Description

Process schematic

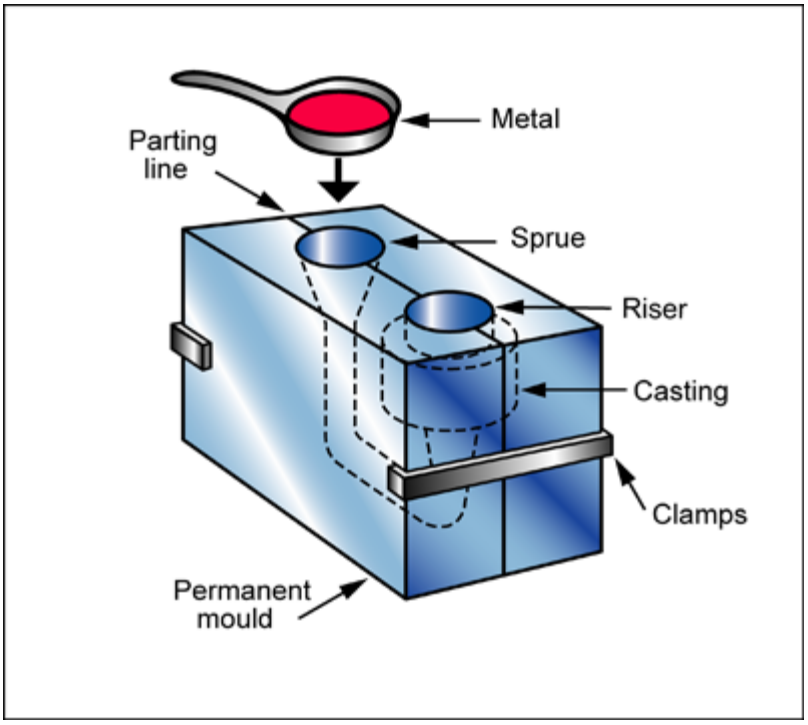


Figure caption

Gravity mold casting.

The process

In GRAVITY DIE or PERMANENT MOLD CASTING, molten metal is poured under gravity into a metal mold where it remains until it solidifies. The mold is then opened and the casting is removed. The mold is usually made of cast iron, but low carbon steels and die steels can also be used. The dies can be of relatively simple construction produced in two halves. Metal or sand cores can be used for making internal details. Shapes are relatively simple with simple coring and fairly uniform wall thickness. The process can be mechanized.

Tradenames

Permanent mold casting

Material compatibility

Metals - non-ferrous	✓

Shape

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

Economic compatibility

Relative tooling cost	medium
Relative equipment cost	medium
Labor intensity	medium

Economic batch size (units)	1e3	-	1e5	

Physical and quality attributes

Mass range	1.1	-	110	lb
Range of section thickness	197	-	1.77e3	mil
Tolerance	9.84	-	78.7	mil
Roughness	0.134	-	0.248	mil
Surface roughness (A=v. smooth)	B			

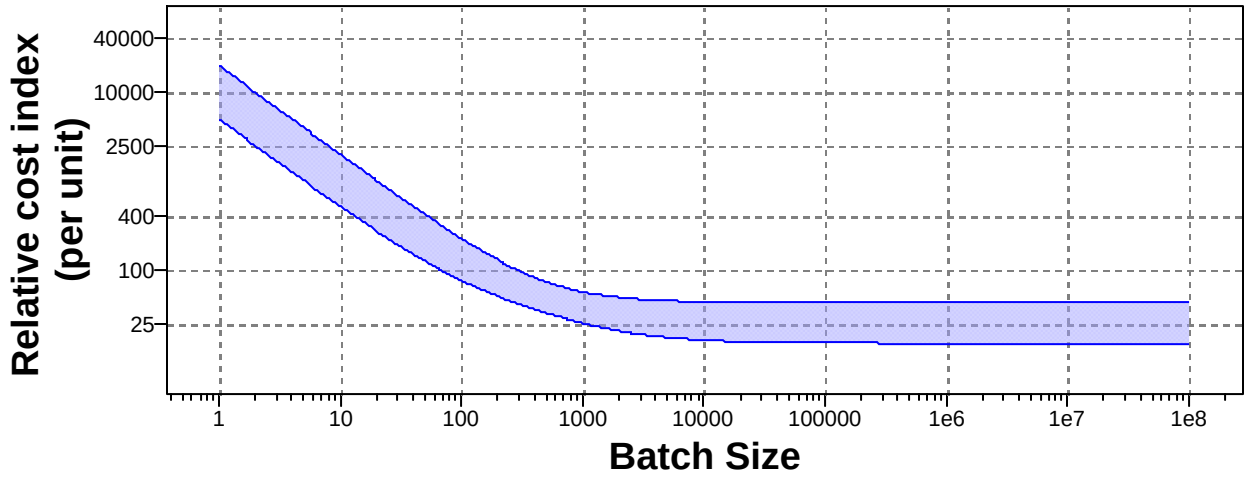
Process characteristics

Primary shaping processes	✓
Discrete	✓

Cost model and defaults

Relative cost index (per unit)	25.5	-	57.3	

Parameters: Material Cost = 3.63USD/lb, Component Mass = 2.2lb, Batch Size = 1e3, Overhead Rate = 150USD/hr, Discount Rate = 5%, Capital Write-off Time = 5yrs, Load Factor = 0.5



Capital Write-off Time=5yrs, Component Mass=2.2lb, Load Factor=0.5, Material Cost=3.63USD/lb, Overhead Rate=150USD/hr, Discount Rate=5%

Capital cost	1.64e4	-	6.56e4	USD
Material utilization fraction	0.6	-	0.8	
Production rate (units)	5	-	50	/hr
Tooling cost	4.92e3	-	1.97e4	USD
Tool life (units)	1e4	-	1e5	

Supporting information

Design guidelines

The tolerances, surface finish and mechanical properties provided by gravity die casting are better than those of sand casting but the complexity of shape is very limited.

Technical notes

The process is most used for aluminum alloys, but is also significant in the production of copper, magnesium and zinc alloys and cast iron castings. Uniform wall thickness and generous taper (5-10 deg for Mg-base alloys) are recommended.

Typical uses

Automotive pistons, gears, air-cooled cylinder heads, splines, wheels, gear housings, pipe fittings, hydraulic

The economics

Pattern and tooling costs are low, even for large, complex shapes.

Links

MaterialUniverse

Reference