



Elektron® WE54

Elektron WE54 is a high strength fully heat treatable magnesium based casting alloy for use at temperatures up to 300°C. The alloy develops high strength properties at elevated temperatures, without containing either silver or thorium.

Applications

The excellent retention of properties at elevated temperatures and improved corrosion resistance will be of interest to designers of power systems, transmissions, missiles, high performance cars and other high technology applications.

Prolonged use of this alloy (ie in excess of 1000 hours) at temperatures in the range 100°C–250°C may result in the loss of ductility. An alternative alloy is Elektron WE43.

Specifications

AECMA MG-C96001
AMS 4426
ASTM B80 WE54A-T6
BS2970 MAG14-TF
UNS M18410
ISO 16220: MC95310

Chemical composition

Yttrium	4.75–5.5%
Heavy rare earths*	1.0–2.0%
Neodymium	1.5–2.0%
Zirconium	0.4% min
Magnesium	Balance

*Heavy rare earth fraction contains mainly Yb, Er, Dy, and Gd.

Heat treatment

The alloy develops its properties in the fully heat treated (T6) condition ie: 8 hours at 525°C, Hot water or polymer quench or air cool, Age for 16 hours at 250°C, Air cool.

Physical properties

Specific gravity	1.85
Coefficient of thermal expansion	$27.0 \times 10^{-6} \text{K}^{-1}$
Thermal conductivity	$52 \text{ Wm}^{-1}\text{K}^{-1}$
Specific heat	$960 \text{ Jkg}^{-1}\text{K}^{-1}$
Electrical resistivity	173 nΩm
Modulus of elasticity	44.1 GPa
Poissons ratio	0.3
Melting range	545–640°C
Damping index	0.17
Brinell hardness	85

Design data

Minimum specification tensile properties	
ISO 16220	
0.2% Proof stress	170 MPa
Tensile strength	250 MPa
Elongation	2%

Other properties

Castability

Fine grained and pressure tight with good casting characteristics.

Pattern makers shrinkage factor

1.5%

Weldability

Weldable by the tungsten arc inert gas process (TIG) with a filler rod of the parent alloy composition. Castings should be heat treated after welding: 1 hour at 510°C, quenched or air cooled and 16 hours at 250°C.

Machining

Elektron WE54 castings, like all magnesium alloys, machine faster than any other metal. Providing the geometry of the part allows, the limiting factor is the power and speed of the machine rather than the quality of the tool material.

The power required per cubic centimetre of metal removed varies from 9 to 14 watts per minute depending on the operation.

Surface treatment

Yttrium containing magnesium alloys do not respond to certain chemical treatments, notably some of the chromate conversion coating baths. The precautions and alternative treatments are identified in the Luxfer MEL Technologies Design Guide.

Corrosion resistance

Additions of yttrium contribute to the excellent corrosion resistance characteristics of Elektron WE54 to the extent that it is of a similar order to aluminium casting alloys under salt spray conditions.

Corrosion rate	mg/cm ² /day
Intermittent salt spray	0.023
ASTM B117 salt fog	0.1–0.2
Sea water immersion	0.1

Ambient temperature mechanical properties

Typical tensile properties

0.2% Proof stress	205 MPa
Tensile strength	280 MPa
Elongation	4%

Typical compressive properties

0.2% Proof stress	165–175 MPa
Ultimate strength	410 MPa

Typical shear properties

Ultimate stress	150 MPa
-----------------	---------

Fracture toughness

K _{IC}	14.3 MPa m ^{1/2}
-----------------	---------------------------

Fatigue properties

Rotating bend test

Endurance limit MPa	Stress reversals			
	10 ⁶	5 x 10 ⁶	10 ⁷	5 x 10 ⁷
Unnotched	102	100	99	97

Ambient temperature mechanical properties

Typical tensile properties

	0.2% Proof stress (MPa)	Tensile strength (MPa)	Elongation (%)
20 °C	205	280	4.0
100 °C	197	260	4.5
150 °C	195	255	5.0
200 °C	183	241	6.5
250 °C	175	230	9.0

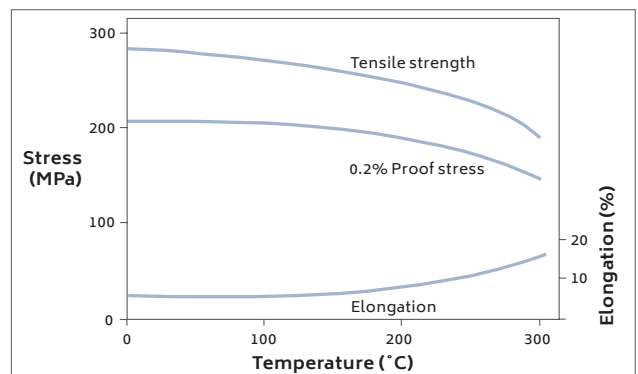


Figure 1. Effect of temperature on tensile properties.

Creep properties

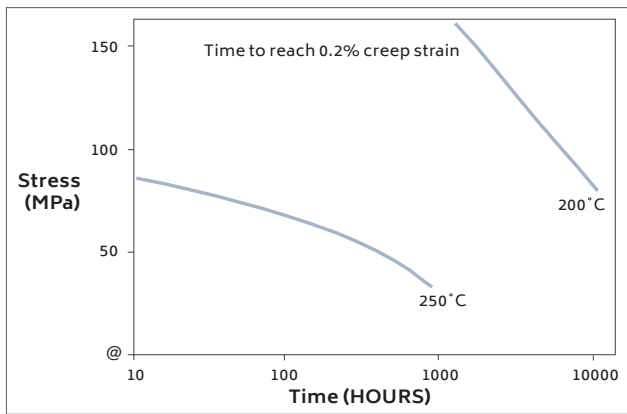


Figure 2. Stress/time relationship at 200 °C and 250 °C.

Fatigue properties

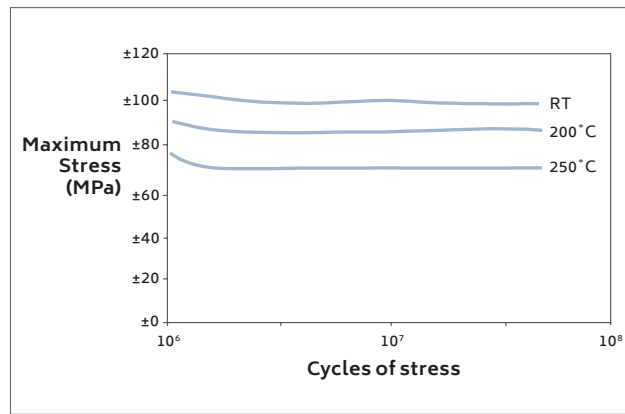


Figure 3. Rotating bend fatigue tests.

Cut up properties on samples taken from actual castings

Source	Section thickness (mm)	Number of tests		0.2% proof stress (MPa)	Tensile strength (MPa)	Elongation
U.K.	5–20	27	Maximum	219	300	11
			Average	195	274	5
			Minimum	177	250	1
Canada	8–20	58	Maximum	238	297	7
			Average	203	275	3
			Minimum	183	240	1
France	10–20	34	Maximum	222	303	8
			Average	204	276	5
			Minimum	190	237	1
Germany	8–20	59	Maximum	254	304	7
			Average	212	277	4
			Minimum	187	230	1
USA	10–20	41	Maximum	222	281	7
			Average	202	263	3
			Minimum	168	214	1

Discover more at www.luxfermeltechnologies.com



† The information contained within is meant as a guideline only

Copyright © Luxfer MEL Technologies 2018. The information provided within this document is aimed to assist manufacturers and other interested parties in the use of magnesium alloys. Luxfer MEL Technologies accepts no liability in whole or in part from use and interpretation of the data herein. All information is given in good faith but without warranty. Freedom from patent rights must not be assumed. Health and Safety information is available for all Luxfer MEL Technologies products. **DS-1010-1118**



Certificate No. FM12677

Luxfer MEL Technologies
Elektron Technology Centre
Lumns Lane, Manchester, M27 8LN, UK
T +44 (0) 161 911 1000

Luxfer MEL Technologies
500 Barbertown Point Breeze Road
Flemington, NJ 08822, USA
T +1 908 782 5800

Luxfer MEL Technologies
4601 Westown Parkway Suite 130
West Des Moines, IA 50266
T +1 515 421 4100