



# Hall & Botterill

## CAST ALUMINIUM PRODUCTS

### LM4 ALUMINIUM CASTING ALLOY

(Al – Si5Cu3)

This alloy conforms with British Standards 1490 LM4 and is similar to the obsolete specifications BS.L79 and D.T.D 424A. Castings may be in the cast (M) or fully heat treated (TF) conditions.

#### CHEMICAL COMPOSITION

	%
Copper	2.0 - 4.0
Magnesium	0.15 max.
Silicon	4.0 - 6.0
Iron	0.8 max.
Manganese %	0.2 - 0.6
Nickel	0.3 max.
Zinc	0.5 max.
Lead	0.1 max.
Tin	0.1 max.
Titanium	0.2 Max.
Aluminium	Remainder.

#### MECHANICAL PROPERTIES LM4-M

	SAND CAST	CHILL CAST
0.2% Proof Stress (N/mm <sup>2</sup> ) *	70 - 110	80 - 110
Tensile Stress (N/mm <sup>2</sup> ) *	<b>140</b> - 170	<b>160</b> - 220
Elongation (%) *	<b>2</b> - 3	<b>2</b> - 4
Impact Resistance. Izod (Nm)	1.4	2.1
Brinell Hardness Number	65 - 80	70 - 90
Endurance Limit (5 x 10 <sup>7</sup> cycles + N/mm <sup>2</sup> )	75	85
Modulus of Elasticity (x 10 <sup>3</sup> N/mm <sup>2</sup> )	71	71

## LM4-TF

	SAND CAST	CHILL CAST
0.2% Proof Stress (N/mm <sup>2</sup> ) *	200 – 300	200 – 300
Tensile Stress (N/mm <sup>2</sup> ) *	230 – 290	280 – 370
Elongation (%) *	0 - 2	5
Brinell Hardness Number	90 – 120	90 – 120
Modulus Of Elasticity (x 10 <sup>3</sup> N/mm <sup>2</sup> )	71	71

\* The values shown are typical ranges for sand and chill cast test bars produced to the requirements of B.S. 1490, those in heavier type are minimum specification values.

### **STRENGTH AT ELEVATED TEMPERATURES.**

Room temperature tensile strength of LM4-M is largely retained up to 200°C and falls to about half at 300°C.

### **PHYSICAL PROPERTIES**

Coefficient Of Thermal Expansion (per °C at 20 - 100°C)	0.000021
Thermal Conductivity (cal/cm <sup>2</sup> /cm/°C at 25°C)#	0.29
Electrical Conductivity (% copper standard at 20°C)#	32
Specific Gravity	2.73
Freezing Range (°C) approx.	625 - 525

# Applies to chill castings; value is approximate and will vary with condition.

## **MACHINABILITY**

LM4 has fairly good machining properties being intermediate between the rather difficult aluminium - silicon alloys and the easily machinable aluminium - copper group. As with the former, moderately high tool wear must be expected. Liberal cutting lubricant and coolant should be employed.

Castings show improved machinability after heat treatment.

## **CORROSION RESISTANCE**

Resistance to attack under normal atmospheric condition is fairly good. Considerable improvement in resistance to corrosion is however effected by anodic treatment; small increase in resistance is obtained when the alloy is solution heat treated.

## **ANODISING**

Treatment by the chromic acid process will give a resistant but generally greyish coloured surface, but a lighter film suitable for dyeing can be obtained with the sulphuric acid method. The colour and quality of the coating depend to some extent upon the condition of the castings, i.e. whether sand or chill cast and whether heat treated, and also on the thickness of the film.

## **CASTING CHARACTERISTICS**

**FLUIDITY** Of a moderately high order intermediate between aluminium silicon and aluminium - copper alloys.

**PRESSURE TIGHTNESS** Suitable for leak tight castings.

**HOT TEARING** Its resistance to hot tearing is superior to that of most aluminium base casting alloys except the aluminium - silicon type.

**TYPICAL POURING TEMPERATURE - 720<sup>0</sup>C** The actual temperatures employed may range considerably above or below this value and will depend upon the particular for each casting.

## **NOTES**

Overheating during melting of this alloy may result in coarse grained sand castings and should be avoided. Grain refining treatment may be employed to advantage. The placing of feeders (or sometimes chills) at isolated heavy sections of castings is essential.

## **HEAT TREATMENT**

A very considerable increase in mechanical properties is obtained by the following heat treatment (TF)

**Solution Treatment** - 6 to 16 hours at 505 - 520 °C followed by quenching in hot water.

**Precipitation Treatment** - 6 to 18 hours at 160°C. Allowed to cool in air.

If bending or straightening of castings is necessary, this should be carried out after the solution heat treatment since in this state the castings exhibit greatly increased ductility.

## **APPLICATION AND GENERAL NOTES**

Suitable for most general engineering purposes including crankcase, junction boxes, gear boxes, clutch case, switch gear covers, Instruments cases, tool handles, and where moderate mechanical properties are desirable. Its casting characteristics permit it to be used for the production of moderately thin forms and also for castings required to be pressure tight. In the heat treat state it may be used for castings required to maintain a relatively high static loading.

LM4 is equally suitable for the production of sand and permanent mould castings. It can be die cast but the higher silicon alloys such as LM2 and LM24 are generally to be preferred.