

Guide to the Selection of Casting Techniques

	Description	Metals	Size Range	+ Part Price	+ Design Freedom	Surface Finish	** Minimum Draft Requirements	+ + Normal Minimum Section Thickness	Ordering Quantities	+ + + Normal Lead Time
DIE CASTING	Molten metal is injected, under pressure, into hardened steel dies, often water cooled. Dies open and castings ejected.	Aluminum, Zinc, Magnesium and limited Brass.	Not normally over 2 feet square. Some foundries capable of larger sizes.	5	4	32-63RMS	Al & Mg: 1° to 3° Zinc: ½° to 2° Brass: 2° to 5°	Al: .03" Small parts .06" Medium parts Mg: .03" Small parts .045" Medium parts Zinc: .025" Small parts .040" Medium parts	Usually 2,500 and up.	Samples: 12-22 weeks Production: 8-10 weeks A.S.A.
PERMANENT MOLD	Molten metal is gravity poured into cast iron molds, coated with ceramic mold wash. Cores can be metal, sand, sand shell or other. Molds open and castings ejected. New L.PPM. method pressure-pours with up to 15 p.s.i.	Aluminum, Zinc, some Brass, Bronze, Lead and Gray Iron.	Limitation mainly foundry capabilities. Aluminum and Copper base: ounces to 100 lbs. Ferrous: 60 lbs. max.	Non-Ferrous 3-4 Ferrous 4	Non-Ferrous 3 Ferrous 5	Aluminum: 150-250RMS Copper Base: 125-200RMS Ferrous: 200-350RMS	Non-Ferrous: Outside: 2° Min. (3° desirable) Inside: 2° Min. (4° desirable) Ferrous: Outside: 1° Inside: 5°	Aluminum: .100" for small areas, up to ¾" or more for large areas. Copper Base: .060" Ferrous: ¾" for small areas, ¼" normal.	Minimum One Day's run: (100-1,000, depending on size).	Samples: 8-20 weeks Production: 4-8 weeks A.S.A.
GRAPHITE MOLD	Same as Permanent Mold, except no ceramic mold wash is needed, since Graphite molds are used. Core pins are usually steel.	Presently limited to Zinc alloys ZA12, ZA27.	One ounce to 10 lbs. Currently 12" to 14" with a depth of 7".	3	4	63-125RMS	External: ½° Internal: 1°	.100" (Can go to .06 for very small areas).	Usually 300 and up.	Samples: 6-10 weeks Production: 4 weeks A.S.A.
SAND CASTING	Tempered sand is packed onto wood or metal pattern halves, removed from pattern, assembled with or without cores, and metal is poured into resultant cavities. Various core materials can be used. Molds broken to remove castings. Specialized Binders now in use can improve tolerances and surface finish.	Most all castable metals.	Limitation mainly foundry capabilities. Ounces to many tons.	3-4	2	Non-Ferrous: 150-350RMS Ferrous: 300-700RMS	1° to 5° Cores: 1° to 1½°	Non-Ferrous: ⅛"-¼" Ferrous: ¼"-¾"	All quantities.	Samples: 2-10 weeks Production: 2-4 weeks A.S.A.
INVESTMENT (Lost Wax)	Metal mold makes wax or plastic replica. These are sprued, then surrounded with investment material, baked out, and metal poured in resultant cavity. Molds broken to remove castings.	Most all castable metals.	Fraction of an ounce to 150 lbs.	1	1	63-125RMS	None	.030" (Small Areas) .060" (Larger Areas)	Aluminum: usually under 1,000. Other metals: all quantities.	Samples: 5-16 weeks (depending on complexity) Production: 4-12 weeks A.S.A. (depending on subsequent operations).
PLASTER MOLD	Plaster slurry is poured onto pattern halves, allowed to set, then mold is removed from pattern, baked, assembled, and metal is poured into resultant cavity. Molds broken to remove castings.	Aluminum, Brass, Bronze, Zinc, Beryllium, Copper, Magnesium ² .	Normally up to 500 square inch area. Some foundries capable of going much larger.	1	2	63-125RMS	External: 0° to ½° Internal: ½° to 2°	.070"	Usually low. Often used to prototype for die castings. Average: 50 to 250 pieces.	Samples: 2-6 weeks Production: 2-4 weeks A.S.A.
CERAMIC MOLD	Ceramic slurry poured over cope and drag patterns, allowed to set, then molds removed from pattern, baked at 1800 F producing hard, stable molds. Molds assembled with or without cores and metal poured into resultant cavity. Molds broken to remove castings.	Most all castable metals.	5 lbs. to 350 lbs.	1	3	80-125RMS	0° to ½°	⅛"	Low to medium. Often used for tooling for other casting methods. Forging Dies, Plastic Injection Molds, Special Machine Parts.	Samples: 3-8 weeks (depending on complexity). Production: 2-8 weeks A.S.A. (depending on metal and quantity).
RESIN SHELL MOLD	Resin-coated sand is poured onto hot metal patterns, curing into shell-like mold halves. These are removed from pattern, assembled with or without cores. Metal is poured into resultant cavities. Molds broken to remove castings.	Most all castable metals.	Normal maximum 550 square inches usable mold area. Depends on equipment at each foundry.	2	2	Non-Ferrous: 125-200RMS Ferrous: 200-350RMS	Outside: ½° to 1° Inside: ½° to 2°	Non-Ferrous: ⅜" Ferrous: ⅛"	Non-Ferrous: Usually 100 and up. Ferrous: Usually 1,000 and up.	Samples: 12-16 weeks Production: 6-10 weeks A.S.A.

A.S.A. After Sample Approval
*These are for critical dimensions and should not be specified where not necessary.
**Draft requirements inversely affected by depth of draw.

1. Mg and Zn have been cast to 0 draft and press-fit tolerances.
2. Limited basis only.

+ 1 Most, 5 Least
+ + Size and surface area influence this considerably.
+ + + This will vary widely depending on business conditions and foundry load.