Description

Process schematic

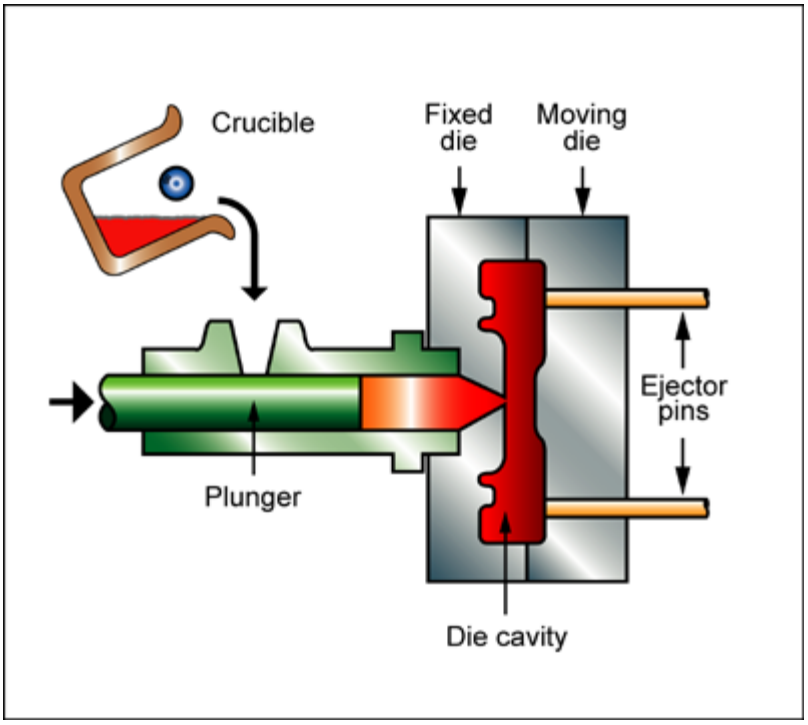


Figure caption

Pressure die casting

The process

Most small aluminum, zinc or magnesium components with a complex shape - camera bodies, housings, the chassis of video recorders - are made by DIE CASTING. It is to metals what injection molding is to polymers, and the two compete directly. In the process, molten metal is injected under high pressure into a metal die through a system of sprues and runners. The pressure is maintained until the component is solid, when the die is opened and the component ejected. The dies are precision-machined from heat-resistant steel and are water cooled to increase life.

Material compatibility

Metals - non-ferrous	✓

Shape

Circular prismatic	✓
Non-circular prismatic	✓
Solid 3-D	✓
Hollow 3-D	✓

Economic compatibility

Relative tooling cost	high
Relative equipment cost	high
Labor intensity	low

Economic batch size (units)	1e4	-	1e6	

Physical and quality attributes

Mass range	0.01	-	50	kg
Range of section thickness	0.5	-	12	mm
Tolerance	0.15	-	0.5	mm
Roughness	0.8	-	1.6	µm
Surface roughness (A=v. smooth)	A			

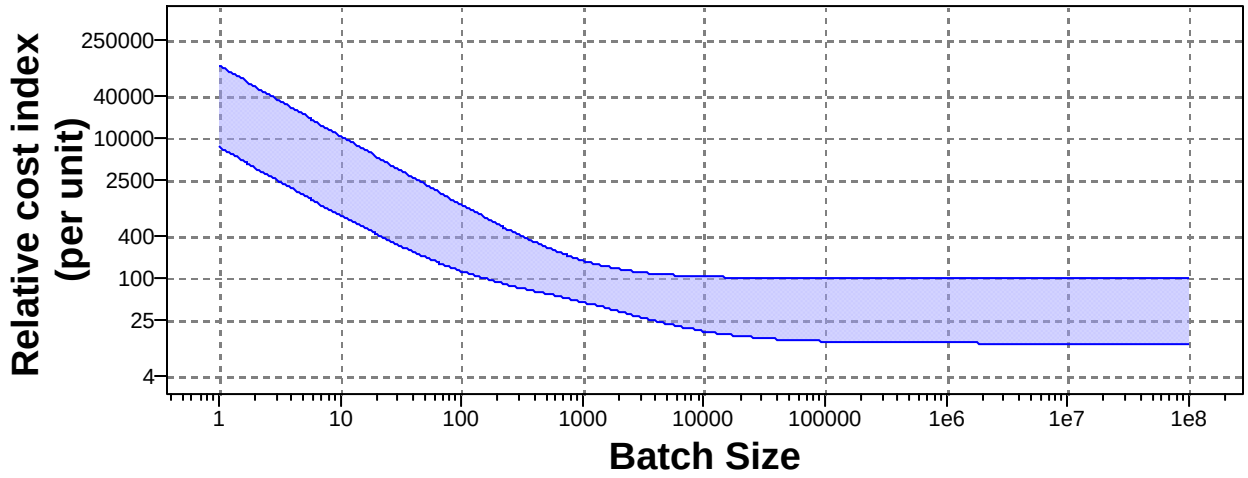
Process characteristics

Primary shaping processes	✓
Discrete	✓

Cost model and defaults

Relative cost index (per unit)	* 46.4	-	181	

Parameters: Material Cost = 8USD/kg, Component Mass = 1kg, Batch Size = 1e3, Overhead Rate = 150USD/hr, Discount Rate = 5%, Capital Write-off Time = 5yrs, Load Factor = 0.5



Material Cost=8USD/kg, Component Mass=1kg, Overhead Rate=150USD/hr, Capital Write-off Time=5yrs, Load Factor=0.5, Discount Rate=5%

Capital cost	* 1.64e5	-	8.2e5	USD
Material utilization fraction	* 0.75	-	0.8	
Production rate (units)	* 2	-	200	/hr
Tooling cost	* 7.38e3	-	1.07e5	USD
Tool life (units)	* 2e4	-	1e6	

Supporting information

Design guidelines

Pressure die casting allows thin walled shapes and excellent surface detail. The integrity of the material properties is less good: turbulent filling of the mold and fast cycle time can lead to shrinkage and porosity. The process can make complex shapes, but elaborate movable cores increase the tooling costs.

Technical notes

Two types of die casting equipment are commonly used: cold or hot. In the 'cold' process, the hot metal is held in a separate container and passed to the pressure chamber only for casting. In the 'hot' process the reservoir of hot metal is held in the pressure chamber, the prolonged contact times restrict this process to magnesium and zinc alloys.

Typical uses

Record player and video player chassis, pulleys and drives, motor frames and cases, switch-gear housings, housings for small appliances and power tools, carburetor and distributor housings, housings for gearboxes and clutches.

The economics

High tooling costs mean that pressure die casting becomes economic only for large batch sizes, but the process is one of the few that allows thin-walled castings. Aluminum has a small solubility for iron, limiting die life to about 100,000 parts. Magnesium has none, giving almost unlimited die-life. Gravity die casting has lower equipment costs but is usually less economic because the molten metal has to be more fluid - and thus hotter - to fill the mold well, this reduces the production rates.

The environment

Aluminum, zinc and magnesium scrap can all be recycled. The process poses no particular environmental

Links

MaterialUniverse

Reference