D.T.D. 197A

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OBSOLESCENCE NOTICE

All DTD specifications were declared obsolescent from 1st April 1999. All DTD 900 series approvals also lapsed at that time. The standards will no longer be updated but will be retained as obsolescent documents to provide for the servicing of existing equipment.

Further Guidance

The aim in declaring the specifications obsolescent is to recognise that the documents are not being updated and thus should be used with care by both purchaser and supplier. For example, a specification could contain valid technical information but may also contain type approval clauses that contradict procurement policy and/or use materials that do not comply with environmental legislation. The obsolescent specification can still be used as a basis for a purchase provided that the supplier and purchaser agree suitable changes to the specification within the purchase order/contract.

For the DTD 900 system, each specification has provided an MoD approved material and process. For these items, the declaration of obsolescence will constitute the termination of both the extant MoD approval and the continuing MoD assessment that had underpinned those approvals. Again, the technical content of the document remains valid and can be used by both purchaser and supplier as a basis for a contract but an acceptable (to the parties) approval/assessment procedure would be required.

MINISTRY OF SUPPLY

D.T.D. 197A

(Superseding Specificaton D. T. D. 197)
December, 1944
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Aircraft Material Specification
ALUMINIUM-NICKEL-IRON BRONZE BARS AND FORGINGS

NOTE.--This specification is one of a series issued by the Ministry of Supply, either to meet a limited requirement not covered by any existing British Standard Specification or to serve as a basis for inspection of material the properties and uses of which are not sufficiently developed to warrant submission to the British Standards Institution for standardisation

Section I. Provisions applicable to all Material to this Specification.
Section II. Bars and Billets for Forging.
Section III. Bars for Machining.
Section IV. Forgings.

The term "forging" in this specification includes drop-forgings and pressings.

SECTION I

Provisions applicable to all Material to this Specification

1. **Chemical Composition.**

(a) The chemical composition of the alloy shall be :-

Aluminium	not less than 8.0 nor more than 11.0 per cent.
Nickel	not less than 4.0 nor more than 6.0 per cent.
Iron	not less than 4.0 nor more than 6.0 per cent.

Manganese may be present at the option of the Manufacturer to an amount of not more than 2.5 per cent.

Impurities. -The following elements must not be present in amounts greater than the following :-

Lead	not more than 0.05 per cent.
Tin	not more than 0.20 per cent.
Zinc	not more than 0.50 per cent.
Silicon	not more than 0.25 per cent.
Magnesium	not more than 0.10 per cent.
Copper	the remainder.

(b) The analysis of not less than 5 per cent. of the casts of alloy shall be submitted to the Inspector. The minimum number of analyses required may be increased by the Inspector if he is not satisfied with the conditions of manufacture.

(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) Where a continuous melting process is employed, a cast shall be taken as the amount of metal tapped from the furnace without any further additions of metal having been made to the charge.
(v) Or as otherwise defined from time to time.

2. **Mechanical tests.**

(a) All tests shall be carried out to the satisfaction of the Inspector.

(b) The mechanical properties of the test pieces shall be :-

Diameter or minor sectional dimension.	0.1 per cent. proof stress. Tons per sq. in.	Ultimate tensile stress. Tons per sq. in.	Elongation per cent.
Up to and including 4 inches ..	Not less than 25	Not less than 45	Not less than 15
Over 4 inches	Not less than 20	Not less than 42	Not less than 15

(c) Tensile Test. - For bars, other than rectangular bars less than $\frac{9}{32}$ inch in thickness, and for test samples representing forgings, the tensile test pieces shall be turned to the dimensions of the standard round test piece of British Standard A.4 ; if the samples are too small, the test pieces shall be machined to the dimensions of the largest possible size of subsidary test piece shown in British Standard A.4

Round, square and hexagonal bars less than $\frac{9}{32}$ inch diameter or width across flats may be tested in full section.

Material thinner than $\frac{9}{32}$ inch shall be tested by means of a rectangular test piece of maximum available thickness and $\frac{1}{2}$ inch wide, or as nearly $\frac{1}{2}$ inch wide as the section will permit. The elongation of the flat test pieces shall be measured on a gauge length of 1 inch or $4\sqrt{A}$ area at the option of the Manufacturer.

The parallel portion of any test piece may be increased in length to accommodate the extensometer employed.

The load shall be applied axially.

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

(d) Hardness Test.-(i) The Brinell test shall be carried out in accordance with British Standard 240, using a P/D^2 ratio of 30.

(ii) Where the Brinell test is unsuitable, some other approved hardness test shall be adopted.

3. **Freedom from defects.**

(a) The material shall be free from defects.

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

SECTION II

Bars and Billets for Forging

4. **Manufacture.**

The bars and billets shall be supplied in the extruded, rolled, extruded and drawn, rolled and drawn, forged or cast condition.

The use of bars or billets in the cast condition shall be agreed between the Purchaser and the Manufacturer.

5. **Margins of manufacture.**

Margins of manufacture, when required, shall be agreed between the Manufacturer and the Purchaser and shall be specified on the order.

6. **Selection and preparation of mechanical test samples.**

(a) (i) Bars or billets in the wrought condition shall be grouped in parcels and the nominal size of the bars or billets in each parcel shall not differ in diameter or minor sectional dimension by more than $\frac{1}{4}$ inch for bars and billets up to and including three inches nominal size or by more than $\frac{1}{2}$ inch for bars and billets over three inches nominal size. The size of each parcel shall be as follows :-

Nominal size (diameter or minor sectional dimension) of bar or billet.	Maximum size of parcel
Up to and including $\frac{1}{2}$ inch	3 cwt.
Over $\frac{1}{2}$ inch up to and including $2\frac{1}{2}$ inches	10 cwt.
Over $2\frac{1}{2}$ inches	40 cwt. or 100 ft. of bar, whichever is the greater weight.

(ii) Bars or billets in the cast condition shall be grouped in parcels of not more than 20 cwt.

(b) The Inspector shall select one test sample from each parcel for testing. The test samples shall be marked as directed by the Inspector, and shall then be removed from the bars or billets by nicking and breaking off, or they may be sawn and, after separation from the bar, fractured. The faces of the fractures must show freedom from piping or other defects.

(c) (i) For bars and billets up to and including $1\frac{1}{8}$ inches diameter or minor sectional dimension the tensile test piece shall be machined concentrically from the test sample.

(ii) For bars or billets over $1\frac{1}{8}$ inches diameter or minor sectional dimension the longitudinal axis of the tensile test piece shall be $\frac{9}{16}$ inch from the surface of the test sample.

At the option of the Manufacturer the test samples may be forged down to $1\frac{1}{8}$ inches diameter before being tested.

(iii) Test samples from bars or billets in the cast condition shall be forged down to not less than one-quarter of the original cross-sectional area of the bar or billet before being tested.

For test samples up to and including $1\frac{1}{8}$ inches diameter or minor sectional dimension, the tensile test piece shall be machined concentrically from the test sample.

For test samples over $1\frac{1}{8}$ inches diameter or minor sectional dimension, the longitudinal axis of the tensile test piece shall be $\frac{9}{16}$ inch from the surface of the test sample.

(d) A test piece shall be cut from each test sample for the forging test specified in Clause 8. The test piece shall have a length equal to not less than the diameter or minor sectional dimension of the bar or billet.

7. **Tensile test.**

The mechanical properties of the tensile test pieces machined from the samples selected and prepared as specified in Clause 6 must pass the tensile test specified in Clause 2.

8. **Forging test.**

The forging test piece selected and prepared as specified in Clause 6 shall, when heated to a temperature of 900/950°C., withstand without cracking being placed on end and compressed to 20 per cent. of its original length.

9. **Re-tests.**

(a) Tensile Test.-If any test piece fails to pass the tensile test specified in Clause 2, the Inspector shall select for test from the same parcel two further samples, one of which must be from the bar or billet from which the original test sample was taken, unless that bar or billet has been withdrawn by the Manufacturer. Test pieces prepared from these two further samples as specified in Clause 6 must pass the tensile test specified in Clause 2.

(b) Forging Test.-If any test piece fails to pass the forging test specified in Clause 8, the Inspector shall select from the same parcel two further samples, one of which must be from the bar or billet from which the original test sample was taken unless that bar or billet has been withdrawn by the Manufacturer. Test pieces prepared from these two further samples as specified in Clause 6 must pass the forging test specified in Clause 8.

10. **Identification.**

(a) All bars $\frac{3}{4}$ inch diameter or major sectional dimension and under passed by the Inspector shall be tied in bundles, which shall bear a tag stamped with the mark of the Inspector and such other markings as will ensure full identification of the material.

(b) All billets and bars over $\frac{3}{4}$ inch diameter or major sectional dimension 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.

SECTION III

Bars for Machining

11. **Manufacture.**

The bars may be delivered in the extruded, rolled, extruded and drawn, extruded and rolled, rolled and drawn, or forged condition. They may be tempered, or quenched and tempered, at the option of the Manufacturer.

12. **Margins of manufacture.**

The margins of manufacture shall be agreed between Manufacturer and Purchaser.

13. **Straightness.**

All bars shall be straight.

14. **Selection and preparation of mechanical test samples.**

(a) Bars shall be grouped in parcels, and the nominal size of the bars in each parcel shall not differ in diameter or minor sectional dimension by more than $\frac{1}{4}$ inch for bars up to and including 3 inches nominal size, or by more than $\frac{1}{2}$ inch for bars over 3 inches nominal size. The size of each parcel shall be as follows :-

Nominal size (diameter or minor sectional dimension) of bar	Maximum size of parcel
Up to and including $\frac{1}{2}$ inch	3 cwt.
Over $\frac{1}{2}$ inch up to and including $2\frac{1}{2}$ inches	10 cwt.
Over $2\frac{1}{2}$ inches	40 cwt. or 100ft. of bar, whichever is the greater weight.

(b) The Inspector shall select one test sample from each parcel for the tensile test as specified in Clause 2.

(c) The test samples shall be marked as directed by the Inspector and shall then be removed from the bars by nicking and breaking off, or they may be sawn and, after separation from the bar, fractured. The surfaces of the fractures shall show freedom from piping or other defects.

(d) (i) For bars up to and including $1\frac{1}{8}$ inches diameter or minor sectional dimension, the tensile test piece shall be machined concentrically from the test sample.

(ii) For bars over 1 inches diameter or minor sectional dimension, the longitudinal axis of the tensile test piece shall be $\frac{9}{16}$ inch from the surface of the test sample.

(e) The test samples shall not be further heat-treated or mechanically worked before being tested.

15. **Tensile test.**

(a) The mechanical properties of the tensile pieces machined from the samples selected and prepared as specified in Clause 14 must pass the appropriate tensile test specified in Clause 2.

(b) Re-Tests.-If any test piece fails to pass the tensile test specified in Clause 2, the Inspector may reject the parcel represented by that test piece or, at the request of the Manufacturer, adopt either of the following procedures :-

(i) Select for test from the same parcel two further samples, one of which must be from the bar from which the original test sample was taken, unless that bar has been withdrawn by the Manufacturer. Test pieces prepared from these two further samples as specified in Clause 14 must pass the appropriate tensile test specified in Clause 2.

(ii) Allow the parcel to be re-heat-treated and re-tested in accordance with Clauses 14, 15 and 16.

16. **Hardness test.**

(a) All bars in each parcel shall be tested at one end for hardness. The Inspector at his discretion may require the hardness test to be made at both ends of the bar. The hardness number shall not be less than 179 nor more than 255 on the Brinell scale, or its equivalent on the scale of the method adopted.

17. **Identification.**

(a) All bars $\frac{3}{4}$ inch diameter or major sectional dimension and under passed by the Inspector shall be tied in bundles, which shall bear a tag stamped with the mark of the Inspector and such other marking as will ensure full identification of the material.

All bars over $\frac{3}{4}$ inch diameter or major sectional dimension 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.

SECTION IV

Forgings

Note.-Attention is called to the difficulty of specifying tensile test values which will accurately represent the tensile properties of the forgings. The test samples only indicate the quality of the material, and it must not be assumed that the properties of the forgings and the test samples are similar.

18. **Materials.**

The forgings shall be made from bars or billets which have been inspected and passed as complying with Section II of this specification, except that when the Manufacturer of the forgings is also the Manufacturer of the bars or billets from which the forgings are made, the tests on the bars or billets as specified in Section II may be waived at the option of the Manufacturer.

19. **Heat treatment.**

The forgings may be delivered in the forged, forged and annealed, forged and tempered, or quenched and tempered condition at the option of the Manufacturer.

20. **Selection and preparation of mechanical test samples.**

(a) The forgings shall be grouped in parcels as follows :-

Size of forgings in parcel	Maximum size of parcel
Up to and including 1 lb.	5 cwt.
Over 1 lb. up to and including 5 lb.	10 cwt.
Over 5 lb. up to and including 201b.	20 cwt.
Over 20 lb.	40 cwt.

(b) For each parcel of forgings, test samples shall be provided from the bars or billets from which the forgings represented have been made. These test samples shall be of sufficient length to provide the tensile test piece specified in Clause 2 and shall be heated simultaneously with and similarly to the forgings they represent.

(c) (i) For bars or billets in the wrought condition, the test samples shall be forged in plain tools to a cross-sectional area approximately equal to two-thirds of the original cross-sectional area of the bar or billet before being tested.

(ii) For bars or billets in the cast condition, the test samples shall be forged down to not less than one-quarter of the original cross-sectional area of the bar or billet before being tested.

(iii) If the forgings are tempered, quenched and tempered, or annealed, the test samples shall be forged as specified above and then tempered, quenched and tempered, or annealed simultaneously with and similarly to the forgings they represent, whatever their previous heat treatment may have been.

(d) Alternatively, at the option of the Manufacturer, any of the forgings in each parcel may be selected and, without being further worked or heat treated, shall be used to provide the tensile test piece specified in Clause 2.

(e) (i) For test samples up to and including 1$\frac{1}{8}$ inches diameter or minor sectional dimension, the tensile test piece shall be machined concentrically from the test sample.

(ii) For test samples over 1$\frac{1}{8}$ inches diameter or minor sectional dimension, the longitudinal axis of the tensile test piece shall be $\frac{9}{16}$ inch from the surface of the test sample.

21. **Tensile test.**

(a) The mechanical properties of the tensile test piece machined from the samples selected and prepared as specified in Clause 20 must pass the tensile test specified in Clause 2.

(b) Re-Tests.-If any test piece fails to pass the tensile test specified in Clause 2, the Inspector may reject the parcel represented by that test piece or, at the request of the Manufacturer, adopt either of the following procedures :-

(i) Select for test two further samples representing the parcel of forgings from which the original sample was taken. Test pieces prepared from these two further samples as specified in Clause 20 must pass the tensile test specified in Clause 2.

(ii) Allow the parcel to be re-heat-treated and re-tested in accordance with Clauses 20, 21 and 22.

22. **Hardness test.**

(a) The hardness number of all forgings shall be not less than 179 nor more than 255 on the Brinell scale, or its equivalent on the scale of the method adopted.

(b) If any forging fails to pass the hardness test specified in para. *(a)* above, it may be rejected or, at the request of the Manufacturer, be re-heat-treated and re-tested in accordance with Clauses 20, 21 and 22.

23. **Identification.**

(a) Each forging 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 such stamping shall be done wherever it is least liable to be detrimental to the forging.

(b) Where the forgings passed by the Inspector are too small for individual marking, they shall be made into parcels which shall bear a tag stamped with the mark of the Inspector and such other marking as will ensure full identification of the material.

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