Magnesium Die Casting Alloys

Commercial:	AZ91D	AZ81	AM60B	AM50A	AM20	AE42	AS41B
Mechanical Properties							
Ultimate Tensile Strength B ksi (MPa)	34 (230)	32 (220)	32 (220)	32 (220)	32 (220)	27 (185)	33 (225)
Yield Strength E B ksi (MPa)	23 (160)	21 (150)	19 (130)	18 (120)	15 (105)	20 (140)	20 (140)
Compressive Yield Strength H ksi (MPa)	24 (165)	N/A	19 (130)	N/A	N/A	N/A	20 (140)
Elongation B % in 2 in. (51mm)	3	3	6-8	6-10	8-12	8-10	6
Hardness F BHN	75	72	62	57	47	57	75
Shear Strength B ksi (MPa)	20 (140)	20 (140)	N/A	N/A	N/A	N/A	N/A
Impact Strength D ft-lb (J)	1.6 (2.2)	N/A	4.5 (6.1)	7.0 (9.5)	N/A	4.3 (5.8)	3.0 (4.1)
Fatigue Strength A ksi (MPa)	10 (70)	10 (70)	10 (70)	10 (70)	10 (70)	N/A	N/A
Latent Heat of Fusion Btu/lb (kJ/kg)	160 (373)	160 (373)	160 (373)	160 (373)	160 (373)	160 (373)	160 (373)
Young's Modulus B psi x 10^6 (GPa)	6.5 (45)	6.5 (45)	6.5 (45)	6.5 (45)	6.5 (45)	6.5 (45)	6.5 (45)
Physical Properties							
Density lb/in ^{3} (g/cm ^{3})	0.066 (1.81)	0.065 (1.80)	0.065 (1.79)	0.064 (1.78)	0.063 (1.76)	0.064 (1.78)	0.064 (1.78)
Melting Range °F (°C)	875-1105 (470-595)	915-1130 (490-610)	1005-1140 (540-615)	1010-1150 (543-620)	1145-1190 (618-643)	1050-1150 (565-620)	1050-1150 (565-620)
Specific Heat B BTU/lb °F (J/kg °C)	0.25 (1050)	0.25 (1050)	0.25 (1050)	0.25 (1050)	0.24 (1000)	0.24 (1000)	0.24 (1000)
Coefficient of Thermal Expansion B µ in/in°F (µ m/m°K)	13.8 (25.0)	13.8 (25.0)	14.2 (25.6)	14.4 (26.0)	14.4 (26.0)	14.5 G (26.1)	14.5 (26.1)
Thermal Conductivity BTU/ft hr°F (W/m °K @)	41.8 C (72)	30 B (51)	36 B (62)	36 B (62)	35 B (60)	40 B G (68)	40 B (68)
Electrical Resistivity B µ Ω in. (µ Ω cm.)	35.8 (14.1)	33.0 (13.0)	31.8 (12.5)	31.8 (12.5)	N/A	N/A	N/A
Poisson's Ratio	0.35	0.35	0.35	0.35	0.35	0.35	0.35

n/a = data not available. A Rotating Beam fatigue test according to DIN 50113. Stress corresponding to a lifetime of 5 x 10^7 cycles. Higher values have been reported. These are conservative values. Soundness of samples has great effect on fatigue properties resulting in disagreement among data sources. B At 68°F (20°C). C At 212-572°F (100-300°C). D ASTM E 23 unnotched 0.25 in. die cast bar. E 0.2% offset. F Average hardness based on scattered data. G Estimated. H 0.1% offset. I Casting conditions may *significantly* affect mold shrinkage. Source: International Magnesium Assn.

* There are additional magnesium alloys that have been and are being developed for elevated temperature and creep resistant applications. See the data table on page 3-20. Contact your alloy producer for more information.

Alloy Data

Die casting alloy selection requires evaluation not only of physical and mechanical properties, and chemical composition, but also of inherent alloy characteristics and their effect on die casting production as well as possible machining and final surface finishing.

This table includes selected die casting and other special characteristics which are usually considered in selecting a magnesium alloy for a specific application.

The characteristics are rated from (1) to (5), (1) being the most desirable and (5) being the least. In applying these ratings, it should be noted that all the alloys have sufficiently good charac teristics to be accepted by users and producers of die castings. A rating of (5) in one or more categories would not rule out an alloy if other attributes are particularly favorable, but ratings of (5) may present manufacturing difficulties.

The benefits of consulting a custom die caster experienced in casting the magnesium alloy being considered are clear.

Table A-3-12 Die Casting and Other Characteristics: Mg Alloys
(1 = most desirable, 5 = least desirable)

	Magnesium Die Casting Alloys						
Commercial:	AZ91D	AZ81	AM60B	AM50A	AM20	AE42	AS41B
Resistance to Cold Defects a	2	2	3 G	3 G	5 G	4 G	4 G
Pressure Tightness	2	2	1 G	1 G	1 G	1 G	1 G
Resistance to Hot Cracking B	2	2	2 G	2 G	1 G	2 G	1 G
Machining Ease & Quality C	1	1	1 G	1 G	1 G	1 G	1 G
Electroplating Ease & Quality D	2	2	2 G	2 G	2 G	—	2 G
Surface Treatment E	2	2	1 G	1 G	1 G	1 G	1 G
Die-Filling Capacity	1	1	2	2	4	2	2
Anti-Soldering to the Die	1	1	1	1	1	2	1
Corrosion Resistance	1	1	1	1	2	1	2
Polishing Ease & Quality	2	2	2	2	4	3	3
Chemical Oxide Protective Coating	2	2	1	1	1	1	1
Strength at Elevated Temperature F	4	4	3	3	5	1	2

A The ability of alloy to resist formation of cold defects, for example, cold shuts, cold cracks, *non-fill* "woody" areas, swirls, etc. B Ability of alloy to withstand stresses from contraction while cooling through the hot-short or brittle temperature range. C Composite rating based on ease of cutting, chip characteristics, quality of *finish* and tool life. D Ability of the die casting to take and hold on electroplate applied by present standard methods. E Ability of castings to be cleaned in standard pickle solutions and to be conditioned for pest paint adhesion. F Rating based on resistance to creep at elevated temperatures. G Rating based upon limited experience giving guidance only. Sources: ASTM B94-92, International Magnesium Association.

* There are additional magnesium alloys that have been and are being developed for elevated temperature and creep resistant applications. Contact your alloy producer for more information.