



# Magnesium Elektron

SERVICE & INNOVATION IN MAGNESIUM

## Elektron WE54 Wrought Alloy

Datasheet : 480

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# ELEKTRON WE54

Wrought ELEKTRON WE54 is a high strength fully heat treatable magnesium based alloy for use at temperatures up to 300°C. The mechanical properties of ELEKTRON WE54 are more isotropic than conventional magnesium alloys.

## APPLICATIONS

The excellent retention of properties at elevated temperatures and improved corrosion resistance will be of interest to designers of aircraft, aero engines and performance cars.

## DESIGNATIONS

ASTM WE54A  
UNS M18410

## CHEMICAL COMPOSITION

Yttrium	4.75–5.5%
Rare Earths*	3.0–4.0%
Zirconium	0.4% min
Magnesium	Balance

\*Rare earths consist of neodymium 1.5–2.0%, the remainder being heavy rare earths, principally ytterbium, erbium, dysprosium and gadolinium

## HEAT TREATMENT

The alloy develops its properties in the fully heat treated (T6) condition ie:

4–8 hours at 525°C,  
Hot water or polymer quench or air cool,  
Age for 16 hours at 250°C,  
Air cool.

Alternatively, for applications up to 200°C, the alloy may be used in the T5 condition ie:  
16 hours at 250°C.

## 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

### Proposed minima

EXTRUDED BAR T6	
0.2% Proof stress	160 MPa
Tensile strength	250 MPa
Elongation	6%
EXTRUDED BAR T5	
0.2% Proof stress	180 MPa
Tensile strength	280 MPa
Elongation	6%

## OTHER PROPERTIES

### WELDABILITY

Weldable by the tungsten arc inert gas process (TIG) with a filler rod of the parent alloy composition. Components should be heat treated after welding.

### FORGING

ELEKTRON WE54 is a high strength alloy that responds well to press forging.

### MACHINING

ELEKTRON WE54, like all magnesium alloys, machines 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. 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 alloys under salt spray conditions.

Corrosion rate	mg/cm <sup>2</sup> /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**

**EXTRUDED**

	0.2% Proof stress MPa	Tensile strength MPa	Elongation %
<b>T5</b>	200	300	10
<b>T6</b>	190	275	10

**FORGED**

	0.2% Proof stress MPa	Tensile strength MPa	Elongation %
<b>T5</b>	210	320	8
<b>T6</b>	195	295	6

**FRACTURE TOUGHNESS**

<b>T5</b>	$K_{IC}$	15–17 MPa m <sup>1/2</sup>
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**TYPICAL FATIGUE PROPERTIES**

Rotating bend test

Endurance limit MPa	$5 \times 10^7$
T5 Unnotched	145

**ELEVATED TEMPERATURE MECHANICAL PROPERTIES**

**TYPICAL TENSILE PROPERTIES**

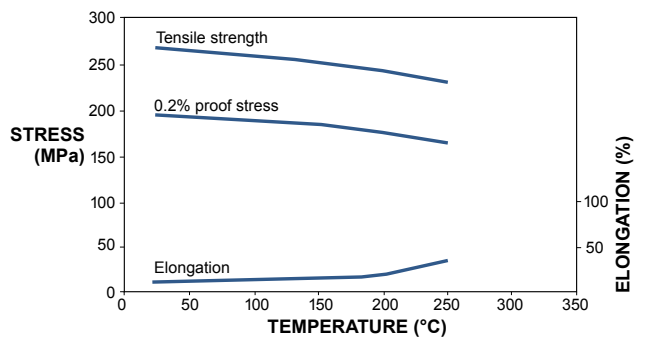
**EXTRUDED**

	0.2% Proof stress MPa	Tensile strength MPa	Elongation %
<b>T5</b> 20°C	200	300	10
250°C	125	190	50
<b>T6</b> 20°C	190	275	10
250°C	180	240	20

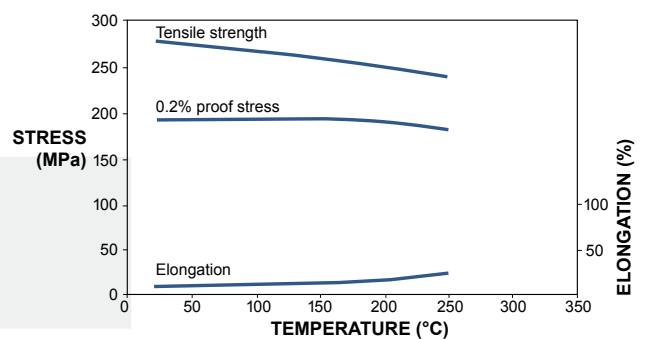
**FORGED**

	0.2% Proof stress MPa	Tensile strength MPa	Elongation %
<b>T5</b> 20°C	210	320	8
150°C	190	294	11
250°C	189	246	13
<b>T6</b> 20°C	195	295	6
150°C	175	253	11
250°C	170	225	17

**FIG. 1** Tensile properties vs temperature  
Extruded T6 bar



**FIG. 2** Tensile properties vs temperature  
Forged T6 bar





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