

Description

Image



Image caption

(1) View of a mold for precision casting © Federal government of the United States at Wikimedia Commons [Public domain] (2) Creating a sand-casting mold © OKFoundryCompany at Wikimedia Commons (CC BY 2.0) (3) Fuel pumps © Pashminu at Pixabay [Public domain]

The process

The LOW PRESSURE SAND CASTING or COSWORTH process is a high-precision sand casting process developed for the production of premium quality aluminum alloy castings for the automobile industry.

Zircon sand is used in place of the more usual silica sand to overcome the problem of unpredictable expansion, allowing more precise castings. The sand is mixed with a binder and shaped into a mold before the curing agent is introduced. The curing agent in the form of a gas (the gas hardening SO₂ process) is passed through the sand/binder mixture resulting in the polymerization of the resin.

Metal is melted and held in an electric resistance furnace. The metal is transferred by a pump from the furnace to the mold and enters the base of the mold through gates. These gates, together with the pump control system, control the rate of mold filling and provide pressure assisted feeding. The absence of conventional gating and feeding systems results in castings free of porosity and inclusions.

Process schematic

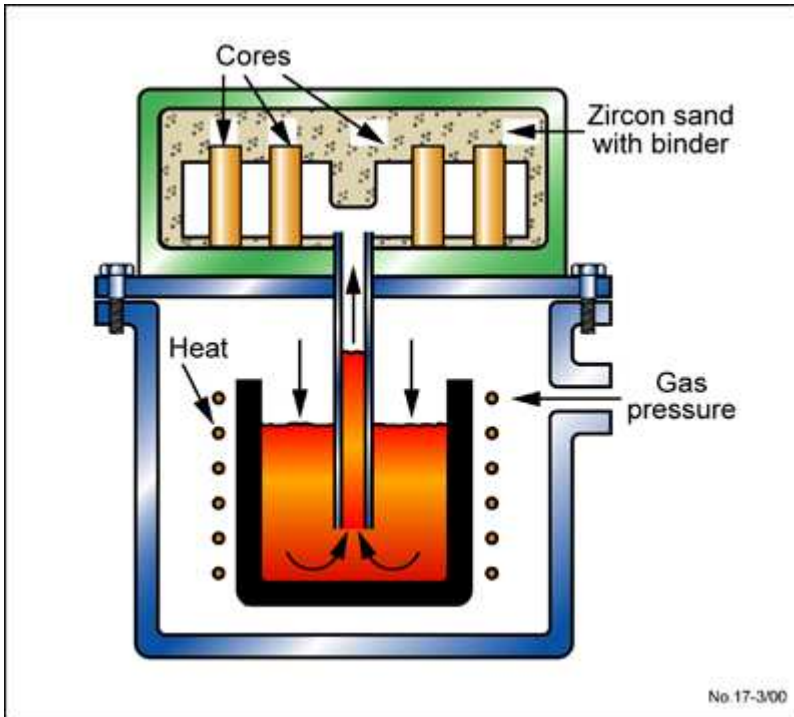


Figure caption

Low pressure sand casting.

Tradenames

Cosworth process

Material compatibility

Metals - non-ferrous	✓
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Shape

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

Economic compatibility

Relative tooling cost	medium
Relative equipment cost	high
Labor intensity	medium
Economic batch size (units)	1e3 - 1e6

Physical and quality attributes

Mass range	0.441	-	110	lb
Range of section thickness	157	-	3.94e3	mil
Tolerance	5.91	-	118	mil
Roughness	0.394	-	3.94	mil

Surface roughness (A=v. smooth)

C

Process characteristics

Primary shaping processes

✓

Discrete

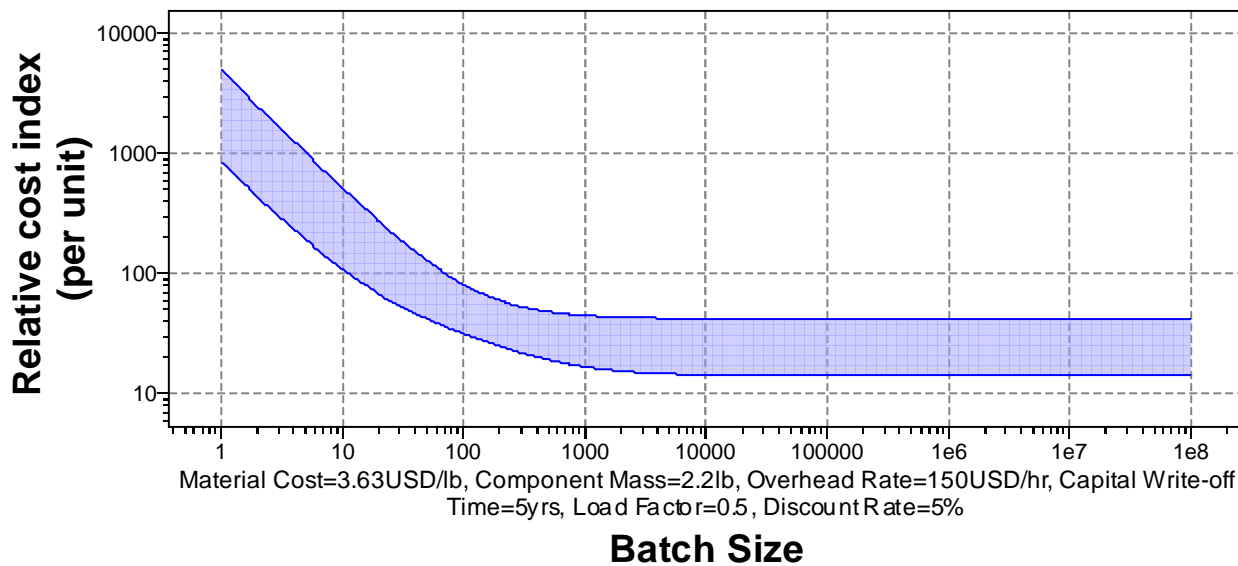
✓

Cost model and defaults

Relative cost index (per unit)

16.8 - 45

[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 cost

1.64e4 - 8.2e4 USD

Material utilization fraction

0.6 - 0.9

Production rate (units)

5 - 50 /hr

Tooling cost

820 - 4.92e3 USD

Tool life (units)

1e4 - 1e6

Supporting information

Design guidelines

Complex, thin-walled shapes are possible.

Technical notes

The process was developed for the production of precision aluminum alloy castings. In principle, it can be used for other non-ferrous alloys. The castings require minimal machining and possess exceptional high strength and ductility.

Typical uses

Aerospace components such as fuel system pumps and controls, flight refuelling manifolds, weapon mountings and lightweight undercarriage components. Automotive castings such as cylinder heads, engine blocks, sumps and transmission cases.

The environment

Because of the use of organic binder systems, considerable care must be taken in the handling of ingredients, sand mixing, molding, etc. Proper ventilation is essential and protective clothing is advisable.

Links

MaterialUniverse

Reference