YODER INDUSTRIES DIE CASTING GUIDE

Why Die Casting?

- Die castings are specified for high volume production parts when strength, weight control, long service life, contours and complex shapes, textures and finishes, blind holes, external threads, projections, durability and repeatable accuracy are required.
- Aluminum die cast parts are lighter, dimensionally stable, and offer good mechanical properties and corrosion resistance. Parts can withstand temperatures from 300° to 600°F (continuous), provide electrical or thermal conductivity and good heat dissipation.
- Production advantages include fast delivery, minimal secondary operations and low unit costs.
- Die casting is very often the superior choice over stamping, forging, permanent mold, sand casting or plastic molding.

Why Yoder Industries?

Quality & Process Control

- ISO/TS 16949:2009 and ISO 9001:9008 Certified
- Closed Loop and Visi-Trak® process shot monitoring system
- Fully equipped QA lab with real time X-ray, spectrograph alloy analysis and 60,000 lb Instron tensile testing machine – ASTM compliant

Engineering & Design

- Advanced engineer design support
- MAGMAsoft® HPDC mold flow software and casting design
- Mold Flow Analysis for all programs
- Fast prototype tooling and die cast parts
- Cost saving design solutions

Capabilities

- Two full service die casting facilities
- Complete “net shape” finishing and assembly
- Machining, flow through/tumble shot blast finish, wash, and leak test
- Unparalleled automotive expertise over 30 years
  - Specialize in automotive castings for:
    - Electronic Control Modules - Heat Sink
    - Dual Clutch Transmission (DCT) - Heat Sink
    - Electronic Power Steering
    - Rubber-to-metal applications for Engine and Transmission Mounts
    - Cast-in bearings and flash-free threaded studs and inserts
    - Variable Valve Timing (VVT), Chassis and Powertrain

YODER ALUMINUM & ZINC DIE CASTING ALLOYS

Commercial: **ANSI/AA:**	**A380** **A380.0**	**383** **383.0**	**A413** **A413.0**	**Zamak** **No. 3**	**ZA-12**	**ZA-27**
Nominal Composition	Cu 3.5 Si 8.5	Cu 2.5 Si 10.5	Si 12.0	Al 4.0 Mg 0.035	Al 11.0 Mg 0.023 Cu .88	Al 27.0 Mg 0.015 Cu 2.25
Detailed Composition (%)						
Copper (Cu)	3.0-4.0	2.0-3.0	1.0	0.25 max.	0.5-1.2	2-2.5
Magnesium (Mg)	0.10	0.10	0.10	0.02-0.05	0.015-.030	0.010-0.020
Tin (Sn)	0.35	0.15	0.15	0.003	0.003	0.003
Manganese (Mn)	0.50	0.50	0.35	—	—	—
Nickel (Ni)	0.5	0.30	0.50	—	—	—
Silicon (Si)	7.5-9.5	9.5-11.5	11-13	—	—	—
Iron (Fe)	1.3	1.3	1.3	0.10	0.075	0.075
Lead (Pb)	—	—	—	0.005	0.006	0.006
Cadmium (Cd)	—	—	—	0.004	0.006	0.006
Total Others	0.50	0.50	0.25	—	—	—
Aluminum (Al)	Balance	Balance	Balance	3.5-4.3	10.5-11.5	25.0-28.0
Zinc (Zn)	3.0	3.0	.50	Balance	Balance	Balance
Mechanical Properties						
Ultimate Tensile Strength						
ksi	47	45	42	41	59	62
(MPa)	(320)	(310)	(290)	(283)	(400)	(426)
Yield Strength						
ksi	23	22	19	32	45-48	52-55
(MPa)	(160)	(150)	(130)	(221)	(310-331)	(359-379)
Elongation						
% in 51 mm	3.5	3.5	3.5	10	4-7	2.0-3.5
Hardness						
BHN	80	75	80	82	95-105	116-122
Shear Strength						
ksi	27	—	25	31	43	47
(MPa)	(190)		(170)	(214)	(296)	(325)
Impact Strength						
ft-lb	—	3	—	43	15-27	7-12
(J)		(4)		(58)	(20-37)	(9-16)
Fatigue Strength						
ksi	20	21	19	6.9	—	21
(MPa)	(140)	(145)	(130)	(47.6)		(145)
Physical Properties						
Density						
lb/in^3	0.098	0.099	0.096	0.24	0.218	0.181
(g/cm^3)	(2.71)	(2.74)	(2.66)	(6.6)	(6.03)	(5.00)
Melting Range						
°F	1000-1100	960-1080	1065-1080	718-728	710-810	708-903
(°C)	(540-595)	(516-582)	(574-582)	(381-387)	(377-432)	(375-484)
Specific Heat						
BTU/lb°F	0.230	0.230	0.230	0.10	0.107	0.125
(J/kg°C)	(963)	(963)	(963)	(419)	(450)	(525)
Coefficient of Thermal Expansion						
µ in/in/°Fx10^{-6}	12.1	11.7	11.9	15.2	13.4	14.4
(µ m/m°K)	(21.8)	(21.1)	(21.6)	(27.4)	(24.1)	(26.0)
Thermal Conductivity						
BTU/ft hr °F	55.6	55.6	70.1	65.3	67.1	72.5
(W/m°K)	(96.2)	(96.2)	(121)	(113)	(116)	(122.5)
Electrical Conductivity						
% IACS	23.0	23.0	31.0	27.0	28.3	29.7

Source: North American Die Casting Assoc. - ASTM B85-92a; Aluminum Assoc., ASTM B86, ASTM B791