

Magnesium Casting Alloys

Typical Chemical Composition – Major Alloying Elements %	Magnesium Alloy	Tensile Properties ¹			Compressive Properties		Fatigue Properties ³		Hardness	Description
		0.2% Proof Stress (MPa)	Tensile Strength (MPa)	Elongation ² (%)	0.2% Proof Stress (MPa)	Ultimate Strength (MPa)	Unnotched (MPa)	Notched (MPa)	v.p.n.	
Y 5.25 Nd and other heavy rare earth metals 3.5 Zr 0.5	ELEKTRONWE54 Solution and precipitation treated Sand cast Chill cast	185 185	255 255	2 2	167–175 -	410 -	95–100 -	- -	90–105 -	High strength at elevated temperatures.
Y 4.0 Nd and other heavy rare earth metals 3.0 Zr 0.5	ELEKTRONWE43 Solution and precipitation treated Sand cast Chill cast	172 172	220 220	2 2	187 -	323 -	85 -	- -	85–105	Excellent retention of strength after long exposure at 250°C. Good castability, weldable.
Nd 2.7 Gd 1.3 Zn 0.3 Zr 0.6	ELEKTRON21 Solution and precipitation treated Sand cast	145	248	2	(156)	(348)	(115–120)	–	(70–80)	High strength alloy. Good corrosion resistance, good castability.
Rare earth metals 3.0 Zn 2.5 Zr 0.6	ELEKTRONZRE1 Precipitation treated Sand cast Chill cast	95 100	140 155	3 3	85–120 -	275–340 -	66–75 -	50–55 -	55–70 -	Creep-resistant up to 250°C. Excellent castability. Pressure tight and weldable.
Zn 4.2 Rare earth metals 1.3 Zr 0.7	ELEKTRONRZ5 Precipitation treated Sand cast Chill cast	135 135	200 215	3 4	130–150 -	330–365 -	90–105 -	75–90 -	60–80 -	Easily cast, weldable, pressure tight, with useful strength.
Ag 1.5 Nd rich rare earth metals 2.0 Zr 0.6 Cu 0.07	ELEKTRONEQ21 Solution and precipitation treated Sand cast Chill cast	175 185	240 240	2 2	165–200 -	310–385 -	100–110 -	60–70 -	80–105 -	Heat-treated alloys with high yield strength up to 200°C. Pressure tight and weldable.
Ag 2.5 Nd rich rare earth metals 2.5 Zr 0.6	ELEKTRONMSR-B Solution and precipitation treated Sand cast Chill cast	185 185	240 240	2 2	165–200 -	310–385 -	100–110 -	60–70 -	80–105 -	
Ag 2.5 Nd rich rare earth metals 2.0 Zr 0.6	ELEKTRONQE22 Solution and precipitation treated Sand cast Chill cast	175 175	240 240	2 2	165–200 -	310–385 -	100–110 -	60–70 -	80–105 -	
Al 8.0 Zn 0.5 Mn 0.3	ELEKTRONA8 As cast Sand cast Chill cast Solution treated Sand cast Chill cast	 (85) (85) 80 80	 140 185 200 230	 2 4 7 10	 75–90 - 75–90 -	 280–340 - 325–415 -	 75–85 - 75–90 -	 58–65 - 60–70 -	 55–70 - 55–70 -	General purpose alloy. Good founding properties. Good ductility, strength and shock resistance. Also available as a high purity grade.
Al 9.5 Zn 0.5 Mn 0.3	ELEKTRONAZ91 As cast Sand cast Chill cast Solution treated Sand cast Chill cast Solution and precipitation treated Sand cast Chill cast	 (95) (100) 80 80 120 120	 125 170 200 215 200 215	 - 2 4 5 - 2	 85–110 - 75–110 - 110–140 -	 280–340 - 185–432 - 385–465 -	 77–85 - 77–92 - 70–77 -	 58–65 - 65–77 - 58–62 -	 60–75 - 60–75 - 85–100 -	General purpose alloy. Good founding properties. Suitable for pressure die castings.
Al 9.0 Zn 0.5 Mn 0.3	AZ91D Die cast	160	230	3	160	-	100	-	-	
Al 5.0 Mn 0.5	AM50A Die cast	110	200	10	-	-	-	-	-	
Al 6.0 Mn 0.5	AM60B Die cast	130	220	8	-	-	-	-	-	

Approximate conversion factors 1 MPa=0.065 T.S.I.=0.145 K.S.I.

The tensile properties quoted are the specification minima for the first specification listed for that alloy and condition. The ranges given are the specified minima; bracketed values are for information only.

1. The values quoted are for separately cast test bars and may not be realised in certain portions of castings.
2. Elongation values are based on a gauge length of $5.65\sqrt{A}$, except in the case of thin material where a gauge length of 50mm may be used (see B.S. 2 L.500, 3370 and 3373).

- With the latter gauge length, elongation requirements for sheet and plate depend on thickness and a range of minima is quoted.
3. Endurance values for 50×10^6 reversals in rotating bending-type tests; semi-circular notch, radius 1.2mm, S.C.F. approx. 2.

Magnesium Casting Specifications

Magnesium Alloy Designation and condition	BRITISH		AMERICAN				GERMAN		FRENCH			EUROPEAN
	B.S. Series		ASTM Alloy Designation & temper	ASTM	Federal	AMS	Aircraft Number	DIN 1729 Number	Commercial Designation	Air 3380	AFNOR	General Engineering EN1753
	Aircraft	General Engineering										
ELEKTRON WE54 Solution & precipitation treated	-	2970 MAG14-TF	WE54A-T6	B80	-	4426	-	-	-	-	-	EN-MB95310
ELEKTRON WE43 Solution & precipitation treated	-	-	WE43A-T6	B80	-	4427	-	-	-	-	-	EN-MB95320
ELEKTRON 21 Solution & precipitation treated	-	-	EV31A-T6	-	-	4429	-	-	-	-	-	-
ELEKTRON ZRE1 Precipitation treated	2 L.126	2970 MAG6-TE	EZ33A-T5	B80	QQ-M-56B	4442	3.6204	3.5103	ZRE1	ZRE1	G-TR3Z2	EN-MB65120
ELEKTRON RZ5 Precipitation treated	2 L.128	2970 MAG5-TE	ZE41A-T5	B80	-	4439	3.6104	3.5101	RZ5	RZ5	G-Z4TR	EN-MB35110
ELEKTRON EQ21 Solution & precipitation treated	-	2970 MAG13-TF	EQ21A-T6	B80	-	4417	-	-	-	-	-	EN-MB65220
ELEKTRON MSR-B Solution & precipitation treated	-	2970 MAG12-TF	-	-	-	-	-	-	MSR-B	-	G-Ag25 TR	EN-MB65210
ELEKTRON QE22 Solution & precipitation treated	-	-	QE22A-T6	B80	QQ-M-56B	4418	3.5164	3.5106	-	-	-	-
ELEKTRON A8 As cast Solution treated	- 3 L.122	2970 MAG1-M 2970 MAG1-TB	AZ81A-F AZ81A-T4	B80 B80	QQ-M-56B QQ-M-56B	- -	- -	3.5812 3.5812	FT FT	G-A9 G-A9	G-A9 G-A9	EN-MB21110
ELEKTRON AZ91 As cast Solution treated Solution & precipitation treated	- 3 L.124	2970 MAG3-M 2970 MAG3-TB	AZ91E-F AZ91E-T4	B80 B80	QQ-M-56B QQ-M-56B	- -	- 3.5194	- -	F10 F10	G-A9Z1 G-A9Z1	G-A9Z1 G- A9Z1	EN-MB21120
	3 L.125	2970 MAG3-TF	AZ91E-T6	B80	QQ-M-56B	4437	3.5194	-	F10	G-A9Z1	G-A9Z1	
ELEKTRON AZ91 Die cast	-	-	AZ91D	B94	-	-	-	-	-	-	-	-
ELEKTRON AM60 Die cast	-	-	AM60B	B94	-	-	-	-	-	-	-	-
ELEKTRON AM50 Die cast	-	-	AM50A	B94	-	-	-	-	-	-	-	-

Magnesium Casting Specifications

Physical Properties of Magnesium Casting Alloys

Magnesium Alloy	Specific gravity (20°C)	Coefficient of thermal expansion 10^{-6} K^{-1} (20–200°C)	Thermal conductivity $\text{Wm}^{-1} \text{ K}^{-1}$ (20°C)	Electrical resistivity $\text{n}\Omega\text{m}$ (20°C)	Specific heat $\text{Jkg}^{-1} \text{ K}^{-1}$ (20–100°C)
ELEKTRON WE54	1.85	24.6	52	173	960
ELEKTRON WE43	1.84	26.7	51	148	966
ELEKTRON 21	1.82	26.7	86	94.6	997
ELEKTRON ZRE1	1.80	26.8	100	73	1050
ELEKTRON RZ5	1.84	27.1	109	68	960
ELEKTRON MSR-B	1.82	26.7	113	68	1000
ELEKTRON QE22	1.82	26.7	113	68	1000
ELEKTRON A8	1.81	27.2	84	134	1000
ELEKTRON AZ91	1.83	27.0	84	141	1000
ELEKTRON C	1.81	27.2	84	134	1000

Certificate No. FM12677