MINISTRY OF SUPPLY **D.T.D. 748**

January, 1954

Aircraft Material Specification

MAGNESIUM-ZINC-CERIUM-ZIRCONIUM ALLOY INGOTS AND CASTINGS (Heat treated)

(Zinc 4·0, rare earth metals 1·2, zirconium 0·7)

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 materials the properties and uses of which are not sufficiently developed to warrant submission to the British Standards Institution for standardisation.

Ingots — Sand castings — Die castings

1. Inspection and testing procedure.

Ingots	Section One and Section Two, Clause 2, of British Standard L.101.
Sand castings	Section One and Section Three or Four of British Standard L.101.
Die castings	Section One and Section Three or Four of British Standard L.101.

2. Quality of material.

2.1. *Ingots.*

Scrap or secondary material may be used at the discretion of the ingot maker.

2.2. *Castings.*

The castings shall be made from ingots complying with Clauses 1 and 3.1, with or without approved scrap therefrom.

3. Chemical composition.

3.1. The chemical composition of the ingots shall be :—

Zinc	not less than 3·5 nor more than 5·0 per cent.
Total rare earth metals	not less than 1·0 nor more than 1·75 per cent.
Zirconium, "available"	not more than 1·0 per cent.
Manganese	not more than 0·15 per cent.
Copper	not more than 0·03 per cent.
Silicon	not more than 0·01 per cent.
Iron	not more than 0·01 per cent.
Nickel	not more than 0·005 per cent.
Magnesium	the remainder.

3.2. The chemical composition of the castings shall be :—

Zinc	not less than 3·5 nor more than 5·0 per cent.
Total rare earth metals	not less than 0·75 nor more than 1·75 per cent.
Zirconium, "available"	not less than 0·4 nor more than 1·0 per cent.
Manganese	not more than 0·15 per cent.
Copper	not more than 0·03 per cent.
Silicon	not more than 0·01 per cent.
Iron	not more than 0·01 per cent.
Nickel	not more than 0·005 per cent.
Magnesium	the remainder.

3.3. The "available" zirconium is defined as that portion of the zirconium which is dissolved in dilute hydrochloric acid when the method of determination given in the appendix is used ; any alternative method of determination shall be approved by the Inspecting Authority.

4. Heat treatment.

4.1. The castings and related test samples shall be heated together at a temperature not exceeding 375° C. for not less than 2 hours, and cooled in air or quenched in oil or water at the option of the manufacturer.

5. Tensile test

	Ultimate tensile stress, tons/sq. in. not less than	0·1 *per cent. proof stress*, tons/sq. in. not less than	*Elongation* per cent. not less than
Sand cast test samples (Fig. 1)	13·0	8·0	3
Chill cast test samples (Fig. 2, 3 or 4)	14·0	8·0	4

6. Protection against corrosion.

6.1. Unless otherwise specified by the purchaser, the castings shall, before delivery, be protected against corrosion by chromate treatment in accordance with one of the methods given in Specification D.T.D. 911 (latest issue) or by approved treatment No. 4078 listed in Specification D.T.D. 900 (latest issue).

APPENDIX

Method of determination of "available" zirconium

Reagents.

Hydrochloric acid A.R. ...	concentrated (sp. gr. 1·18).
Ammonia	"25 per cent." solution (1 vol. ammonia sp. gr. 0·880 to 3 vol. water).
Ammonium chloride A.R.	
Hexamine	20 per cent. solution.
Ammonium arsenate	10 per cent. solution (100 g./litre; filter before use).
Ammonium arsenate	1 per cent. solution (10 g./litre; filter before use).
Hydrochloric acid	"10 per cent." solution (1 vol. acid sp. gr. 1·18 to 9 vol. water).
Sugar charcoal	prepared from pure cane sugar (less than 0·02 per cent. ash content).

Method.

1. Weigh out accurately 5-15 g. of sample into an 800 ml. beaker, cover with 20 ml. of water for every gram of sample, and dissolve by the gradual addition of 10 ml. of concentrated hydrochloric acid for each gram of sample. When all the metal has dissolved, boil for 5 minutes, filter the solution through a thin pulp pad, and wash any precipitate three times with hot water.

2. To the filtrate add "25 per cent." ammonia, while stirring, until a faint permanent precipitate appears. Just clear by adding drops of concentrated acid, and add about 10 g. of ammonium chloride. Add about 40 ml. of 20 per cent. hexamine solution, and allow the precipitate to coagulate by standing in a warm place.

3. Filter off the zirconium hydroxide on a No. 541 Whatman filter paper, and wash a few times with warm water. Wash the precipitate from the paper into the original beaker, and dissolve in 85 ml. of hot concentrated hydrochloric acid. Dilute the solution with cold distilled water to a volume of about 350 ml.

4. To the diluted solution add slowly and with constant stirring 50 ml. of 1 per cent. ammonium arsenate solution, and then bring to the boil. Add 15 ml. of 10 per cent. ammonium arsenate solution, and boil for 20 minutes. Allow the precipitate to settle and filter through a No. 40 Whatman filter paper. Remove the adherent precipitate from the beaker by means of a rubber-tipped rod using warm "10 per cent." hydrochloric acid. Wash the precipitate five times with hot water, dry, and transfer to a weighed silica crucible. Ignite at a dull-red heat. Cover the residue with sugar charcoal, and ignite at 900° C.-1,000° C. to constant weight (for about one hour). Add a little charcoal and again ignite to constant weight; if the loss exceeds 0·001 g. a further treatment with charcoal is necessary.

$$\text{per cent. Zr} = \frac{100 \times \text{weight of precipitate} \times 0{\cdot}7403}{\text{weight of sample}}$$

Note.—Under no circumstance should a platinum crucible be used for the ignition since it would be attacked by the arsenic.

Approved for issue.

H. SUTTON,

Director of Materials Research and Development (Air).

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