Basic Mould Construction

Basic mould construction:
- Core plate and Core (moving)
- Cavity plate and cavity (fixed)
Other features include
- Guide pillars / guide bush
- Sprue bush
- Locating ring

Single Cavity Mould

- In single cavity moulds, the part is usually located centrally, and plastic flows directly from the sprue into the cavity.
- After ejection the sprue remains attached to the component and must be removed manually.

Multi Cavity Mould

- With multi impression moulds the cavity is filled through a runner system at the split line.
- This allows the part to be filled through a small opening or gate allowing the runner to be easily separated from the moulded part.

Ejection System

- On cooling the moulded component will shrink onto and remain on the core or moving half when the mould opens.
- The part must therefore be removed or ejected from the moving. This is achieved using the ejector system.
- This comprises of a:
  - Hydraulic actuator
  - Ejector plate
  - Ejector pins
Ejection Techniques

- When ejecting the component it is important not to distort or otherwise damage the component.
- This can be avoided by appropriate location of ejector pins to insure the ejection forces are evenly distributed and applied to the more rigid areas of the moulded component.

Complex components consisting of ribs etc. can be ejected using a combination of regular and edge ejectors.

Another type of ejector is a sleeve ejector. This are used where it is required to mould a component with a central hole. Here the ‘core pin’ remains stationary while the sleeve ejector ejects the component from around it.

Push back pins

- Push back pins ensure that the ejector pin are returned to their start position when mould is closed.
- This can prevent damage to a mould in the event of ejector bar breakage.
- Alternately, they can provide an alternate return mechanism for the ejector pins where the ejector plate is not physically connected to the ejection system.

Stripper Plate Ejection

- An alternative to edge ejection is to use a stripper plate mould.
- Stripper plate moulds remove the component from the core by moving an entire mould plate to ‘strip’ the part from the core.

Figure 3.56—Principle of stripper plate ejection
Multiple daylight moulds

- Daylight refers to the number of mould openings or separations.
- Use of multiple openings for both part and sprue allows:
  - Part to be fill centrally for optimum flow.
  - Part to be filled through a small gate.
  - Part and sprue to be separated automatically during mould opening.

Feed systems

- In multi cavity moulds the cavity is filled through the runner system which consists of:
  - Sprue
  - Runner
  - Gate
- Runners may have a variety of cross section and may be machined into one or both halves of the mould.
- Runners must be balanced to ensure even filling.

Gates

Gates may be located at the split line or may be located below the surface:
- When gated at the split line part and runner remain attached during ejection and must be separated manually.
- Using subsurface gates, the part and runner are separated automatically during ejection.

Gates

- The diagrams below demonstrates how ejection breaks the link between the moulded component and its runner system.
Parting surface / Split line
- To mould any component the mould must split at its widest point. Not doing so would give rise to an undercut which would damage the moulding as it is being removed.
- The resulting split line or parting surface may be flat or non-flat depending on the shape of the component.

Shutouts
- Where it is required form a hole in a component, and where this detail is in the line of draw (no undercut), this can be achieved by the core and cavity surfaces coming into contact.
- It is preferable to form such a shut out internally so that any resulting flash or sharp edge will be on the inside.
- Where a similar hole is required in the side of a component a sliding core or other mechanism will be required.

Undercuts / Sliding cores
- With some components undercuts are unavoidable.
- In such cases it is necessary that some portion of the mould be moved sideways in order to eject the part.

This can achieved using:
- **Sliding core**: where a pin or small detail moves sideways to relieve the undercut.
- **Split mould**: where the entire mould cavity separates to reveal the component.

Sliding Cores
- Sliding cores may be used to extract pins.
- Alternatively they may be used to extract an entire section of mould.
- Sliding core movement may be linked to mould opening.
- Alternatively the may be operated independently using hydraulic actuators.
Split Mould

- Split moulds are used where there is a significant amount of undercut detail.
- In such cases it is easier to split the mould cavity completely.

In the case of a split mould the entire cavity separates in order to eject the component.
- This can be achieved using angled guide pins to move the cavity halves sideways as the mould opens.

Internal Undercuts

- Some components have internal undercuts. This has the additional complication of very limited space for lateral movement.
- This undercut detail can be relieved by allowing a portion of the core to move at an angle during ejection.

Moulding of threads

- Moulding of threads is made possible by using a rotating cores, which retract as they rotate in order to remove the component from the cores.
- Also referred to as unscrewing moulds.
A consequence of gating a cup shaped component from the side is the formation of weld lines. Weld lines occur when flow fronts travelling in opposite directions meet. This leaves a visible trace on the surface of the component called a weld line. This occurs because the plastic has already partly cooled by the time the flow fronts meet.

This can be avoided by gating at the centre. This can be achieved using a multi-plate mould.

If plastic ‘jets’ into a mould (like squirting tooth paste from a tube) this will leave evidence in the form of a ripple effect on the surface of the plastic.

It is preferable to encourage the plastic to advance smoothly. This can be achieved by gating at the side.

Gating from the side of a long slender core can cause deflection of the core resulting in uneven wall thickness.

Temperature control is an essential part of the moulds operation.

It is essential to remove heat from the mould as quickly as possible so that it will be sufficiently cool and rigid to be ejected without damage.

The shorter the cooling time the shorter the cycle time and the more parts can be produced.
Mould Cooling

- The challenge in cooling channel design is to maximize the proximity of the cooling liquid to the part surface.
- This can be difficult with complex shaped components.

Conformal Cooling channels

- Selective Laser Sintering is a rapid prototyping process which allows metal components to be 'printed' directly from a CAD model.
- Using this process, cooling channels of any shape can be incorporated in the core and cavity blocks.