

Typical Magnesium Sand & Permanent Mold Casting Alloys



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The following is a summary of typical magnesium sand and permanent mold casting alloys, including links to supplier property data and links to articles and handbook information.

For additional resources, visit <http://www.materialstechnology.org>

Designations in parentheses are British designations for the ASTM designations which precede them.

Alloy	Temper	Description	Link to Supplier Information	Article or Handbook	Link to Article or Handbook
AZ91E	T4, T6	General purpose gravity and sand casting Mg-Al-Zn alloy with excellent corrosion resistance. Used in aerospace applications where there is no elevated temperature requirements or pressure tightness requirements.	Magnesium-Elektron	Handbook of Materials Selection, ed. Kutz, Myer, 2002 John Wiley & Sons Metallic Materials Properties Development and Standardization, U. S. Department of Transportation, 2003 Y. W. Riddle and M. M. Makhlof, "Characterizing Solidification by Non-Equilibrium Thermal Analysis", Magnesium Technology 2003, TMS, pp. 101-106.	Read the Full Article Read the Full Article Read the Full Article
AZ81A (ElektronA8)	T4, T6	General purpose gravity and sand casting Mg-Zn-Al alloy with excellent corrosion resistance. Used in aerospace applications where there is no elevated temperature requirements or pressure tightness requirements.	Magnesium-Elektron	L. Lin, L. Chen and Z. Liu, "Effect of Temperature on the Superplasticity of AZ81 Magnesium Alloy Processed by Hot Extrusion", Materials Science Forum, Vols. 488-489 (2005) pp. 585-588.	Acquire the Article
AZ92A	various	Mg-Zn-Al sand and permanent mold casting alloy with high tensile strength and good yield strength.		ASM Specialty Handbook: Magnesium and Magnesium Alloys, eds. M. M. Avedesian and H. Baker, ASM International, 1999. Metallic Materials Properties Development and Standardization, U. S. Department of Transportation, 2003	Acquire the Book Read the Full Article
ZC63A	T6	Mg-Zn-Cu sand casting alloy with superior properties and castability compared to AZ91C. Used in pressure tight applications. Is weldable.		ASM Specialty Handbook: Magnesium and Magnesium Alloys, eds. M. M. Avedesian and H. Baker, ASM International, 1999. B. L. Tiwari and R. K. Mishra, "Evaluation of a New Concept for Semi-solid Magnesium Billet Forming", Magnesium Technology 2002, TMS, pp. 201-206.	Acquire the Book Read the Full Article
ZE63A	T6	Mg-Zn-RE high strength, sand casting alloy with excellent castability and pressure tightness. Requires special heat treatment in hydrogen, limiting wall thicknesses.		ASM Specialty Handbook: Magnesium and Magnesium Alloys, eds. M. M. Avedesian and H. Baker, ASM International, 1999.	Acquire the Book
ZK51A	T5	Mg-Zn-Zr high strength, sand casting alloy with good ductility.		ASM Specialty Handbook: Magnesium and Magnesium Alloys, eds. M. M. Avedesian and H. Baker, ASM International, 1999.	Acquire the Book
ZK61A	T5, T6	Mg-Zn-Zr high strength, sand casting alloy. Used in high stressed aerospace and military applications. Is expensive and not weldable.		ASM Specialty Handbook: Magnesium and Magnesium Alloys, eds. M. M. Avedesian and H. Baker, ASM International, 1999.	Acquire the Book

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ZE41A (RZ5)	T5	Elevated temperature high integrity Mg-Zn-RE casting alloy for use up to 150°C. Contains Zn, rare earths and Zr. Is pressure tight and weldable.	Magnesium-Elektron	Handbook of Materials Selection, ed. Kutz, Myer, 2002 John Wiley & Sons Metallic Materials Properties Development and Standardization, U. S. Department of Transportation, 2003 Y. W. Riddle, L. P. Barber and M. M. Makhlof, "Characterization of Mg Alloy Solidification and As-Cast Microstructures", Magnesium Technology 2004, TMS, pp. 203-208. X. Cao, M. Xiao, M. Jahazi, and Y. L. Lin, "Nd:YAG Laser Welding of Magnesium Alloy Castings", Magnesium Technology 2005, TMS, pp. 441-446.	Read the Full Article Read the Full Article Read the Full Article Acquire the Article
QE22A	T6	Elevated temperature Mg-Ag-RE sand and permanent mold casting alloy with high yield strength at temperatures up to 200°C. Pressure tight and weldable.	Magnesium-Elektron	ASM Specialty Handbook: Magnesium and Magnesium Alloys, eds. M. M. Avedesian and H. Baker, ASM International, 1999. Handbook of Materials Selection, ed. Kutz, Myer, 2002 John Wiley & Sons Metallic Materials Properties Development and Standardization, U. S. Department of Transportation, 2003	Acquire the Book Read the Full Article Read the Full Article
MSR-B	T6	Elevated temperature, high strength Mg-Ag-RE alloy with good foundry characteristics. Used at temperatures up to 200°C. Is pressure tight and weldable.	Magnesium-Elektron		
EQ21A	T6	Elevated temperature, high strength Mg-RE-Ag alloy with good foundry characteristics. The silver level is lower than that of MSR-B, making it a lower cost alternative. Used at temperatures up to 200°C.	Magnesium-Elektron	ASM Specialty Handbook: Magnesium and Magnesium Alloys, eds. M. M. Avedesian and H. Baker, ASM International, 1999.	Acquire the Book

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Alloy	Temper	Description	Link to Supplier Information	Article or Handbook	Link to Article or Handbook
WE54A	T6	Elevated temperature, high strength, corrosion resistant Mg-Y-RE alloy developed for use at temperatures up to 300°C. Prolonged use at 100°C to 250°C may cause loss of ductility.	Magnesium-Elektron	Handbook of Materials Selection, ed. Kutz, Myer, 2002 John Wiley & Sons H. Karimzadeh, P. Lyon, J.F. King, "Factors Affecting the Corrosion Performance of Elecktron WE43 and WE54 Magnesium Casting Alloys", Mordike, BL, Kainer, KU eds (1998) Magnesium Alloys and their Applications, Hamburg, Germany, Werkstoff-informations gesellschaft. ASM Specialty Handbook: Magnesium and Magnesium Alloys, eds. M. M. Avedesian and H. Baker, ASM International, 1999.	Read the Full Article Acquire this Book Acquire the Book For more articles, search Magnesium Article and Presentation Database, Eric Nyberg of Pacific Northwest National Laboratory, 2007. Search Database
WE43A	T6	Elevated temperature, high strength Mg-Y-RE alloy developed for use at temperatures up to 300°C. Contains yttrium, rare earths and zirconium. Is stable up to 250°C. Has excellent corrosion resistance.	Magnesium-Elektron	Handbook of Materials Selection, ed. Kutz, Myer, 2002 John Wiley & Sons H. Karimzadeh, P. Lyon, J.F. King, "Factors Affecting the Corrosion Performance of Elecktron WE43 and WE54 Magnesium Casting Alloys", Mordike, BL, Kainer, KU eds (1998) Magnesium Alloys and their Applications, Hamburg, Germany, Werkstoff-informations gesellschaft.	Read the Full Article Acquire this Book For more articles, search Magnesium Article and Presentation Database, Eric Nyberg of Pacific Northwest National Laboratory, 2007. Search Database

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EZ33A (ZRE1)	T5	Elevated temperature Mg-Zn-RE alloy with excellent casting characteristics. Components are pressure tight, weldable and creep resistant to 250°C.	Magnesium-Elektron	Handbook of Materials Selection, ed. Kutz, Myer, 2002 John Wiley & Sons	Read the Full Article
				Metallic Materials Properties Development and Standardization, U. S. Department of Transportation, 2003	Read the Full Article
				Y. W. Riddle, L. P. Barber and M. M. Makhlof, "Characterization of Mg Alloy Solidification and As-Cast Microstructures", Magnesium Technology 2004, TMS, pp. 203-208.	Read the Full Article
EV31A (Elektron 21)	T6	Elevated temperature alloy. High strength for use up to 200°C. Excellent corrosion resistance and castability.	Magnesium-Elektron	M. Massazza, G. Riontino, D. Lussana, A. Iozzia, P. Mengucci, G. Barucca, A. Di Cristoforo, R. Ferragut, R. Doglione, "Structural Evolution on Thermal Treatments of EV31 Alloy", Kainer, KU editor (2006) Magnesium: Proceedings of the 7th International Conference on Magnesium Alloys and Their Applications, 2006, DGM, Frankfurt, Germany.	Acquire the Proceedings
				P. Lyon, T. Wilks, and I. Syed, "The Influence of Alloying Elements and Heat Treatment Upon Properties of Elektron 21 (EV31A) Alloy", Neelameggham, N, Kaplan, HI, and Powell, BR eds (2005) Magnesium Technology 2005 TMS, Warrendale, PA, pp. 303-308.	Acquire the Article
				P. Lyon, "New Magnesium Alloy for Aerospace and Specialty Applications", Magnesium Technology 2004, TMS, pp. 311-316.	Read the Full Article
MRI-201S	T6	Elevated temperature alloy with good mechanical properties and creep resistance up to 300°C. Is castable, pressure tight, weldable, dimensionally stable and has improved corrosion resistance compared to other magnesium casting alloys. Targetted for use in engine blocks, engine cylinder heads and aerospace transmission	Dead Sea Magnesium	E. Aghion, B. Bronfin, F. Von Buch, S. Schumann, and H. Friedrich, "Newly Developed Magnesium Alloys for Powertrain Applications", JOM, November 2003, pp. 30-33.	Read the Full Article
				B. Bronfin, M. Katsir, O. Bar-Yosef, F. Moll, and S. Schumann, "Metallurgical Background to the Development of Creep Resistant Gravity Casting Magnesium Alloys", Magnesium Technology 2005, TMS, pp. 395-402.	Acquire the Article

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Alloy	Temper	Description	Link to Supplier Information	Article or Handbook	Link to Article or Handbook
MRI-202S	T6	Elevated temperature alloy with good mechanical properties and creep resistance up to 250°C. Is castable, pressure tight, weldable, dimensionally stable and has superior corrosion resistance. Targetted for use in engine blocks and aerospace transmission housings. Slightly lower in properties and cost compared to MRI-201S.	Dead Sea Magnesium	<p>E. Aghion, B. Bronfin, F. Von Buch, S. Schumann, and H. Friedrich, "Newly Developed Magnesium Alloys for Powertrain Applications", JOM, November 2003, pp. 30-33.</p> <p>B. Bronfin, M. Katsir, O. Bar-Yosef, F. Moll, and S. Schumann, "Metallurgical Background to the Development of Creep Resistant Gravity Casting Magnesium Alloys", Magnesium Technology 2005, TMS, pp. 395-402.</p>	<p>Read the Full Article</p> <p>Acquire the Article</p>
AM-SC1	T6	Elevated temperature, creep resistant alloy developed for automotive powertrain components. Has good castability and is well suited to mass production.	AM Technologies	<p>C. J. Bettles, C. T. Forwood, D. H. StJohn, M. T. Frost, D. S. Jones, M. Qian, G-L. Song, J. R. Griffiths and J. F. Nie, AMC-SC1: An Elevated Temperature Magnesium Alloy Suitable for Precision Sand Casting of Powertrain Components", Magnesium Technology 2003, TMS, pp. 223-226.</p> <p>G. Song, D. StJohn, C. Bettles and G. Dunlop, "The Corrosion Performance of Magnesium Alloy AM-SC1 in Automotive Engine Block Applications", JOM, May 2005, pp. 54-56.</p>	<p>Read the Full Article</p> <p>Read the Full Article</p>