

# Zinc alloys

<b>Chemical composition (EN1774) Guaranteed analysis (in %)</b>	<b>ZAMAK 2 ZL2/ZL0430 ZnAl4Cu3</b>	<b>ZAMAK 3 ZL3/ZL0400 ZnAl4</b>	<b>ZAMAK 5 ZL5/ZL0410 ZnAl4Cu1</b>	<b>ZA 8 ZL8/ZL0810 ZnAl8Cu1</b>	<b>SUPERLOY GDSL</b>
Al	3.8 - 4.2	3.8 - 4.2	3.8 - 4.2	8.2 - 8.8	6.6 - 7.2
Cu	2.7 - 3.3	≤ 0.03	0.7 - 1.1	0.9 - 1.3	3.2 - 3.8
Mg	0.035 - 0.06	0.035 - 0.06	0.035 - 0.06	0.02 - 0.03	≤ 0.005
Pb	≤ 0.003	≤ 0.003	≤ 0.003	≤ 0.005	≤ 0.003
Fe	≤ 0.020	≤ 0.020	≤ 0.020	≤ 0.035	≤ 0.020
Cd	≤ 0.003	≤ 0.003	≤ 0.003	≤ 0.005	≤ 0.003
Sn	≤ 0.001	≤ 0.001	≤ 0.001	≤ 0.002	≤ 0.001
Si	≤ 0.02	≤ 0.02	≤ 0.02	≤ 0.035	≤ 0.020
Ni	≤ 0.001	≤ 0.001	≤ 0.001	≤ 0.001	≤ 0.001

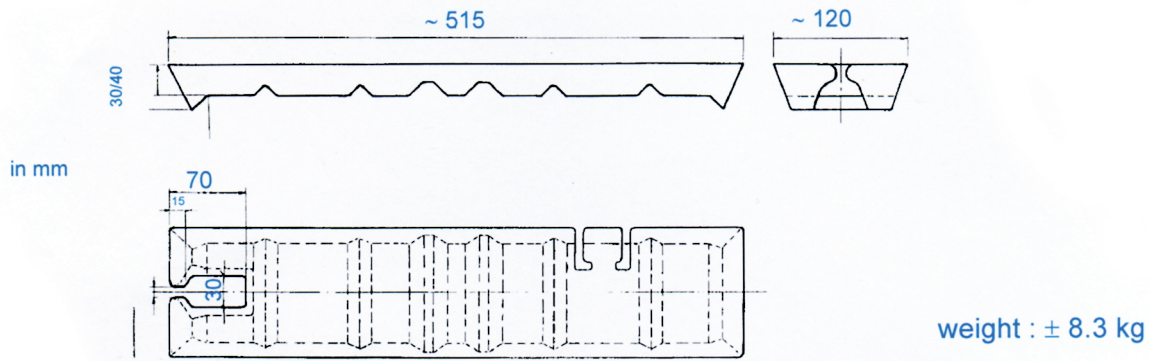
<b>Typical analysis (in %) (reference 2005)</b>	<b>ZAMAK 2 ZL2/ZL0430 ZnAl4Cu3</b>	<b>ZAMAK 3 ZL3/ZL0400 ZnAl4</b>	<b>ZAMAK 5 ZL5/ZL0410 ZnAl4Cu1</b>	<b>ZA 8 ZL8/ZL0810 ZnAl8Cu1</b>	<b>SUPERLOY GDSL</b>
Al	4.04	4.05	4.02	8.53	6.94
Cu	2.87	0.0005	0.8442	1.082	3.8
Mg	0.0425	0.046	0.0444	0.0233	0.003
Pb	0.0021	0.0019	0.0019	0.0018	0.0018
Fe	0.0032	0.0021	0.0028	0.0041	0.0002
Cd	≤ 0.0002	≤ 0.0002	≤ 0.0002	≤ 0.0003	≤ 0.0002
Sn	≤ 0.001	≤ 0.001	≤ 0.001	≤ 0.002	≤ 0.001
Si	≤ 0.02	≤ 0.02	≤ 0.02	≤ 0.015	≤ 0.02
Ni	≤ 0.001	≤ 0.001	≤ 0.001	≤ 0.001	≤ 0.001

<b>Physical data</b>	<b>ZAMAK 2 ZL2/ZL0430 ZnAl4Cu3</b>	<b>ZAMAK 3 ZL3/ZL0400 ZnAl4</b>	<b>ZAMAK 5 ZL5/ZL0410 ZnAl4Cu1</b>	<b>ZA 8 ZL8/ZL0810 ZnAl8Cu1</b>	<b>SUPERLOY GDSL</b>
Density	6.8	6.6	6.7	6.3	6.5
Solidification range (°C)	379 - 390	381 - 387	380 - 386	375 - 404	377
Shrinkage in %	4 - 5	4 - 5	4 - 5	8	7
Linear thermal expansion (coeff. per °C)	27.8 x 10 <sup>-6</sup>	27.4 x 10 <sup>-6</sup>	27.4 x 10 <sup>-6</sup>	23.2 x 10 <sup>-6</sup>	25 x 10 <sup>-6</sup>
Electrical conductivity (%IACS)	25	27	26	27.7	22.9

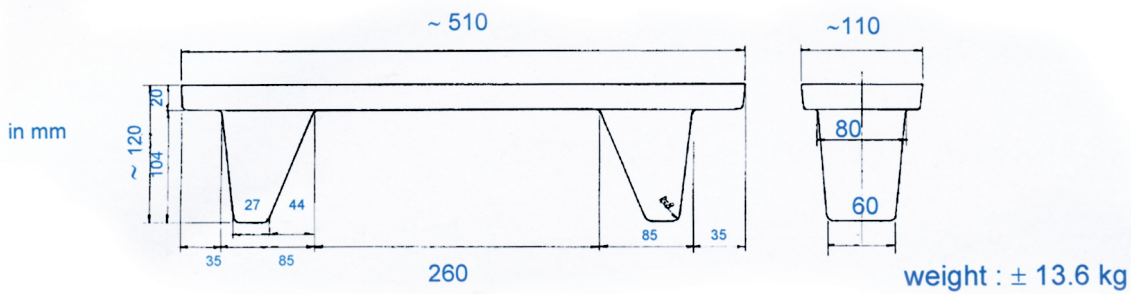
**Mark  
Shapes  
Packing**

OVERCOR V ZAMAK  
ingots of about 8.3 kg  
strapped bundles of about 650 kg

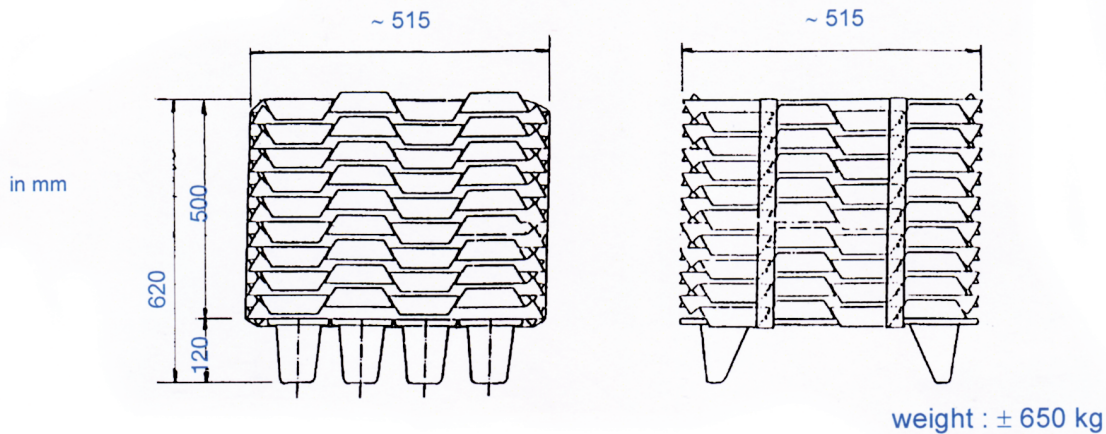
## Zinc alloy ingot: Overcor®



## Zinc alloy ingot feet: Overcor®



## Zinc alloy bundle: Overcor®



		ZINC ALLOYS							
Property	Units	ZP3	ZP5	ZP2	ZP8	Superloy	KS	ZP12	ZP27
Process technology		HCDC	HCDC	HCDC	HCDC	HCDC	SC	CCDC	CCDC
<b>Mechanical Propertis</b>		*	*	*	*	*			
Yield strength	MPa	268	295	361	319	300	<200	320	371
Ultimate tensile strength (UTS)	MPa	308	331	397	387	333	<200	404	426
Youngs modulus	GPa	96	96	96	96	96		86	78
Torsional modulus	GPa	>33	>33	>33	>33	>33			
Elongation at F <sub>max</sub>	%	3	2	3	4	3	<2		2,5
Elongation at fracture	%	6,3	3,6	6	8	10	<2	5	
Shear strength	MPa	214	262	317	275	245			325
Compressive yield stress	MPa	414	600	641	~600	590			385
Impact resistance	Joules	46	52	38	42	65		28	12,7
Fatigue resistance (5x10 <sup>6</sup> )	MPa	48	57	59		89			
Hardness Brinell HBN	Brinell	97	114	130	110	131	150	100	119
Fracture toughness K <sub>IC</sub>	x10 <sup>3</sup> N.m <sup>3/2</sup>	2,25	2,1		1,95				
Specific damping capacity @ 35 MPa	%	18	19	19	20	21			
Specific damping capacity @ 100 MPa	%	40	41	42	44	45			
<b>Physical properties @ 20°C</b>									
Density	g cm <sup>3</sup>	6,7	6,7	6,8	6,3	6,5	6,8	603	5
Coefficient of thermal expansion	x10 <sup>6</sup> °C <sup>-1</sup>	27,4	27,4	27,8	23,3	27	27,8	24,1	26
Thermal conductivity	W m <sup>-1</sup> hr <sup>-1</sup> m <sup>2</sup>	113	109	105	112	112	105	116	125
Electrical conductivity	% IACS	27	26	25	27,7	26	25	28,3	29,7
Electrical conductivity	Sm mm <sup>2</sup>	15-16	15-16	15-16	15-16	15-16	15-16		
Electrical resistivity	_ohm cm	6,37	6,54	6,85	6,2	6,9	6,85	6,1	5,8
Melting temperature range	°C	381-387	380-386	379-390	375-404	375-377	379-390	377-432	377-484
Specific heat capacity	J kg <sup>-1</sup> °C <sup>-1</sup>	419	419	419	435	429	419	450	525
Coefficient of friction	-	0,07	0,08	0,08	0,11	0,07	0,08		
<b>Production specific parameters</b>									
Typical precision	%	0,1	0,1	0,1	0,1	0,1	0,5	0,25	0,3
Min. wall thickness	mm	0,4	0,4	0,5	0,6	0,3	1,2	0,9	1,2
Typical production speeds	shots/hour	large 200-500; small 400-1000; thin 2000-3000					20	200-300	100-300
Broad production speed range	shots/hour	200-3600					10-30	250	175
Typical tool life	shots x 10 <sub>3</sub>	750-2000					0,2	700	500
<b>Chemical composition</b>									
	standard	EN12844	EN12844	EN12844	EN12844	nyrstar	nyrstar	EN12844	EN12844
	Al%	3,7-4,3	3,7-4,3	3,7-4,3	8,0-8,8	6,4-7,0	3,8-4,2	10,5-11,5	24-27
	Cu%	<0,05	0,7-1,25	2,7-3,3	0,9-1,1	3,0-3,5	2,5-3,5	0,9-1,5	2,0-2,5
	Mg%	0,02-0,06	0,02-0,06	0,02-0,06	0,015-0,03	<0,05	0,4-0,6	0,015-0,03	0,01-0,02
	Zn%	balance	balance	balance	balance	balance	balance	balance	balance
	Mn%	-	-	-	-	-	-	-	-
	Fe%	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05	<0,07	<0,01
	Si%	<0,03	<0,03	<0,03	<0,045	<0,03	<0,03	<0,06	<0,08
	Ni%	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02
	Cu%								
	Pb%	<0,005	<0,005	<0,005	<0,006	<0,005	<0,005	<0,006	<0,006
		Zamak 3 ZP0400 ZnAl4	Zamak 5 ZP0410 ZnAl4Cu1	Zamak 2 ZP0430 ZnAl4Cu3	ZA 8 ZP0810 ZnAl8Cu1	Superloy GDSDL	KS	ZA 12 ZP1110 ZnAl11Cu1	ZA 27 ZP2720 ZnAl27Cu2
		IZA	IZA	IZA	IZA	nyrstar	nyrstar	IZA	IZA



Legend:  
**HCDC:** hot chamber die casting  
**CCDC:** cold chamber die casting  
**ConCast:** continuous cast  
**IM:** injection molding  
**SC:** spin casting  
**EX:** extruded  
**Pr:** pressing

All properties and data for guidance only  
 \* Properties on 1,5mm specimen after 8 weeks of ageing @ 20°C

**EN12844:** standard for zinc die casting parts  
**EN1706:** standard for aluminium die casting parts  
**EN1753:** standard for magnesium die casting parts  
**IZA:** International Zinc Association  
**IMA:** International Magnesium Association  
**ECI:** European Copper Institute  
**IAA:** International Aluminium Association  
**EMS:** plastic producer data  
**MatWeb:** website for material properties www.matweb.com

\*\* Production Speeds governed largely by product size, material used and rate of cooling, which, size for size, tends to be far slower than metals.

ALUMINIUM ALLOYS		MAGNESIUM	BRASS		STEEL	PLASTICS					Proprietà
AISI9Cu3 CCDC	AISI12 CCDC	AZ91 HCDC/CCDC	ISO CuZn37 CCDC	ISO CuZn35Pb1 EX	DIN 1.0402 Pr	ABS IM	PA 66 IM	PA66+PA6 IM	50% GF IM	30% GF IM	Tecnologia Fusoria
											<b>Proprietà Meccaniche</b>
159	165	111-170	120	330	345	25-65	55-90	40-70		n/a	Resistenza allo Snervamento
317	330	200-260	280	435	440	25-65	80	45	240-250	155-210	Resistenza alla Trazione Maximale
71	71	44	110	105	200	1,79-3,2	0,7-1,8	7,5-27	17,5-18	3,2-12,7	Modulo di Elasticità
26,9	26,9	16,5				1,6-5,9				n/a	Modulo di Torsione
						1,7-6		4-15			Allungamento a F <sub>max</sub>
1-3	0,5-3	7	4	30	35,8	2-110	9-50	25-50	2	3-5	Allungamento a Rottura
195	186	138		295							Resistenza al Taglio
		108-159				53-86					Resistenza allo Snervamento per Compressione
3,4	4	3,7 - 6			16,9	0,4-6,4	no break	no break	8	5	Resistenza all'Urto
70-100	60-90	50-70	110			7					Resistenza alla Fatica
75	85	63-85	75	135	131	too soft	too soft	too soft	too soft	too soft	Durezza
3,6 (?)	3,6 (?)										Duttilità alla Rottura K <sub>ic</sub>
1	1	25									Capacità di Smorzamento @ 35MPa
4	4	53									Capacità di Smorzamento @ 100MPa
											<b>Proprietà fisiche @ 20°</b>
2,79	2,65	1,82	8,5	8,47	7,87	1,02-1,21	1,07	1,14	1,65	1,11-1,68	Densità
21	21,1	25,2-26,0	20,3	20,3	16	50-150	60-90	80-120	40-15	17-104	Coefficiente di Espansione Termica
109	96	51-72,7	30-100	115	52	0,13-0,19				<1 (?)	Conduttività Termica
24	27	11,5-12,1			12,1	n/a				n/a	Conduttività elettrica
12-28	12-28	6-10	4-15	4-15							Conduttività elettrica
6,4	7,5		6,6	6,6	15,9	10 <sup>-15</sup>	10 <sup>-12</sup>	10 <sup>-10</sup>	10 <sup>-11</sup>	10 <sup>-12</sup>	Resistenza elettrica
538-593	516-582	468-598	885-925	885-925			260	260	325	260	Intervallo di Fusione
963	960	1020	380	380	486	1960-2130				1200-2350	Capacità Calorifica Specifica
						0,45					Coefficiente di Attrito
											<b>Produzione</b>
0,25-0,3	0,25-0,3	0,175				High shrinkage and humidity make close tolerances difficult for palstics					Precisione Standard oltre 100 mm
1,3	1,3	1,2									Spessore minimo della Parete
50-250		20-275	125			**	**	**	**	**	Velocità di Produzione Standard
30-350		40-2400	30-200	300-720	180-1800	100-400					Intervallo di Velocità di Produzione Essenziale
100-225		300-500				Fuction of composition and reinforcment					Durata standard dello stampo
											<b>Composizione</b>
EN1706	EN1706	EN1753				ISO 1874	ISO 1874	ISO 1874	ISO 1874	ISO 1874	
balance	balance	8,3									
3,0-4,0	3,0-4,0	<0,030									
<0,30	<0,1	balance	60-65	60-65							
<3,0	<1,0	0,35-1,0									
<0,5	<0,1	0,15-0,50	30-37	30-37							
<1,3	<0,6	<0,005			0,3-0,6						
7,5-9,5	10,5-12	<0,10		<0,1							
<0,5	<0,5	<0,002									
					0,17-0,23						
			<1	0,8-1,4							
LM 24 A380	LM 25 A384		ISO CuZn37	ISO CuZn35Pb1	AISI1020 UNS G10200 DIN 1.0402		PA 66 MFHR 14-140	PA66/PA6 MHR 14-030N	PA6T/6I MH 12-190 GF50	PA 66 MHR 14-120 GF35	
IAA	IAA	IMA	ECI	ECI		EMS	EMS	EMS	EMS	EMS	