

Aircraft Material Specification

ALUMINIUM - SILICON - MAGNESIUM ALLOY INGOTS AND PREMIUM QUALITY CASTINGS

**(Solution treated and precipitation treated)
(Si 7, Mg 0.3)**

NOTE 1. This specification is one of a series issued by the Ministry of Technology, either to meet a limited requirement not covered by any existing British Standard for aircraft material, 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.

NOTE 2. This specification will normally be used only after prior consultation between the purchaser and the manufacturer at the earliest possible stage in design. British Standards in the "aircraft" series and D.T.D. specifications for castings draw attention to the fact that the tensile values specified for test pieces from separately cast test samples may not always be realised in certain portions of castings. In order that the intrinsic variation of strength in castings shall be minimised and the actual strengths optimised, it is essential that the design of each casting to this specification is such that engineering design requirements are compatible with foundry requirements.*

1. Inspection and testing procedure

The ingots and castings shall be inspected and tested in accordance with the following requirements:

- Ingots British Standard L.101, Sections One and Two.
- Premium quality castings British Standard L.101, Section One and Section Three or Four, and the additional requirements of this specification.

2. Quality of material

2.1 Ingots.

- (a) The aluminium used shall comply with British Standard L.48.
- (b) Approved scrap only may be used.

2.2 Castings. The castings shall be made from:

- (a) Approved ingots, with or without approved scrap therefrom, or
- (b) Aluminium complying with British Standard L.48 and alloying constituents.

3. Chemical composition

3.1 Ingots.

3.1.1 The chemical composition of the ingots shall be:

Element	Per cent	
	min.	max.
Copper	—	0.10
Magnesium	0.20	0.45
Silicon	6.5	7.5
Iron	—	0.15
Manganese	—	0.10
Nickel	—	0.10
Zinc	—	0.10
Lead	—	0.05
Tin	—	0.05
Titanium	—	0.20
Aluminium	The remainder	

3.1.2 The ingot shall be grain refined with titanium or with titanium and boron. The ingot maker shall declare the grain refining element(s) used.

3.2 Castings.

3.2.1 The manufacturer shall supply to the inspector, in respect of every cast, the results of analysis for the specified elements.

* The purchaser is responsible for securing the concurrence of the parent design firm.

3.2.2 The chemical composition of the castings shall be:

Element	Per cent	
	min.	max.
Copper	—	0.10
Magnesium	0.20	0.45
Silicon	6.5	7.5
Iron	—	0.20
*Manganese	—	0.10
*Nickel	—	0.10
*Zinc	—	0.10
*Lead	—	0.05
*Tin	—	0.05
†Titanium	—	0.20
Aluminium	The remainder	

* The proportion of casts in which this element is determined may be reduced, subject to the discretion of the Inspecting Authority, to not less than one in five.

† The determination of this element is not required by the Inspecting Authority when the castings have been produced from approved ingots with or without approved scrap therefrom.

4. Heat treatment

The castings and test samples shall be heated together at a temperature of $540^{\circ} \pm 5^{\circ}\text{C}$ ($1004^{\circ} \pm 9^{\circ}\text{F}$) for not less than 12 hours and quenched in water at a temperature of not less than 65°C (149°F). They shall then be reheated at a temperature of $155^{\circ} \pm 5^{\circ}\text{C}$ ($311^{\circ} \pm 9^{\circ}\text{F}$) for not less than 4 hours and cooled in air. Alternative heat treatments to give specific properties may be agreed between the purchaser and the manufacturer and stated on the drawing or order.

5. Mechanical properties

5.1 The mechanical properties obtained from chill cast test samples selected and prepared in accordance with the relevant requirements of B.S.L.101 shall be not less than the following values:

	0.2 per cent proof stress		Tensile strength		Elongation per cent
	tonf/in ²	kgf/mm ²	tonf/in ²	kgf/mm ²	
Chill cast test samples (Forms A, B, C or D)	13.0	20.4	18.0	28.3	5

(References to test sample forms are to those in British Standard L.101).

5.2 In addition to the mechanical testing required by Clause 5.1, castings are to be subjected to cut-up testing as follows:

(a) *Pattern approval cut-up test procedure from initial production castings; to be repeated after any significant change in manufacture.*

- (i) The number of castings to be subjected to cut-up test shall be stated on the drawing or order.
- (ii) The location, size and form of the test pieces to be taken from the highly stressed or otherwise important regions in each casting shall be stated on the drawing—these to be referred to as tests from designated locations.
- (iii) Further test pieces shall be taken in typical undesignated locations at the discretion of the manufacturer, to demonstrate satisfactory strength in such locations.
- (iv) Castings for test shall be heat treated in accordance with Clause 4, and shall not be further heat treated or mechanically worked before testing.
- (v) The test results shall be made available to the purchaser.

and (b) *Routine cut-up tests as follows:*

- (i) From each pattern of casting one casting shall be selected for test from every 50 castings passed by the founder's inspector, subject to a minimum of one casting per test in any period of six months when less than 50 castings have been passed by the inspector.
- (ii) Unless otherwise agreed, tests shall be taken from designated locations as required by Clauses 5.2(a)(ii) and (iv).
- (iii) When agreed between the manufacturer and the purchaser, and stated on the drawing or order, the number of test pieces cut from a production casting may be less than the number required for a pattern approval casting.
- (iv) The castings selected for test may be those rejected for reasons which do not affect cut-up strength properties, e.g. faulty fettling.

- 5.3 The mechanical properties of test pieces cut from castings shall be not less than the following values:

	0.2 per cent proof stress		Tensile strength		Elongation per cent
	tonf/in ²	kgf/mm ²	tonf/in ²	kgf/mm ²	
Designated locations	12.5	19.7	17.0	26.7	5
Undesignated locations	11.5	18.1	14.5	22.8	3

6. Re-test procedure

- 6.1 *Chill cast test samples (Clause 5.1).* The re-test procedure shall be in accordance with the relevant requirements of British Standard L.101, except that if the additional samples tested fail to comply with the specified requirements, test pieces shall be machined from a casting selected from the batch represented, in accordance with Clause 5.2, and shall comply with the appropriate requirements of Clause 5.3.
- 6.2 *Test pieces cut from castings.* If any test piece cut from a casting fails to comply with the specified requirements, the test results shall be submitted to the purchaser and the Inspecting Authority, and a re-test procedure agreed.

Approved for issue,

E. W. RUSSELL,

Director of Materials Research and Development.

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