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BRITISH STANDARD 1490 : 1963

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SPECIFICATION FOR

ALUMINIUM AND ALUMINIUM ALLOY INGOTS AND CASTINGS

For General Engineering Purposes

BRITISH STANDARDS INSTITUTION

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SPECIFICATION FOR

ALUMINIUM AND ALUMINIUM ALLOY INGOTS AND CASTINGS

FOR GENERAL ENGINEERING PURPOSES

B.S. 1490 : 1963

Price 15/- net

BRITISH STANDARDS INSTITUTION

INCORPORATED BY ROYAL CHARTER

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THIS BRITISH STANDARD, having been approved by the Non-ferrous Metals Industry Standards Committee and endorsed by the Chairman of the Engineering Divisional Council, was published under the authority of the General Council on 23rd May, 1963.

First published 18th August, 1949.
First revision October, 1955.
Second revision May, 1963.

The Institution desires to call attention to the fact that this British Standard does not purport to include all the necessary provisions of a contract.

In order to keep abreast of progress in the industries concerned, British Standards are subject to periodical review. Suggestions for improvements will be recorded and in due course brought to the notice of the committees charged with the revision of the standards to which they refer.

A complete list of British Standards, numbering over 4000, indexed and cross-indexed for reference, together with an abstract of each standard, will be found in the Institution's Yearbook.

This standard makes reference to the following British Standards:

B.S. 1957	Presentation of numerical values (fineness of expression; rounding of numbers).
B.S. 18	Tensile testing of metals.
B.S. 240	Method for Brinell hardness testing. Part 1 Testing of metals.
B.S. 1499	Sampling non-ferrous metals.
B.S. 1728	Methods of analysis of aluminium and aluminium alloys.

British Standards are revised, when necessary, by the issue either of amendment slips or of revised editions. It is important that users of British Standards should ascertain that they are in possession of the latest amendments or editions.

The following B.S.I. references relate to the work on this standard:
Committee reference NFE/18. Draft for comment D62/4096

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*Preferred alloys.

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*Preferred alloys.

CO-OPERATING ORGANIZATIONS

The Non-ferrous Metals Industry Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government departments, and scientific and industrial organizations:

*Admiralty
*Aluminium Federation
Association of Bronze and Brass Founders
Association of Consulting Engineers, Incorporated
British Bronze and Brass Ingot Manufacturers' Association
British Electrical and Allied Manufacturers' Association
British Non-ferrous Metals Federation
*British Non-ferrous Metals Research Association
Cable Makers' Association
Copper Development Association
Crown Agents for Oversea Governments and Administrations
High Commission of India
High Conductivity Copper Association
*Institute of British Foundrymen
*Institute of Metals
Institution of Mechanical Engineers (Automobile Division)
Institution of Mining and Metallurgy
Institution of Structural Engineers
Lead Development Association
Lead Sheet and Pipe Manufacturers' Federation
*Light Metal Founders' Association
London Metal Exchange
Magnesium Industry Council
*Ministry of Aviation
Ministry of Transport
National Brassfoundry Association
Non-ferrous metal stockists
Post Office
Royal Institute of British Architects
Society of British Aircraft Constructors
*Society of Motor Manufacturers and Traders Ltd.
Tin Research Institute
War Office
Zinc Development Association
Individual manufacturers

The Government departments and scientific and industrial organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this British Standard:

ALARS (Association of Light Alloy Refiners and Smelters)
National Physical Laboratory (D.S.I.R.)

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SUMMARY TABLE

	B.S. 1490 main alloying elements[a]					Principal mechanical properties (minimum)						FORMS[c]
						Tensile strength		Elongation		Metric equivalent Tensile strength		sand casting—s gravity die casting—g pressure die casting—p
	Cu	Mg	Si	Mn	Other elements	Sand cast	Chill cast	Sand cast	Chill cast	Sand cast	Chill cast	
	per cent	per cent	per cent	per cent	per cent	ton/sq in	ton/sq in	per cent	per cent	kg/mm²	kg/mm²	
LM 0-M (Al 99·50)	—	—	—	—	—	—	—	—	—	—	—	s, g, p
LM 1-M	7	—	3	—	Zn 3	8·0	10·0	—	—	12·6	15·7	g
*LM 2-M	1·5	—	10	—	—	—	9·5	—	—	—	15·0	p
LM 3-M	3·5	—	—	—	Zn 11	9·0	—	—	—	14·2	—	s
*LM 4-M	3	—	5	0·5	—	9·0	10·0	2	2	14·2	15·7	s, g
*LM 4-WP	3	—	5	0·5	—	15·0	18·0	—	—	23·6	28·3	s, g
*LM 5-M	—	4·5	—	0·5	—	9·0	11·0	3	5	14·2	17·3	s, g
*LM 6-M	—	—	12	—	—	10·5	12·0	5	7	16·5	18·9	s, g, p
*LM 8-M	—	0·5	5	—	—	8·0	10·5	2	3	12·6	16·5	s, g
*LM 8-P	—	0·5	5	—	—	9·5	12·0	1	2	15·0	18·9	s, g
*LM 8-W	—	0·5	5	—	—	10·5	15·0	2·5	5	16·5	23·6	s, g
*LM 8-WP	—	0·5	5	—	—	15·0	18·0	—	2	23·6	28·3	s, g
LM 9-P	—	0·4	12	0·5	—	11·0	15·0	1·5	2	17·3	23·6	s, g
LM 9-WP	—	0·4	12	0·5	—	15·5	19·0	—	—	24·4	29·9	s, g
*LM 10-W	—	10	—	—	—	18·0	20·0	8	12	28·3	31·5	s, g
*LM 11-W	4·5	—	—	—	—	14·0	17·0	7	13	22·0	26·8	s
*LM 11-WP	4·5	—	—	—	—	18·0	20·0	4	9	28·3	31·5	s
LM 12-M	10	0·3	—	—	—	—	11·0	—	—	—	17·3	g
LM 12-WP	10	0·3	—	—	—	—	18·0	—	—	—	28·3	g
*LM 13-WP[b]	1	1	12	—	Ni 1·6	11·0	18·0	—	—	17·3	28·3	s, g, (Pistons)
*LM 13-WP[b] (spcl.)	1	1	12	—	Ni 1·5	9·0	13·0	—	—	14·2	20·5	s, g, (Pistons)
*LM 14-WP[b]	4	1·5	—	—	Ni 2	14·0	18·0	—	—	22·0	28·3	s, g
*LM 14-WP[b] (spcl.)	4	1·5	—	—	Ni 2	12·0	15·0	—	—	18·9	23·6	s, g, (Pistons)
LM 16-W	1·5	0·5	5	—	—	11·0	15·0	2	3	17·3	23·6	s, g
LM 16-WP	1·5	0·5	5	—	—	15·0	18·0	—	—	23·6	28·3	s, g
LM 18-M	—	—	5	—	—	7·5	9·0	3	4	11·8	14·2	s, g
LM 20-M	—	—	12	—	—	10·5	12·0	3·5	5	16·5	18·9	g, p
*LM 21-M	4	0·2	6	0·5	—	10·0	11·0	1	1	15·7	17·3	s, g
*LM 22-W	3·5	—	5	0·5	—	—	16·0	—	8	—	25·2	g
*LM 23-P	1	0·1	2	—	Fe 1 Ni 1	10·0	12·5	2	3	15·7	19·7	s, g
*LM 24-M	3·5	—	8·5	—	—	—	11·5	—	1·5	—	18·1	p

a. Included in this table only as an indication of the type of alloy; for accurate figures see detailed specification.
b. Brinell hardness figures are specified for these castings.
c. The forms of castings which are given in this column for information only are those in which each of the alloys is most commonly used.
NOTE 1. Attention is drawn to the fact that the specified minimum tensile properties apply to standard test bars and may not be realized in all parts of the castings.
NOTE 2. Where no value is given for elongation in the above table or in the specification the amount to be expected is of no practical significance.
*Preferred alloys.

BRITISH STANDARD SPECIFICATION FOR

ALUMINIUM AND ALUMINIUM ALLOY INGOTS AND CASTINGS

FOR GENERAL ENGINEERING PURPOSES

FOREWORD

This British Standard for aluminium and aluminium alloy ingots and castings was first issued in 1949 and revised in 1955, and forms part of a series of British Standards for general engineering purposes.

In this revision two alloys LM 7 and LM 15 previously included have been omitted, alloy LM 12 in the M condition and alloy LM 4 in the WP condition have been introduced. For both of these alloys the mechanical test properties for ingots correspond to the M condition as it is expected that most castings will be used in that condition. Some amendments have been made to chemical compositions and mechanical properties; in particular, LM 0 has been amended and also introduced into this standard as castings in the M condition. Also LM 21 has been amended to bring it into line with one of the alloys included in ISO recommendation R 164.

See small No 1

Certain of the alloys are indicated in the list of contents and in the summary table as preferred alloys and users are encouraged to select from this list as far as possible.

A further change is the introduction of an optional colour code for ingots.

As in the earlier edition main alloy elements are shown in heavy type.

In verifying compliance with these limits the content of each element as determined by analysis, should be rounded in accordance with B.S. 1957* to the degree of precision of the standard. If this rounded value does not fall outside the specified limits the composition of the sample is deemed to comply with the standard. Thus if the specified composition is not less than 4 per cent and not more than 6 per cent, the sample is deemed to comply with the standard if the analytical value is not less than 3·5 per cent and not greater than 6·5 per cent; if the specified limits are 4·0 per cent and 6·0 per cent the sample is deemed to comply with the standard if the analytical value is not less than 3·95 per cent and not greater than 6·05 per cent.

Attention is drawn to the fact that the specified minimum tensile properties apply to standard test bars and may not be realized in all parts of the castings.

*B.S. 1957, 'Presentation of numerical values (fineness of expression; rounding of numbers)'.

In this standard, as in the earlier edition, the following symbols have been adopted:

a. Form of material

Ingots. Alloy number with no suffix letter.

Castings. Alloy number with suffix letter according to condition of material.

b. Condition. Suffix letters have been used to indicate the condition of heat-treatment in which the materials are available. The suffix letters have the following significance:

M Material in the as cast condition.

P Material which has been precipitation treated.

W Material which has been solution treated.

WP Material which has been solution and precipitation treated, i.e. fully heat treated.

The table on pages 6 and 7 gives a summary of the castings covered by the standard with their minimum mechanical properties, and the metric equivalents of those properties. The composition figures included in the tables are given only as an indication of the type of alloy and do not represent the optimum composition. Reference should always be made to the relevant specification for details of composition and properties.

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NOTE. Where metric equivalents are stated the figures in British units are to be regarded as the standard. The metric conversions are approximate; more accurate conversions should be based on the tables in B.S. 350, 'Conversion factors and tables'.

SPECIFICATION

SCOPE

1. This British Standard specifies requirements for ingots and castings in aluminium and 20 aluminium alloys in various conditions.

SECTION ONE : GENERAL CLAUSES APPLICABLE TO INGOTS

FREEDOM FROM DEFECTS

2. The ingots shall be reasonably free from slag or dross.

PROVISION OF TEST SAMPLES

3. Test samples shall be cast separately in sand moulds, unless the supplier and purchaser agree that chill moulds shall be used or unless chill cast properties only are given in the specification in which case test samples shall be cast separately in chill moulds. In all cases, samples shall be cast either directly from the metal from which the ingots are poured, or from the re-melted ingots. The test samples shall be obtained as follows:

a. Sand moulds. The test samples shall be cast in dry sand or green sand moulds which shall have internal dimensions of the form shown in Fig. 2 or Fig. 3. The sand moulds may be formed in any convenient container (such as a steel tube) provided that the portion of the bar tapering from 1 in (25·4 mm) to 15/16 in (23·8 mm) is separated from the container walls by not less than 1 1/16 in (27 mm) of sand. The moulds shall be inclined from the vertical at the commencement of pouring and the metal shall be poured into the top of the moulds.

Alternatively, for LM 10 the test bars may be produced to the design shown in Fig. 4.

b. Chill moulds. The test samples shall be cast in metal chill moulds having dimensions as shown in Figs. 2, 3, 5 or 6.

TENSILE TEST

4. Test pieces shall be prepared from test samples, cast as specified in Clause 3, by machining to the dimensions of the British Standard proportional round test piece shown in Appendix A.

Test samples and test pieces representing ingots to be used for non-heat treated castings shall not be heat treated, hammered or otherwise treated (except by machining the test samples to the shape of the test piece) before being tested.

Test samples representing ingots which may be used for heat treated castings (except LM 4 and LM 12) shall be given the appropriate heat treatment and shall not then be further heat treated, mechanically worked or otherwise treated (except by machining to the shape of the test piece) before being tested.

The testing procedure shall be as specified in B.S. 18, 'Tensile testing of metals'.

RETESTS

5. Should a test piece fail to meet the requirements of the tensile test, two further test pieces which represent the same cast may be selected and tested in the same manner. Should one of the further test pieces meet the requirements of the tensile test, the ingots represented thereby shall be deemed to comply with this standard. Should both of these test pieces fail to meet the requirements of the tensile test, the ingots represented thereby shall be deemed not to comply with this standard.

Alternatively, for heat treatable alloys, if further test samples which have already been heat treated are available, the supplier may re-heat treat, once only, two of these before testing.

CERTIFICATE OF COMPLIANCE

6. The supplier shall certify that the ingots comply with the requirements of this standard.

INSPECTION

7. The purchaser shall notify the supplier when placing the order if it is his intention to inspect the material at the supplier's works. The supplier shall afford the purchaser all reasonable facilities to satisfy himself that the material is in accordance with this standard. For this purpose the purchaser or his representative may, by prior arrangement, attend to inspect the material, to select and identify the test samples for testing and witness the tests being made.

INDEPENDENT TEST

8. Should there be a dispute about the compliance of the material with regard to the composition or the test requirements of this standard, the supplier and the purchaser shall have the right to have tests made by a mutually acceptable testing authority.

The results obtained by the independent testing authority shall be accepted as final. If the material does not comply with this standard, the cost of independent testing shall be borne by the supplier; if the material complies with this standard the cost shall be borne by the purchaser.

The method of sampling for analysis shall be in accordance with B.S. 1499, 'Sampling non-ferrous metals', and the methods of analysis shall be in accordance with B.S. 1728, 'Methods for the analysis of aluminium and aluminium alloys', where the appropriate method exists.

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FACILITIES FOR TESTING

9. For making tests on samples cast as specified in Clause 3 the supplier shall provide and prepare the necessary test pieces, and supply labour and appliances for such testing as may be carried out on his premises in accordance with this standard. Unless otherwise agreed material for testing shall remain the property of the supplier. Failing facilities at his own works for making the prescribed tests, the supplier shall make the necessary arrangements for making the tests elsewhere.

MARKING

10. Material should bear an identification mark which should be agreed between supplier and purchaser.

If colour marking is used, the colours shall be those appropriate to the material unless otherwise specified by the purchaser.

SECTION TWO : GENERAL CLAUSES APPLICABLE TO CASTINGS

FREEDOM FROM DEFECTS

2. The castings shall be clean, sound, and free from harmful inclusions. Defects likely to affect the suitability of the casting for the purpose for which it is designed shall not be repaired unless permission has been obtained from the purchaser.

Any casting may subsequently be deemed not to comply with this standard because of faults in manufacture, notwithstanding that it has been passed previously on chemical composition and mechanical tests.

TOLERANCES

3. Unless otherwise agreed between the supplier and the purchaser the thickness of castings, where not machined, shall be not less than the specified thickness, and shall not exceed it by more than 10 per cent; and the castings shall be capable of being machined, where required, to the finished dimensions without leaving evidence of the cast surface.

PROVISION OF TEST SAMPLES

4. Test samples shall be obtained as follows:

The metal for the test samples shall be taken from the crucible or ladle from which the castings are poured and shall not be subjected to any further treatment other than adjusting the temperature to that suitable for pouring.

a. Sand castings. The test samples shall be cast in dry sand or green sand moulds which shall have internal dimensions as shown in Fig. 2 or Fig. 3. The sand moulds may be formed in any convenient container (such as a steel tube), provided that the portion of the bar tapering from 1 in to $\frac{15}{16}$ in is separated from the container walls by not less than $1\frac{1}{16}$ in of sand. The moulds shall be inclined from the vertical at the commencement of pouring and the metal shall be poured into the top of the moulds.

Alternatively for LM 10, the test bars may be produced to the design shown in Fig. 4.

b. Chill castings. Where the castings are produced from metal moulds, or dies, the test samples may be cast as defined in paragraph *a* above, or in metal chill moulds having dimensions shown in Figs. 2, 3, 5 or 6.

c. If the purchaser requires individual mechanical tests to be carried out he shall state this with the enquiry and the order. In all such instances the number and type of test samples to be cast shall be agreed between the supplier and the purchaser.

MECHANICAL TESTS

5. Test samples and test pieces representing non-heat treated castings shall not be heat treated, hammered or otherwise treated (except by machining to the shape of the test piece) before being tested.

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In the case of heat treated castings the test samples shall be heat treated together with the castings they represent; apart from this the test samples and the test pieces shall not be further heat treated, mechanically worked or otherwise treated (except by machining to the shape of the test piece) before being tested.

a. Tensile test. Test pieces shall be prepared from test samples cast as specified in Clause 4, by machining to the dimensions of the British Standard proportional round test piece shown in Appendix A.

The testing procedure shall be as specified in B.S. 18, 'Tensile testing of metals'.

Should a test piece break outside the middle third of the gauge length the test may, at the option of the manufacturer, be discarded and another test made.

b. Hardness test. If required by Section Three, hardness tests shall be carried out in accordance with B.S. 240: Part 1, 'Method for Brinell hardness test. Part 1 Testing of metals'.

TEST FOR PRESSURE TIGHTNESS

6. If the purchaser requires castings to be tested for pressure tightness, he shall state this and the nature of the test in his enquiry and order; the test pressure, and the testing fluid shall be the subject of agreement between the supplier and the purchaser. Castings shall not be impregnated or otherwise treated by a process designed to improve pressure tightness except as agreed with the purchaser.

RETESTS

7. Should a test piece fail to meet the requirements of the mechanical tests, two further test pieces which represent the same cast may be selected and tested in the same manner. Should one of the further test pieces meet the requirements of the tests the castings represented thereby shall be deemed to comply with this standard. Should both of these test pieces fail to meet the requirements of the tests, the castings represented thereby shall be deemed not to comply with this standard.

Alternatively, for heat treated castings, the supplier may re-heat-treat the castings and test samples once only, before the two further samples are selected.

CERTIFICATE OF COMPLIANCE

8. The supplier shall certify that the castings comply with the requirements of this standard.

INSPECTION

9. The purchaser shall notify the supplier when placing the order if it is his intention to inspect the material at the supplier's works. The supplier shall afford the purchaser all reasonable facilities to satisfy himself that the material

is in accordance with this standard. For this purpose the purchaser or his representative may, by prior arrangement, attend to inspect the material, to select and identify the test samples for testing and to witness the tests being made.

INDEPENDENT TEST

10. Should there be a dispute about the compliance of the material with regard to the composition or the test requirements of this standard, the supplier and the purchaser shall have the right to have tests made by a mutually acceptable testing authority.

The results obtained by the independent testing authority shall be accepted as final. If the material does not comply with this standard, the cost of independent testing shall be borne by the supplier; if the material complies with this standard the cost shall be borne by the purchaser.

The method of sampling for analysis shall be in accordance with B.S. 1499, 'Sampling non-ferrous metals', and the methods of analysis shall be in accordance with B.S. 1728, 'Methods for the analysis of aluminium and aluminium alloys', where the appropriate methods exist.

FACILITIES FOR TESTING

11. For making tests on samples cast as specified in Clause 4 the supplier shall provide and prepare the necessary test pieces, and supply labour and appliances for such testing as may be carried out on his premises in accordance with this standard. Unless otherwise agreed, material for testing shall remain the property of the supplier. Failing facilities at his own works for making the prescribed tests, the supplier shall make the necessary arrangements for making the tests elsewhere.

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LM 0

ALUMINIUM INGOTS

SECTION THREE : SPECIFIC CLAUSES

GENERAL

11. The ingots shall comply with the general requirements of Clauses 2, 6, 7, 8 and 9 of Section One, and with the following chemical composition.

CHEMICAL COMPOSITION

12. The chemical composition of the ingots shall be:

Copper	not more than 0·03 per cent
Magnesium	not more than 0·03 per cent
Silicon	not more than 0·30 per cent
Iron	not more than 0·40 per cent
Manganese	not more than 0·03 per cent
Nickel	not more than 0·03 per cent
Zinc	not more than 0·07 per cent
Lead	not more than 0·03 per cent
Tin	not more than 0·03 per cent
Total of all stated impurities	not more than 0·50 per cent
Aluminium	not less than 99·50 per cent

Aluminium shall be determined by difference.

See amdt. No. 1. For :-
LM 25
LM 25-M
LM 25-P
LM 25 - W (SPECIAL)
LM 25 WP.

LM 0-M

ALUMINIUM CASTINGS

(AS CAST)

USED AS SAND CASTINGS AND GRAVITY AND PRESSURE DIE CASTINGS

SECTION THREE : SPECIFIC CLAUSES

GENERAL

12. The castings shall be made from material complying with the ingot specification LM 0, and shall also comply with the general requirements of Section Two and with the following chemical composition.

CHEMICAL COMPOSITION

13. The chemical composition of the castings shall be:

Copper	not more than 0·03 per cent
Magnesium	not more than 0·03 per cent
Silicon	not more than 0·30 per cent
Iron	not more than 0·40 per cent
Manganese	not more than 0·03 per cent
Nickel	not more than 0·03 per cent
Zinc	not more than 0·07 per cent
Lead	not more than 0·03 per cent
Tin	not more than 0·03 per cent
Total of all stated impurities	not more than 0·50 per cent
Aluminium	not less than 99·50 per cent

Aluminium shall be determined by difference.

CONDITION

14. The castings shall be supplied in the as cast M condition.

If stress relieving treatment is necessary, this shall be stated on the order and the procedure shall be agreed between the supplier and the purchaser.

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LM 1

ALUMINIUM ALLOY INGOTS

SECTION THREE : SPECIFIC CLAUSES

GENERAL

11. The ingots shall comply with the general requirements of Section One and with the following chemical composition and mechanical properties.

CHEMICAL COMPOSITION

12. The chemical composition of the ingots shall be:

Copper	not less than 6 nor more than 8 per cent
Magnesium	not more than 0·15 per cent
Silicon	not less than 2 nor more than 4 per cent
Iron	not more than 1·0 per cent
Manganese	not more than 0·6 per cent
Nickel	not more than 0·5 per cent
Zinc	not less than 2 nor more than 4 per cent
Lead	not more than 0·3 per cent
Tin	not more than 0·2 per cent
Titanium	not more than 0·2 per cent
Manganese + nickel + lead + tin	not more than 1·0 per cent
Aluminium	the remainder.

MECHANICAL PROPERTIES

13. The mechanical properties, obtained from the separately cast test pieces selected in accordance with Clause 3 and prepared and tested in accordance with Clause 4 of Section One, shall be as follows:

	Tensile strength	Metric equivalents
		Tensile strength
	min.	min.
	ton/sq in	kg/mm²
Sand cast	8·0	12·6
Chill cast	10·0	15·7

LM 1-M

ALUMINIUM ALLOY CASTINGS
(CAST)

MAINLY USED FOR GRAVITY DIE CASTINGS

SECTION THREE : SPECIFIC CLAUSES

GENERAL

12. The castings shall be made from material complying with the ingot specification LM 1, and shall also comply with the general requirements of Section Two and with the following chemical composition and mechanical properties.

CHEMICAL COMPOSITION

13. The chemical composition of the castings shall be:

Copper	not less than 6 nor more than 8 per cent
Magnesium	not more than 0·15 per cent
Silicon	not less than 2 nor more than 4 per cent
Iron	not more than 1·0 per cent
Manganese	not more than 0·6 per cent
Nickel	not more than 0·5 per cent
Zinc	not less than 2 nor more than 4 per cent
Lead	not more than 0·3 per cent
Tin	not more than 0·2 per cent
Titanium	not more than 0·2 per cent
Manganese + nickel + lead + tin	not more than 1·0 per cent
Aluminium	the remainder.

CONDITION

14. The castings shall be supplied in the as cast M condition.

If stress relieving treatment is necessary, this shall be stated on the order and the procedure shall be agreed between the supplier and the purchaser.

MECHANICAL PROPERTIES

15. The mechanical properties, obtained from the separately cast test pieces selected in accordance with Clause 4 and prepared and tested in accordance with Clause 5 of Section Two, shall be as follows:

	Tensile strength	Metric equivalents
		Tensile strength
	min.	min.
	ton/sq in	kg/mm²
Sand cast	8·0	12·6
Chill cast	10·0	15·7

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LM 2

ALUMINIUM ALLOY INGOTS

SECTION THREE : SPECIFIC CLAUSES

GENERAL

11. The ingots shall comply with the general requirements of Section One and with the following chemical composition and mechanical properties.

CHEMICAL COMPOSITION

12. The chemical composition of the ingots shall be:

Copper	not less than 0·7 nor more than 2·5 per cent
Magnesium	not more than 0·30 per cent
Silicon	not less than 9·0 nor more than 11·5 per cent
Iron	not more than 1·0 per cent
Manganese	not more than 0·5 per cent
Nickel	not more than 1·0 per cent
Zinc	not more than 1·2 per cent
Lead	not more than 0·3 per cent
Tin	not more than 0·2 per cent
Titanium	not more than 0·2 per cent
Aluminium	the remainder.

MECHANICAL PROPERTIES

13. The mechanical properties, obtained from the separately cast test pieces selected in accordance with Clause 3 and prepared and tested in accordance with Clause 4 of Section One, shall be as follows:

	Tensile strength	Metric equivalent
		Tensile strength
	min.	min.
Chill cast	ton/sq in 9·5	kg/mm² 15·0

LM 2-M

ALUMINIUM ALLOY CASTINGS

(AS CAST)

USED AS PRESSURE DIE CASTINGS

SECTION THREE : SPECIFIC CLAUSES

GENERAL

12. The castings shall be made from material complying with the ingot specification LM 2, and shall also comply with the general requirements of Section Two and with the following chemical composition and mechanical properties.

CHEMICAL COMPOSITION

13. The chemical composition of the castings shall be:

Copper	not less than 0·7 nor more than 2·5 per cent
Magnesium	not more than 0·30 per cent
Silicon	not less than 9·0 nor more than 11·5 per cent
Iron	not more than 1·0 per cent
Manganese	not more than 0·5 per cent
Nickel	not more than 1·0 per cent
Zinc	not more than 1·2 per cent
Lead	not more than 0·3 per cent
Tin	not more than 0·2 per cent
Titanium	not more than 0·2 per cent
Aluminium	the remainder.

CONDITION

14. The castings shall be supplied in the as cast M condition.

If stress relieving treatment is necessary, this shall be stated on the order and the procedure shall be agreed between the supplier and the purchaser.

MECHANICAL PROPERTIES

15. The mechanical properties, obtained from the separately cast test pieces selected in accordance with Clause 4 and prepared and tested in accordance with Clause 5 of Section Two, shall be as follows:

	Tensile strength	Metric equivalent
		Tensile strength
	min.	min.
Chill cast	ton/sq in 9·5	kg/mm² 15·0

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LM 3

ALUMINIUM ALLOY INGOTS

SECTION THREE : SPECIFIC CLAUSES

GENERAL

11. The ingots shall comply with the general requirements of Section One and with the following chemical composition and mechanical properties.

CHEMICAL COMPOSITION

12. The chemical composition of the ingots shall be:

Copper	not less than 2·5 nor more than 4·5 per cent
Magnesium	not more than 0·10 per cent
Silicon	not more than 1·3 per cent
Iron	not more than 1·0 per cent
Manganese	not more than 0·5 per cent
Nickel	not more than 0·5 per cent
Zinc	not less than 9 nor more than 13 per cent
Lead	not more than 0·3 per cent
Tin	not more than 0·2 per cent
Titanium	not more than 0·2 per cent
Aluminium	the remainder.

MECHANICAL PROPERTIES

13. The mechanical properties, obtained from the separately cast test pieces selected in accordance with Clause 3 and prepared and tested in accordance with Clause 4 of Section One, shall be as follows:

	Tensile strength	Metric equivalent Tensile strength
	min.	min.
Sand cast	ton/sq in 9·0	kg/mm² 14·2

LM 3-M

ALUMINIUM ALLOY CASTINGS

(AS CAST)

USED AS SAND CASTINGS

SECTION THREE : SPECIFIC CLAUSES

GENERAL

12. The castings shall be made from material complying with the ingot specification LM 3 and shall also comply with the general requirements of Section Two and with the following chemical composition and mechanical properties.

CHEMICAL COMPOSITION

13. The chemical composition of the castings shall be:

Copper	not less than 2·5 nor more than 4·5 per cent
Magnesium	not more than 0·10 per cent
Silicon	not more than 1·3 per cent
Iron	not more than 1·0 per cent
Manganese	not more than 0·5 per cent
Nickel	not more than 0·5 per cent
Zinc	not less than 9 nor more than 13 per cent
Lead	not more than 0·3 per cent
Tin	not more than 0·2 per cent
Titanium	not more than 0·2 per cent
Aluminium	the remainder.

CONDITION

14. The castings shall be supplied in the as cast M condition.

If stress relieving treatment is necessary, this shall be stated on the order and the procedure shall be agreed between the supplier and the purchaser.

MECHANICAL PROPERTIES

15. The mechanical properties, obtained from the separately cast test pieces selected in accordance with Clause 4 and prepared and tested in accordance with Clause 5 of Section Two, shall be as follows:

	Tensile strength	Metric equivalent Tensile strength
	min.	min.
Sand cast	ton/sq in 9·0	kg/mm² 14·2

Full document details: BS 1490:1963
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