

# 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 HT <sup>1</sup>	Die Cast	
Ultimate Tensile Strength: psi x 10 <sup>3</sup> (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 <sup>3</sup> (MPa)	32 (221)		33 (228)		32 (221)		-		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 <sup>3</sup> (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	89-105	95-115	110-120	90-110	105-125	
Impact Strength: ft-lb (J)	43 <sup>2</sup> (58)		48 <sup>2</sup> (65)		43 <sup>2</sup> (58)		35 <sup>2</sup> (48)		15 <sup>2</sup> (20)	-	31 <sup>2</sup> (42)	19 <sup>2</sup> (25)	-	21 <sup>2</sup> (29)	35 <sup>2</sup> (47)	43 <sup>2</sup> (58)	9 <sup>2</sup> (5)	
Fatigue Strength Rotary Bend - 5x10 <sup>8</sup> cycles psi x 10 <sup>3</sup> (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 10 <sup>3</sup> (MPa)	60 <sup>4</sup> (414)		87 <sup>4</sup> (600)		60 <sup>4</sup> (414)		93 <sup>4</sup> (641)		29 (199)	31 (214)	37 (252)	33(227)	34 (234)	39 (269)	48 (331)	37 (255)	52 (385)	
Modulus of Elasticity - psi x 10 <sup>6</sup> (MPa x 10 <sup>3</sup> )	12.4 <sup>6</sup> (85.5)		12.4 <sup>6</sup> (85.5)		12.4 <sup>6</sup> (85.5)		12.4 <sup>6</sup> (85.5)		12.4 (85.5)	12.4 <sup>7</sup> (85.5)			12.0 <sup>7</sup> (82.7)			11.3 <sup>7</sup> (77.9)		
<b>Physical Properties</b>																		
Density: lb/cu in (g/cm <sup>3</sup> )	.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)				710-810 (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 μin/in/°F (100-200°C μm/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	.007		.007		.007		.007		1/8 in/ft .007				1/8 in/ft		5/32 in/ft .0075		5/32 in/ft	
<b>Chemical Specifications</b>																		
<b>(per ASTM) (% by weight)</b>	Ingot	Casting	Ingot	Casting	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	.005-.020	.025-.05	.020-.050	.020-.030	.015-.030	.020-.030	.015-.030	.012-.020	.010-.020				
Cu	.10 max	.25 max <sup>9</sup>	.75-1.25	.75-1.25	.10 max	.25 max	2.6-2.9	2.5-3.0	0.8-1.3	.8-1.3	0.5-1.2	0.5-1.2	2.0-2.5	2.0-2.5				
Fe (max)	.075	.10	.075	.10	.075	.075	.075	.10	.065	.075	.065	.075	.072	.075				
Pb (max)	.004	.005	.004	.005	.0020	.003	.004	.005	.005	.006	.005	.006	.005	.006				
Cd (max)	.003	.004	.003	.004	.0020	.002	.003	.004	.005	.006	.005	.006	.005	.006				
Sn (max)	.002	.003	.002	.003	.0010	.001	.002	.003	.002	.003	.002	.003	.002	.003				
Ni (other) <sup>10</sup>	-	-	-	-	.005-.020	.005-.020	-	-	-	-	-	-	-	-				
Zn	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance
<b>Industry Standards</b>	Ingot	Casting	Ingot	Casting	Ingot <sup>5</sup>	Casting	Ingot	Casting	Ingot	Casting	Ingot	Casting	Ingot	Casting	Ingot	Casting	Ingot	Casting
ASTM	B240	B86	B240	B86	B240	B86	B240	B86	B669 (B240) <sup>8</sup>	B791 (B86) <sup>8</sup>	B669 (240) <sup>8</sup>	B79 (B86) <sup>8</sup>	B669 (B240) <sup>8</sup>	B86 (B791) <sup>8</sup>				
	AG40A	AG40A	AC41A	AC41A	AG40B	AG40B	AC43A	AC43A										
SAE	J468B	J468B	J468B	J468B			Fomer											
	903	903	925	925			921											
UNS	Z33521	Z33520	Z35530	Z35531	Z33522	Z33523	Z35540	Z35541	Z35635	Z35636	-	Z35630	Z35631	Z35840	Z35841			

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

<sup>7</sup> Values for permanent mold condition which should be similar for other processes except for ZA-27 Sand Cast Heat Treat (HT).

<sup>8</sup> Revision of standard anticipated 1998.

<sup>9</sup> Per ASTM B86-88, \* 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. \*

<sup>10</sup> 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.