

Choosing an Aluminum Casting Method



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CASTING PROCESS	DESCRIPTION	METALS	SIZE RANGE	TOLERANCES	TOOLING COST		RELATIVE COST IN LARGE QUANTITY	RELATIVE COST FOR SMALL QTY.	SURFACE FINISH	MIN. DRAFT REQ.	NORMAL MIN. SECTION THICKNESS	EASE OF CASTING COMPLEX DESIGN	EASE OF CHANGING DESIGN IN PROD.	STATUS
PERMANENT MOLD	Molten metal is gravity poured into cast iron molds, coated with ceramic mold wash. Cores can be metal, sand, shell or other. Inserts can be cast into part: stud, bushings, etc.	Primarily Aluminum with some Copper Base and Cast Iron.	Limitation mainly foundry capabilities. Aluminum: Usually 1/2 lb. To 100 lbs.	Aluminum +/- .015 to 1", add .002" for ea. additional inch. If across parting line add +/- .010" (Small Casting) to +/- .030" (Large Casting)	\$8,000	\$1,500 - \$55,000	Low	High	Aluminum: 125-200 RMS Iron: 200-420 RMS Copper Base: 175-225 RMS	Aluminum: 2 to 4 deg. Iron: 3 to 5 Copper Base: 3 to 5	Aluminum: .100" to .150" Iron: .187" to .250" Copper Base: .100" to .150"	Fair	Poor	Used for moderate quantities of semi-precision castings. Is normally less expensive than sand casting for 100's part or a few 1000 parts. Limited applicability for ferrous metals.
DIE CASTING	Molten metal is injected under pressure into hardened steel dies.	Aluminum, Zinc, Magnesium, and limited Copper Base	Not normally over 3 feet sq. Some foundrys capable of larger sizes.	.0015"/in. Not less than .002" on any one dimension. Additional .010" on dimensions affected by parting line.	\$25,000	\$5,000 - \$150,000	Lowest	Highest	20-90 RMS	Aluminum: 1 to 3 degrees Zinc & Mag: 1/2 to 2 degrees	Aluminum: .050" Small parts .080" Med parts Zinc & Mag.: .025" Small	Good	Poorest	Very widely used for high production of aluminum and zinc castings. An inexpensive way of obtaining precision parts.
SAND CASTINGS	Cope and Drag Method - 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 materials can be used.	Most Castable Metals	Limitation mainly foundry capabilities. All sizes.	0-3" = 1/32" 3"-6" = 3/64" +6" = +1/18" Across parting line add .020" to small castings .090" to large castings	\$2,000	\$50 - \$15,000	Low	Lowest	Aluminum: 175-350 RMS Copper Base: 300-560 Ferrous: 420-900 RMS	1 to 5	Non-Ferrous: .125" - .250" Ferrous: 250"-.375"	Fair to Good	Best	Most widely used process for ferrous metals for both small and large production runs. Various binder systems available.

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V PROCESS	Cope and Drag Method. Softened plastic is drawn to pattern. Sand is backfilled.	Most all Castable Metals	All sizes	+/- .020" up to 6" than +.002" per inch. Add .020" per inch across parting line.	\$5,000	\$3,000 - \$20,000	Medium	High	125-150 RMS	None	0.090" to 0.125"	Good	Fair	Unlimited pattern life. Used for medium to med high volumes.
SHELL MOLD	Resin coated sand is poured onto hot metal patterns, curing into bonded sand mold halves. These are removed from pattern, assembled with or without cores, and metal is poured into the resultant cavities.	Most all Castable Metals	Normal maximum 550 sq. in. usable mold area	Ferrous: +/- .008" per in. 5000 up to 3" Add .003" per in. over 3" Non-Ferrous: under 1" = +/- .004" 1"-3" = +/- .010" 3"-6" = +/- .013" 6"-12" = +/- .016" 12"-20" = +/- .020" Add .005"-.010" across parting lines	5000	\$1500 - \$25,000	Medium	Medium	Iron: 200-350 RMS Copper Base: 150-200 RMS Aluminum: 75-125	Outside: 0 to 1-1/2 deg Inside: 0 to 2 deg	Non-Ferrous: .100" Ferrous: .125"	Good	Fair	Used for production of fairly small parts for which closer tolerances are required than are obtainable from sand castings. Widely used for cores.
INVESTMENT CASTING	Metal mold makes wax or plastic replica. These are sprued, then surrounded with investment material and baked out. Metal is poured in resultant cavity.	Most all Castable Metals	Fraction of an ounce to 100 pounds	+/- .005" up to 3" +/- .002" there after	\$25.00	\$500 - \$20,000	Highest	Medium	60-120 RMS	None	Aluminum Alloy: 0.30" Beryllium Copper: .030" Ductile Iron: .060" Carbon Steel: 0.090"	Best	Fair	Used for precision castings, particularly in gas turbine engines. A specialized process usually performed in foundrys not used for other processes.