

ZINC ALLOY PROPERTIES

Alloy	#3	#5	#7	#2	ZA-8		ZA-12			ZA-27			
Mechanical Properties	Die Cast	Die Cast	Die Cast	Die Cast	Sand Cast	Perm Mold	Die Cast	Sand Cast	Perm Mold	Die Cast	Sand Cast	Sand Cast HT1	Die Cast
Ultimate Tensile Strength: psi x 10 ³ (MPa)	41 (283)	48 (328)	41 (283)	52 (359)	38 (263)	32-37 (221-255)	54 (374)	40-46 (276-317)	45-50 (310-345)	58 (400)	58-64 (400-441)	45-47 (310-324)	61 (421)
Yield Strength-0.2%Offset:psi x 10 ³ (MPa)	32 (221)	33 (228)	32 (21)		29 (200)	30 (206)	42 (290)	31 (214)	39 (269)	46 (317)	54 (372)	37 (255)	55 (379)
Elongation: % in 2"	10	7	13	7	1-2	1-2	6-10	1-3	1-3	4-7	3-6	8-11	1-3
Shear Strength: psi x 10 ³ (MPa)	31 (214)	38 (262)	31 (214)	46 (317)		35 (241)	40 (275)	37 (255)		43 (296)	42 (290)	33 (228)	47 (325)
Hardness: Brinell	82	91	80	100	85	85-90	95-110	89-105	80-105	95-115	110-120	90-110	105-125
Impact Strength: ft-lb (J)	43 ² (58)	48 ² (65)	43 ² (58)	35 ² (48)	155 ⁶ (20)		313 (42)	193 (25)		213 (29)	353 (47)	433 (58)	93 (5)
Fatigue Strength Rotary Bend - 5x10 ⁸ cycles psi x 10 ³ (MPa)	6.9 (48)	8.2 (57)	6.8 (47)	8.5 (59)		7.5 (52)	15 (103)	15 (103)		17 (117)	25 (172)	15 (103)	21 (145)
Compressive Yield Strength - 0.1% Offset: psi x 103(MPa)	60 ¹ (414)	874 (603)	604 (414)	934 (541)	29 (199)	31 (214)	37 (252)	33 (227)	34 (234)	39 (269)	48 (331)	37 (255)	52 (385)
Modulus of Elasticity - psix106(MPaX103)	12.4 ⁶ (85.5)	12.4 ⁶ (85.5)	12.4 ⁶ (85.5)	12.4 ⁶ (85.5)	12.4 (85.5)	12.4 ⁷ (85.5)			12.0 ⁷ (82.7)			11.3 ⁷ (779)	
Physical Properties													
Density: lb/cu in (g/cm ³)	.24 (6.6)	.24 (6.6)	.24 (6.6)	.24 (6.6)		0.227 (6.3)			0.218 (6.0)			0.181 (5.0)	
Melting Range: °F(°C)	718-728 (381-387)	717-727 (380-386)	718-728 (381-387)	715-734 (379-390)		707-759 (375-404)			716-810 (377-432)			708-903 (376-484)	
Electrical Conductivity: % IACS	27	26	27	25		27.7			28.3			29.7	
Thermal Conductivity: BTU/ft-hr/°F (W/m-hr/°C)	65.3 (113.0)	62.9 (108.9)	65.3 (113.0)	60.5 (104.7)		66.3 (114.7)			67.1 (116.1)			72.5 (125.5)	
Coefficient of Thermal Expansion 68-212°F min/in/°F (100-200°C mm/mm/°C)	15.2 (27.4)	15.2 (27.4)	15.2 (27.4)	15.4 (27.8)		12.9 (23.3)			13.4 (24.2)			14.4 (26.0)	
Specific Heat: BTU/lb-°F (J/kg-°C)	.10 (419)	.10 (419)	.10 (419)	.10 (419)	.104 (435)	.107 (448)	.125 (534)						
Pattern or Die Shrinkage: in/in	0.007	0.007	0.007	0.007		1/8 in/ft	0.007	1/8 in/ft	5/32 in/ft	0.0075	5/32 in/ft	5/32 in/ft	0.008

Chemical Specifications

(per ASTM) (% by weight)

	Ingot	Casting	Ingot	Casting	Ingot	Casting	Ingot	Casting	Ingot	Casting	Ingot	Casting	Ingot	Casting
Al	3.9-4.3	3.5-4.3	3.9-4.3	3.5-4.3	3.9-4.3	3.5-4.3	3.9-4.3	3.5-4.3	8.2-8.8	8.0-8.8	10.8-11.5	10.5-11.5	25.5-28.0	25.0-28.0
Mg	.025-.05	.020-.05	.03-.06	.03-.08	.01-.020	.035-.020	.025-.05	.020-.050	.020-.030	.015-.030	.020-.030	.015-.030	.012-.020	.010-.020
Cu	.10 max	.25 max ⁹	.75-1.25	.75-1.25	.10 max	.25 max	2.6-2.9	2.5-3.0	0.8-1.3	0.8-1.3	0.5-1.2	0.5-1.2	2.0-2.5	2.0-2.5
Fe (max)	0.075	0.1	0.075	0.1	0.075	0.075	0.075	0.1	0.065	0.075	0.065	0.075	0.072	0.075
Pb (max)	0.004	0.005	0.004	0.005	0.002	0.003	0.004	0.005	0.035	0.006	0.005	0.006	0.035	0.006
Cd (max)	0.003	0.004	0.003	0.004	0.002	0.002	0.003	0.004	0.005	0.006	0.005	0.006	0.005	0.006
Sn (max)	0.032	0.033	0.002	0.003	0.001	0.001	0.002	0.003	0.002	0.003	0.002	0.003	0.002	0.003
Ni (other) ¹⁰					.005-.020	.005-.020								
Zn	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance

Industry Standards

	Ingot	Casting	Ingot	Casting	Ingot	Casting	Ingot	Casting	Ingot	Casting	Ingot	Casting	Ingot	Casting
ASTM	B240	B86	B240	B86	B240	B86	B240	B86	B669 (B240) ⁸	B791 (B86) ⁸	B669 (240) ⁸	B79 (B86) ⁸	B669 (B240) ⁸	B86 (B791) ⁸
SAE	J4688	J4688	J4688	J4688					Former 921					
UNS	Z33521	Z33520	Z33530	Z33531	Z33522	Z33523	Z33540	Z33541	Z35635	Z35636	Z35630	Z35631	Z35840	Z35841

¹ 3 hr at 610° F and furnace cool. ² 1/4" square specimen unnotched ³ 10mm square specimen unnotched ⁴ Comprehensive strength ⁵ Previous industry accepted standard. ⁶ Estimated values to be confirmed by research

⁷ Values for permanent mold condition which should be similar for other processes except for ZA-27 Sand Cast Heat Treat (HT). ⁸ Revision of standard anticipated 1998.

⁹ Per ASTM 886-88 ' For the majority of commercial applications, a copper content in the range of 0.25 to 0.75% will not adversely affect the serviceability of die castings and should not serve as a basis for rejection

¹⁰ Zamak alloy ingot for die casting (with the exception of % Ni in NO.7) may contain Ni, Cr, Mn, Si, in amounts of up to 0.02, 0.02, 0.06 and 0.035% respectively

ZA Ingot for foundry and pressure die casting may contain Ni Cr. or Mn in amounts of up to 0.01% each or 0.03% total.