



Magnesium Elektron

SERVICE & INNOVATION IN MAGNESIUM

Elektron WE54

Datasheet : 466

Magnesium Elektron UK,
P.O. Box 23, Rake Lane, Swinton, Manchester, M27 8DD, England.
Tel: 0161 911 1000 Fax: 0161 911 1010
Web: www.magnesium-elektron.com VAT No: GB 668 2142 26

A Division of MAGNESIUM ELEKTRON LIMITED. Registered in England No. 3141950.
Registered Office: The Victoria, 150-182 Harbour City, Salford Quays, Salford, M50 3SP
A Luxfer Group Company

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

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	$24.6 \times 10^{-6} \text{K}^{-1}$
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 GPa
Poissons ratio	0.3
Melting range	545–640°C
Damping index	0.17
Brinell hardness	80–90

DESIGN DATA

Minimum specification tensile properties
BS 2970 MAG14-TF

0.2% Proof stress	185 MPa
Tensile strength	255 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 Magnesium Elektron surface treatment data sheet.

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

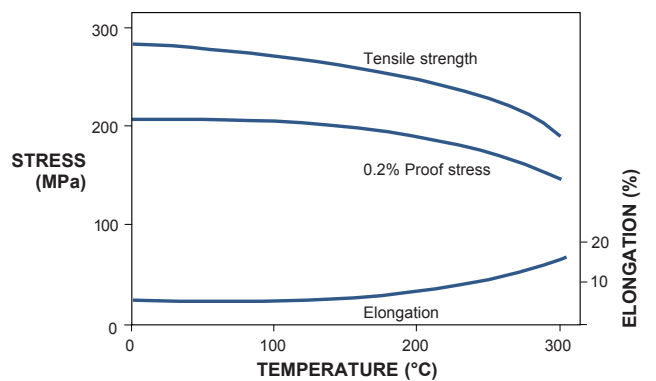
Endurance Limit MPa	Stress Reversals			
	10 ⁶	5 x 10 ⁶	10 ⁷	5 x 10 ⁷
Unnotched	102	100	99	97

ELEVATED TEMPERATURE MECHANICAL PROPERTIES

TYPICAL TENSILE PROPERTIES

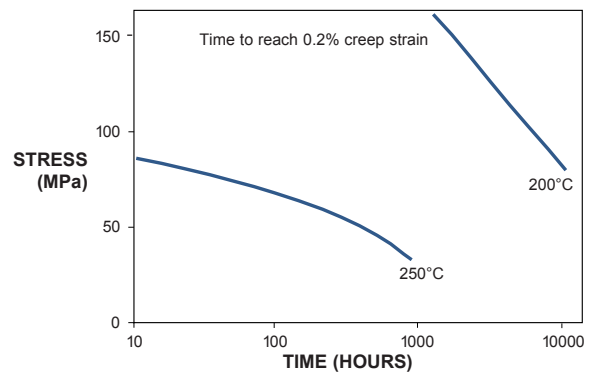
	0.2% Proof stress (MPa)	Tensile strength (MPa)	Elongation (%)
20°C	205	280	4.0
100°C	197	260	4.5
150°C	195	255	5.0
200°C	183	241	6.5
250°C	175	230	9.0

FIG. 1 Effect of temperature on tensile properties



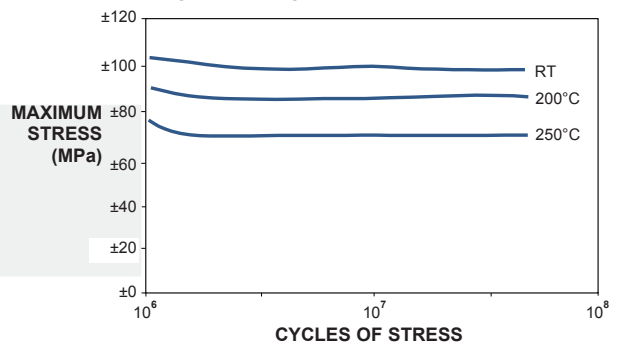
CREEP PROPERTIES

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



FATIGUE PROPERTIES

FIG. 3 Rotating bend fatigue tests



Elektron WE54 Castings

CUT UP PROPERTIES OF 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



Certificate No. FM12677

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 Magnesium Elektron products. MAGNESIUM ELEKTRON, THE 'e' LOGO, MEL, ELEKTRON and ZIRMAX are registered trademarks of Magnesium Elektron Limited.