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Innovation in Technical Blow Moulding

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Blowmoulding

- Injection Blowmoulding
- Stretch Blowmoulding
- **Extrusion Blowmoulding**
  - Continuous Extrusion
    - Parison extrudes during moulding process
    - Generally up to 60 litres
    - Lower shot weights - thinner sections
    - Less parison control
    - Less contamination
    - Limited use in technical blowmoulding
    - Machines generally less versatile
    - Faster cycle times
  - Intermittent Extrusion
    - Parison is extruded prior to moulding phase
    - 1000 litres plus possible
    - Higher shot weights - thicker sections
    - Greater parison control
    - More contamination
    - Ideal for technical blowmoulding
    - Versatile machines
    - Slower cycle times

Moulding Process Comparisons

Blow Moulding

Description

Extruded parison is positioned within an open split mould and expanded against cooled mould walls by air pressure. The mould opens and the part is ejected.

Advantages

- relatively low tool and die costs
- complex, hollow shapes can be moulded in one piece
- can be relatively tough PEs
- very large pieces can be produced
- relatively fast cycle times

Disadvantages

- wall thicknesses difficult to control
- tolerances difficult to control
- surface finish details relatively low

Costs

Tooling - relatively low
Product - competitive

Injection Moulding

Description

Highly automated process injects molten polymer into runners, gates & cavities of the mould. Parts are solidified, and the mould opens to eject the part.

Advantages

- low labour cost
- excellent surface detail
- excellent gloss
- close dimensional tolerances
- wide variety of part sizes and designs possible
- broad range of perfomance and properties can be attained

Disadvantages

- high tooling and die costs
- not practical for small runs
- uses relatively weak PEs

Costs

Tooling - relatively high (up to 3 times blowmoulding cost)
Product - 1/3 to similar blown product

Rotational Moulding

Description

Powdered PE is poured into a mould which is then closed, heated and rotated until PE is fused to the mould's inner walls. The mould is cooled, opened and the part ejected.

Advantages

- low mould cost
- multiple colours can be moulded simultaneously
- scrap losses minimal
- very large pieces can be produced
- moulded parts isotropic by nature
- complex parts can be moulded without need for assembly

Disadvantages

- very labour intensive
- slow production rates
- large floor space required
- resin must be well stabilised
- high part cost

Costs

Tooling - as low as 1/3 blow tooling
Product - can exceed 3 times blown product

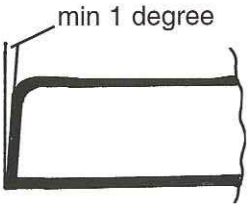
Tooling & Design Considerations

Joint Line

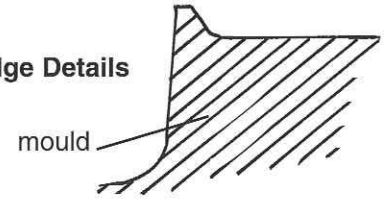
The positioning of the joint line is vital to correct functioning of the mould, material distribution within the product as well as having aesthetic implications.
Avoid feather edges within the mould tool.

Draft Angle

Ensure a minimum of 1 degree for clean part extraction.

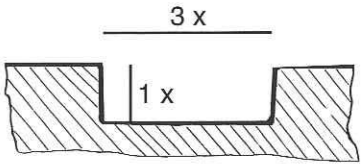


Typical Nip Edge Details

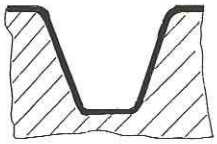


Blow Ratio

Maximum 1:3. i.e.the width of a depression shouldn't be greater than three times it's depth:



BUT...
if the sides slope then this ratio can be improved.



Post Moulding Operations

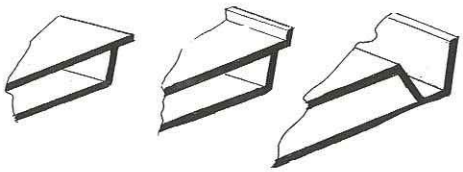
Various operations are available:

- printing
- spraying
- drilling
- routing, and
- attaching threaded fasteners

Strengthening Features

Various techniques are available to strengthen parts.
These need to be incorporatedat the design stage.
Examples include:

Flanges



Shut throughs

Kiss offs

Ribs

Logos

You can mould text, diagrams, logos etc. into the part.
These can be interchangeable for branding purposes.

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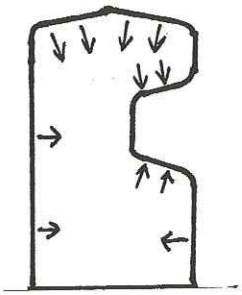
Component Shrinkage

All moulded materials shrink on cooling. The extent of this depends upon:

- wall section
- blow time
- material, and
- types of masterbatch

Typical amounts:

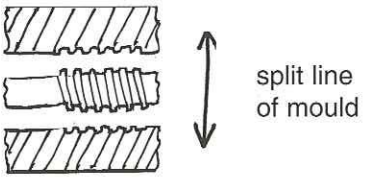
- HDPE = 1.5% - 4%
- Polypropylene = 1% - 2.5%



Threads

External threads can generally be moulded across the joint line.

Internal threads can be produced at a variety of points dependant upon the product design.



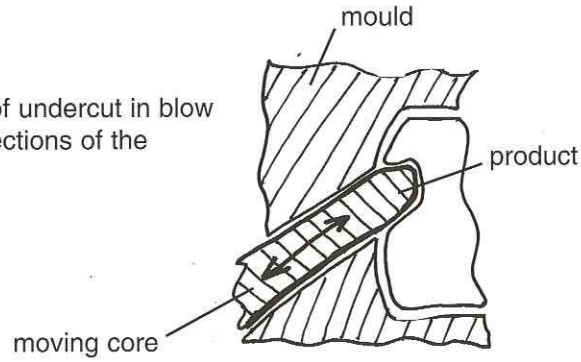
Moulded Inserts

Various forms of inserts can be moulded into the blown product in various materials, typically:

- injection moulded forms
- rubber moulded forms
- steel inserts
- brass inserts
- aluminium inserts

Moving cores

It is possible to produce various forms of undercut in blow moulded products using moving core sections of the mould tool.
Typical samples are handle forms:



Surface Finish

To assist in the removal of air trapped in the parison and the mould cavitiy, blow mould tools have a surface finish ranging from a fine vapour blast to a heavy bead blast.
Chemically etched finishes can also be produced.

Venting

Again, to assist with removal of air from the mould, some shapes may require additional venting of the mould using special inserts.

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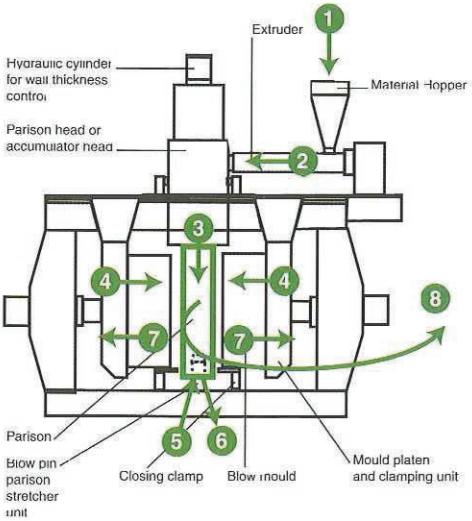
The Process



Cycle Sequence

1. Material (pellet form) fed to Material Hopper
2. Extrude polymer
3. Extrude parison
4. Close mould
   - pre-inflate parison with low volume of air
5. Blow to cavity shape
6. Exhaust air from moulding
7. Open mould
8. Remove the product

Repeat the cycle

Blow Mould Tools

The majority of blow mould tools are manufactured from aluminium (cast or plate) or steel, or a combination of these.

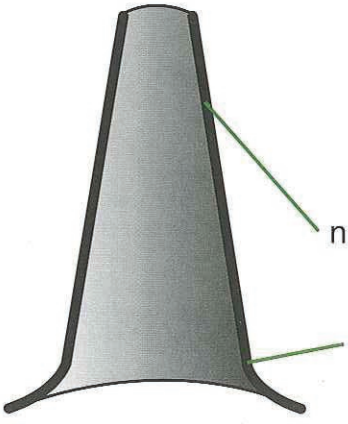
The actual material chosen depends on the following criteria:

- cooling (aluminium cools 4 times quicker than steel)
- life cycle of product
- cost of materials and subsequent machining time
- potential for modifications to be required during development or product life cycle
- the need for frequent adjustments during use
- requirement for chemical etch finish
- weight of completed tool

Markets

- packaging
- automotive
- technical

Wall Thickness Control



Typical Road Cone

Parison Control

- by introducing variations in parison thickness at specific points you can help maintain a more consistent wall thickness in the finished part.

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Glossary

Bottom blown - Product blown from a blowpin located below the mould tool.
Blow out - A section of a moulding that has blown out into a hole.
Blow ratio - The relationship of width to depth of a particular form to be moulded.
Calibrated neck - A process by which the blowpin compresses the sealing face of a moulded form to produce a flat, smooth sealing face.
Compound - Raw material with its colour or other additives in pellet form.
Crease - A line seen on the finished product caused by a folded parison welding together during the moulding process.
Die - The outer element through which the parison is extruded.
Die lines - Longitudinal lines seen on the extruded parison.
Die swell - The amount that the parison swells after it is extruded from the die.
Feather edge - A sharp edge produced in a mould tool through poor design.
Flash relief - Clearance around the nip edge in the flash areas of the mould tool to allow the tool halves to close fully whilst lightly compressing the flash for re-granulation.
HDPE - High density polyethylene.
Joint line - The line around a product formed by the meeting of the mould tool halves.
LDPE - Low density polyethylene.
Masterbatch - Colour, UV stabiliser, anti-static and anti-bacterial additives to the virgin material.
Material mix - The proportion of virgin, regrind, masterbatch or other additives used in producing a particular moulding.
Moving cores - Additional moving sections of a mould tool to form undercuts on difficult moulded forms.
Needle blown - Product blown from one or more hollow pneumatically activated needles attached to the mould tool.
Nip edge - The joint edge of the mould tool that seals the parison whilst producing a thin knife line for flash removal.
Over blown - Product distorted due to the air not being completely evacuated from within the moulding prior to the mould opening.
% letdown - The percentage of masterbatch to be added to the virgin material.
PP - Polypropylene.
Parison - The extruded polymer tube from which products are formed.
Parison program - The profile by which the pin opens from the die whilst the parison is extruded.
Pin - The inner element through which the parison is extruded.
Regrind - The re-chipped flash from the blown products.
Sharking - Circumferential lines seen on the extruded parison.
Shrinkage - The amount the product shrinks from the actual mould cavity size.
Top Blown - Product blown from a blowpin located above the mould tool.
Trapped air - Air trapped between the mould and parison which causes lines or orange peel marks on the finished product.
Under blown - Product with poor definition caused by trapped air or insufficient blow pressure.
Virgin - Raw material in its natural pellet form.
Water marks - Irregular shaped deformations seen on the surface of the moulding caused by water present in the mould cavity during the moulding process.