be substituted for the Izod Test.

(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 adopt either of the following procedures:—

(i) Select two other samples for test, one of which must be from the bar from which the original test sample was taken. If that bar has been withdrawn by the Steelmaker, one other bar shall be selected. If both samples fulfil the tests the parcel from which the samples were selected will be accepted.

(ii) Allow the parcel to be re-heat-treated and re-tested.

(c) Notwithstanding acceptance of a parcel of bars under paragraph (a) or (b), all bars in the parcel must also pass the tests specified in the following paragraphs (d) and (e).

(d) All bars in each parcel shall be submitted to the Brinell Hardness Test specified in Clause 2 (d), the Brinell impression being made at one end of each bar. The Inspector may, at his discretion require a Brinell impression to be made at both ends of every bar. Bars which fail to give the specified test shall be rejected but may, at the option of the Steelmaker, be re-heat-treated in accordance with Clause 7 and submitted again to the Brinell Test. All bars which fail to pass the Brinell Test after this re-heat-treatment shall be rejected.

(e) All bars in each parcel shall be submitted to the Nicked Fracture Test specified in Clause 2 (e); and bars which fail to give the specified fracture shall be rejected but may, at the option of the Steelmaker be—(1) submitted to the Izod Test, when the bar will be accepted if the specified value of not less than 40 ft. lb. is obtained, or (2) be re-heat-treated in accordance with Clause 7 and submitted again to the Brinell, Nicked Fracture (or Izod) Tests. All bars which fail to pass the Brinell, Nicked Fracture (or Izod) Tests after this re-heat-treatment shall be rejected.

10. **Identification.** (a) All bars, half-inch diameter or width across flats and over, shall be stamped with the number S. 2, the cast number and the Steelmaker's trade mark or symbol. All such stamping must be done at one extreme end of each bar.

(b) All bars under half-inch diameter or width across flats, from the same cast, shall be wired up in bundles which shall bear a metal tag stamped with the number S. 2, the cast number and the Steelmaker's trade mark or symbol.

#### SECTION IV.

(No Specification.)

#### SECTION V.

#### S.2-D. Finished Machined Parts.

11. **Material.** The parts shall be made from bars which have been inspected and passed as complying with Section III of this Specification.

**C.C. (AC) 4577.**  
(Cancelling C.B. (AC) 6584.)

For attachment to B.S. Specification 2 S. 2.

BRITISH ENGINEERING STANDARDS ASSOCIATION.

The following Note cancels the Note C.B. (AC) 6584, dated December, 1928, formerly attached to the above Specification.

#### NOTE.

This Specification applies only to bars up to and including 2½ inches diameter or width across flats.

When larger bars are required they should be ordered to the latest issue of B.S. Specification S. 11 or S. 69.

#### ADDENDUM.

SECTION III. S.2-B. BARS FOR MACHINING. CLAUSE B. Selection and Preparation of Mechanical Test Samples. The following paragraph to be added:—

(d) In the case of bars up to and including 2 inches diameter or width across flats, the tensile and Izod test pieces shall be machined concentrically from the test sample.

In the case of bars over 2 inches diameter or width across flats, the longitudinal axes of the tensile and Izod test pieces shall be not less than one inch from the surface of the test sample.

June, 1931.

require Brinell Hardness tests to be made as he may consider necessary to the length specified, provided that the thickness of the part.

national Aircraft Committee on the main Committee on the 1st August,

industries concerned, the British Standard

Director of the British Engineering Association, W. 1, will be welcomed at all times. The assistance of the Committees charged with the

(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 adopt either of the following procedures :—

(i) Select two other samples for test, one of which must be from the bar from which the original test sample was taken. If that bar has been withdrawn by the Steelmaker, one other bar shall be selected. If both samples fulfil the tests the parcel from which the samples were selected will be accepted.

(ii) Allow the parcel to be re-heat-treated and re-tested.

(c) Notwithstanding acceptance of a parcel of bars under paragraph (a) or (b), all bars in the parcel must also pass the tests specified in the following paragraphs (d) and (e).

(d) All bars in each parcel shall be submitted to the Brinell Hardness Test specified in Clause 2 (d), the Brinell impression being made at one end of each bar. The Inspector may, at his discretion require a Brinell impression to be made at both ends of every bar. Bars which fail to give the specified test shall be rejected but may, at the option of the Steelmaker, be re-heat-treated in accordance with Clause 7 and submitted again to the Brinell Test. All bars which fail to pass the Brinell Test after this re-heat-treatment shall be rejected.

(e) All bars in each parcel shall be submitted to the Nicked Fracture Test specified in Clause 2 (e); and bars which fail to give the specified fracture shall be rejected but may, at the option of the Steelmaker be—(1) submitted to the Izod Test, when the bar will be accepted if the specified value of not less than 40 ft. lb. is obtained, or (2) be re-heat-treated in accordance with Clause 7 and submitted again to the Brinell, Nicked Fracture (or Izod) Tests. All bars which fail to pass the Brinell, Nicked Fracture (or Izod) Tests after this re-heat-treatment shall be rejected.

10. **Identification.** (a) All bars, half-inch diameter or width across flats and over, shall be stamped with the number S. 2, the cast number and the Steelmaker's trade mark or symbol. All such stamping must be done at one extreme end of each bar.

(b) All bars under half-inch diameter or width across flats, from the same cast, shall be wired up in bundles which shall bear a metal tag stamped with the number S. 2, the cast number and the Steelmaker's trade mark or symbol.

#### SECTION IV.

(No Specification.)

#### SECTION V.

#### S.2-D. Finished Machined Parts.

11. **Material.** The parts shall be made from bars which have been inspected and passed as complying with Section III of this Specification.

12. **Brinell Test.** The Inspector may require Brinell Hardness tests to be made on as many of the finished machined parts as he may consider necessary to ensure that they comply with the tensile strength specified, provided that the Brinell impression does not affect the serviceableness of the part.

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This Specification was adopted by the Sectional Aircraft Committee on the 7th July, 1927, and approved on behalf of the Main Committee on the 1st August, 1927.

#### NOTE.

*In order to keep abreast of progress in the Industries concerned, the British Standard Specifications are subjected to periodical review.*

*Suggestions for improvements, addressed to the Director of the British Engineering Standards Association, 28 Victoria Street, London, S.W., 1, will be welcomed at all times. They will be recorded and in due course brought to the notice of the Committees charged with the revision of the Specifications to which they refer.*