## Description

### Image



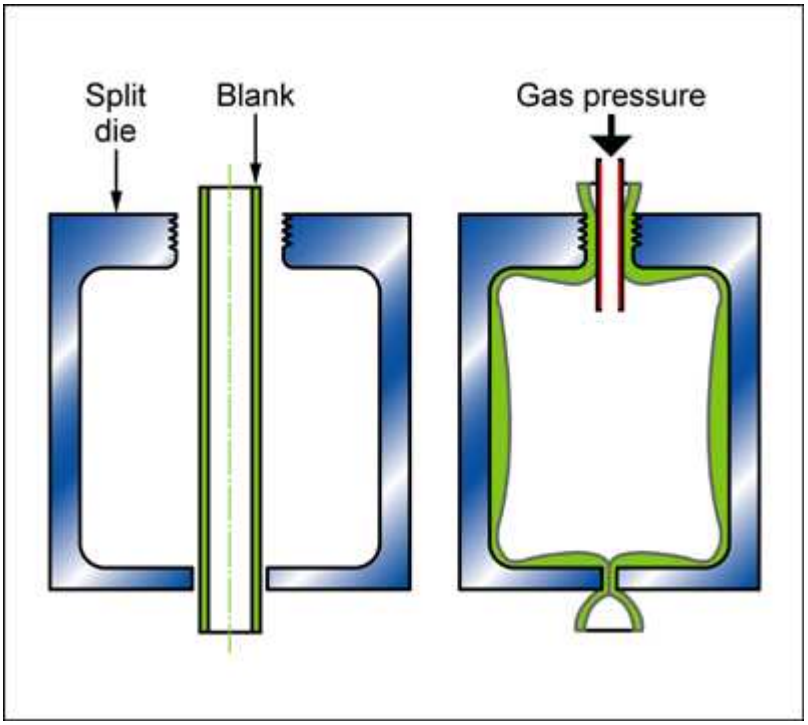
### Image caption

(1) Transparent PET blow molding © Patrickpagliarani at Wikimedia Commons [Public domain] (2) 50 Station, 6 layer Rotary Blow Molding System (courtesy of Wilmington Machinery) © Wikimedia Commons [Public domain]

### The process

BLOW MOLDING is glass blowing technology adapted to polymers. In extrusion blow molding a tube or parison is extruded and clamped in a split mold with a hollow mandrel at one end. Hot air is forced under pressure through the mandrel, blowing the polymer against the mold walls where it cools and freezes. In injection blow molding, a pre-form is injection molded over a mandrel and transferred to the blowing die. Air is injected under pressure through the mandrel blowing the polymer against the mold walls where it cools and freezes, as before. The process gives better control over finished component weight and wall thickness than extrusion blow-molding, with better precision in the unblown, injection molded neck areas, lending itself to screw closures, etc. Solid handles can be molded in. In stretch blow molding, an important variant, the temperature is chosen such that the polymer is drawn as it expands, orienting the molecules in the plane of the surface. It is used in the production of PET drink bottles.

### Process schematic




## Material compatibility

| | |
|---|---|
| Glasses | ✓ |
| Polymers - thermoplastics | ✓ |

## Shape

| | |
|---|---|
| Flat sheet | ✓ |
| Dished sheet | ✓ |
| Hollow 3-D | ✓ |

## Economic compatibility

| | | | | |
|---|---|---|---|---|
| Relative tooling cost | medium | | | |
| Relative equipment cost | medium | | | |
| Labor intensity | low | | | |
| Economic batch size (units) | 500 | - | 5e7 | |

## Physical and quality attributes

| | | | | |
|---|---|---|---|---|
| Mass range | 0.005 | - | 0.3 | kg |
| Range of section thickness | 0.4 | - | 3 | mm |
| Tolerance | 0.25 | - | 1 | mm |
| Roughness | 0.2 | - | 1.6 | µm |
| Surface roughness (A=v. smooth) | A | | | |

## Process characteristics

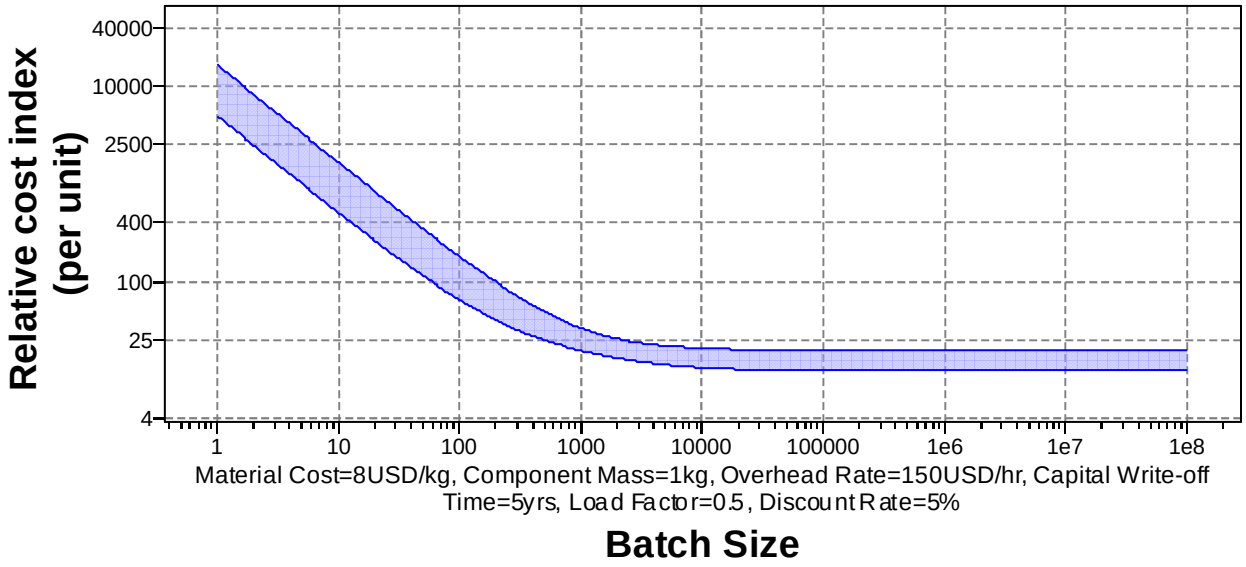
| | |
|---|---|
| Primary shaping processes | ✓ |

| | |
|---|---|
| Discrete | ✓ |

## Cost model and defaults

| | | | | |
|---|---|---|---|---|
| Relative cost index (per unit) | * 19.6 | - | 33.4 | |

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




| | | | | |
|---|---|---|---|---|
| Capital cost | * 4.92e3 | - | 4.92e4 | USD |
| Material utilization fraction | * 0.5 | - | 0.8 | |
| Production rate (units) | * 30 | - | 300 | /hr |
| Tooling cost | * 4.92e3 | - | 1.64e4 | USD |
| Tool life (units) | * 1e5 | - | 1e7 | |

## Supporting information

### Design guidelines

Extrusion blow molding allows a wide variety of hollow shapes to be formed, offering channels for air or liquid. Multi-layer injection blow molding is more commonly used for components that need to be gas tight and strong; here barrier layers are added to prevent gas diffusion and the outer layers to provide strength, impact resistance and good acceptance of printing and decoration. Insert molding is possible.

### Technical notes

Blow molding is limited to thermoplastics, commonly PET, PC, HDPE, LDPE, PP, ABS and some PVC. Limited levels of reinforcement are possible for composite materials. The wall thickness should be as uniform as possible to avoid distortion.

### Typical uses

Injection blow molding: bottles and containers, particularly those with threaded closures. Extrusion blow molding: containers, cases for tools and portable machinery, and large hollow structures such as car bumpers.

### The economics

Extrusion blow molding is the cheaper of the two processes, because the die costs are less. It is competitive for large containers (capacity above 0.5 liters) and high batch sizes. Tooling costs for extrusion blow molding are much higher, limiting the process to volume production.

**The environment**

Waste material can be recycled. The resins can generate dust and vapors, requiring good

## Links

MaterialUniverse

Reference