All about Gate, Runner and Vent Design

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SoCal SPE

Runner Systems

Key Mold Elements

- Sprue
- Runner
- Gate

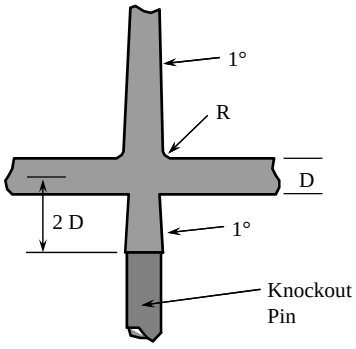
Sprue

Sprue

- "Connecting" pipe between runner and nozzle
- Often cycle limiting element
- Should be last segment to freeze
- Standard taper - 2 degrees
- Standard catalog items
- Keep as short as possible

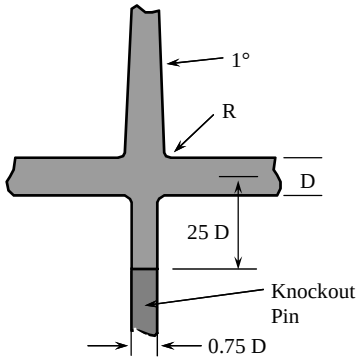
Sprue Puller Designs

Reverse Taper



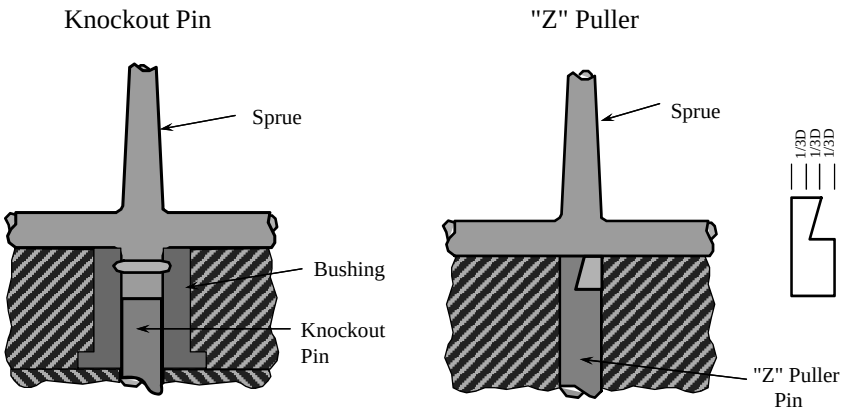
Zytel®

Knockout



Rynite®, Delrin®

Sprue Puller Designs

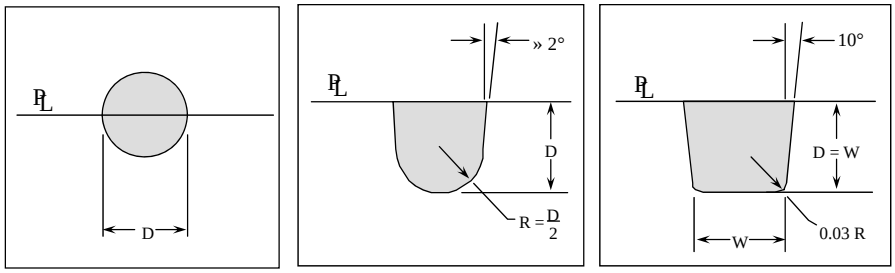


Runners

Runners

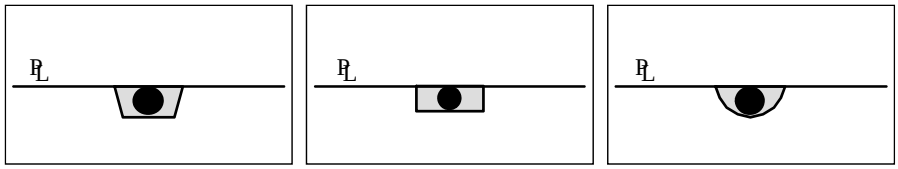
- Melt "pipeline" from sprue to cavity
- Geometry is important
  - Full round – best
  - Trapezoid – ok
  - Half round – poor

Efficient Runners



Round Runner | Modified Trapezoidal Runner | Trapezoidal Runner

Inefficient Runners



Trapezoid Flat Half-Round

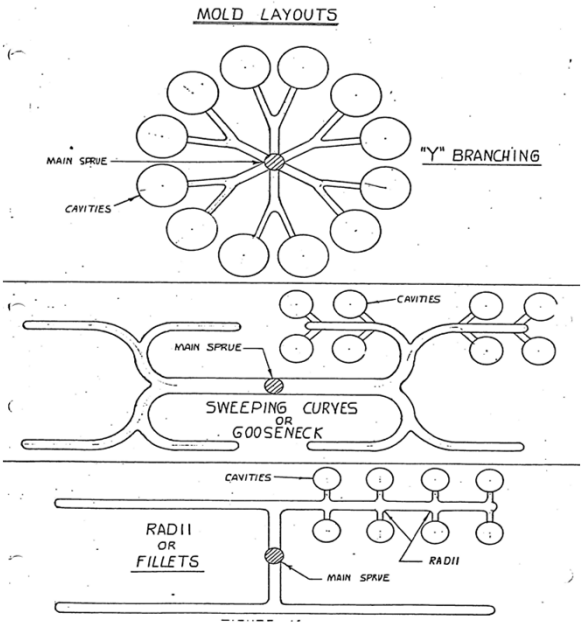
Runners

- Melt "pipeline" from sprue to cavity
- Geometry is important
  - Full round - best
  - Trapezoid - ok
  - Half round - poor
- Diameter important
  - Balance pressure drop vs. weight
- Can be sized to balance fill

Runner Balance

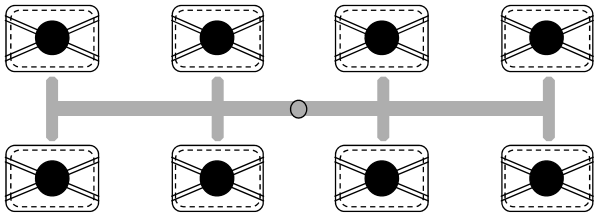
- Number of cavities: 2, 4, 8, 16, 32, 64……
- Calculate pressure drops from nozzle, sprue, runners and gates.

Unbalanced runner layout

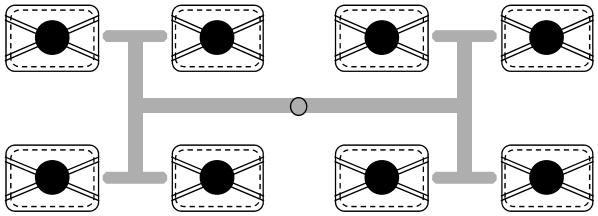


Runner Systems

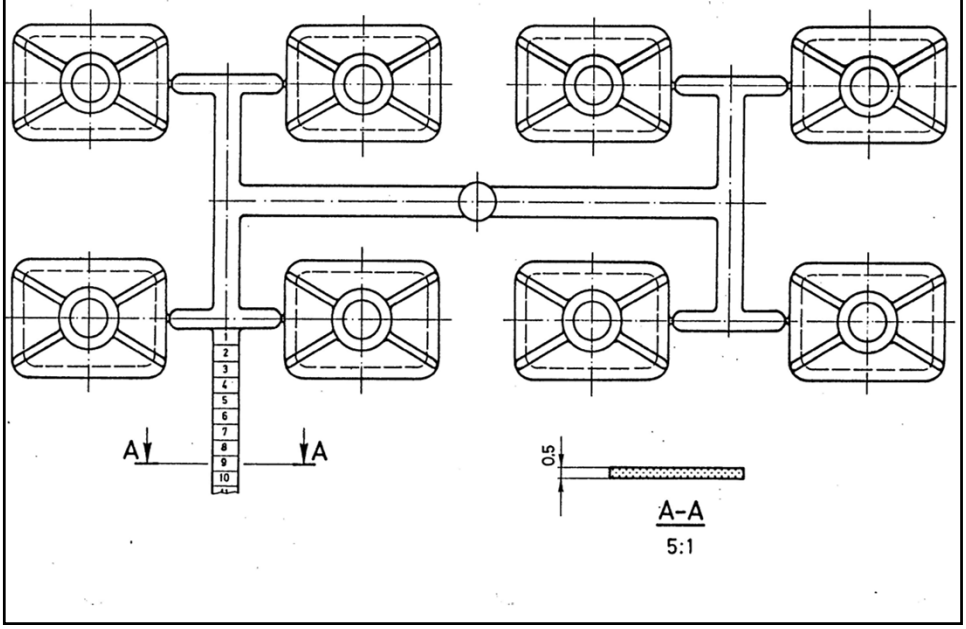
Unbalanced



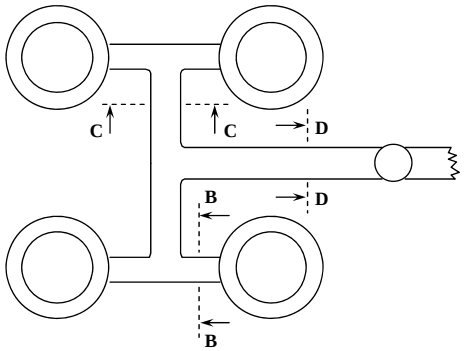
Balanced

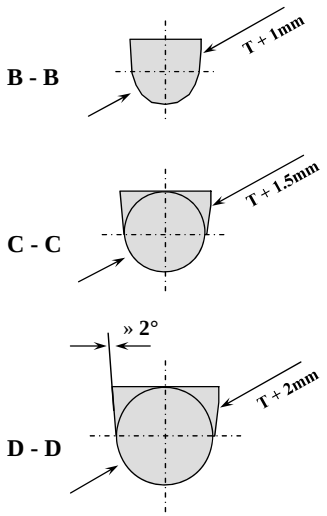


Runner with overflow tab



Sizing Runners





T = part thickness at gate

2:1

The Gate

What is a Gate?

- Can be defined simply as the entrance to a cavity at the end of a runner.
- When properly positioned and designed the gate is an important feature of a mold.

Why a Gate is Used?

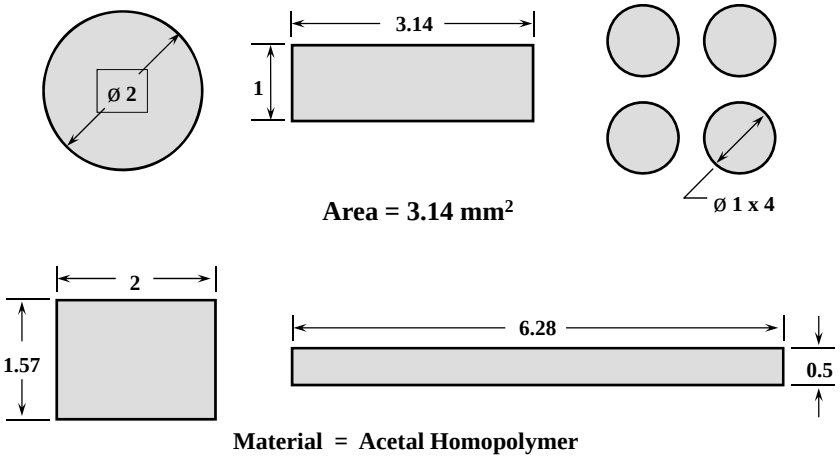
- To permit back pressure to build up in the runner system so that all cavities will fill at approximately the same time and to the same density and volume.
- To lower the molding cycle by effectively seal-off the edge of the cavity so that the part may be ejected although not completely "set up" or hardened.

The Gate

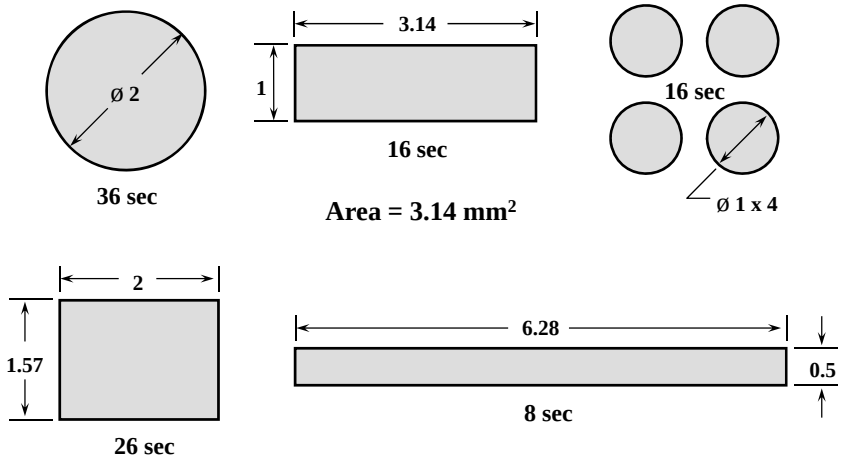
- Permits flow into the cavity
- "Seal" between part and runner
  - Thermal valve
- Provides separation from the runner

Gate Areas

Which gate freezes first? Last?



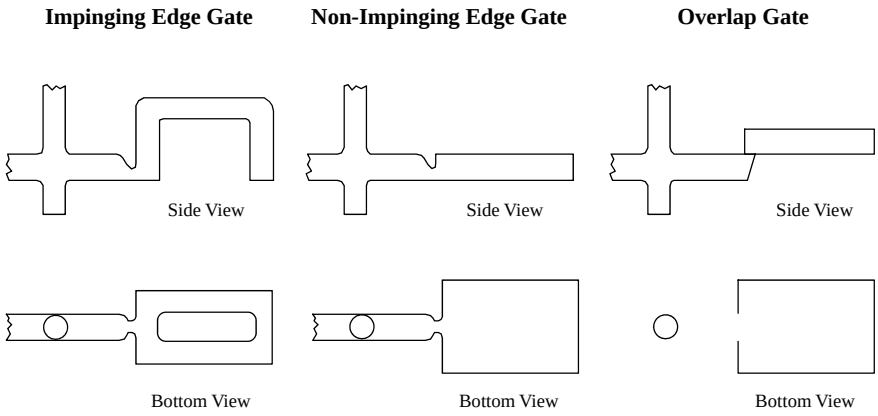
Gate Areas



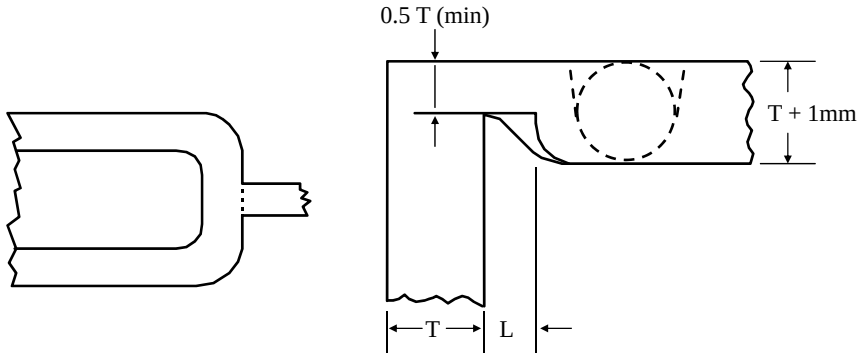
Common Gate Designs

- Rectangular
- Fan or flash
- Diaphragm
- Tunnel
- Banana
- Pin point
- Direct sprue

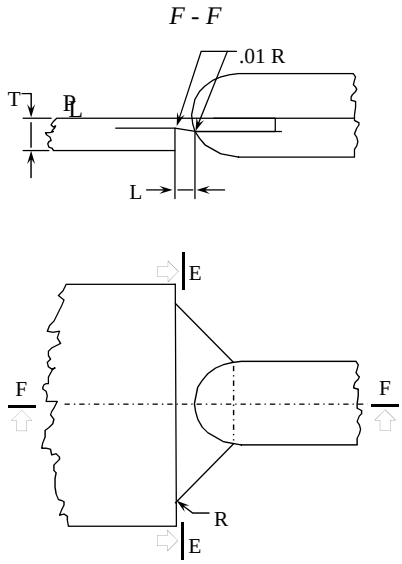
Rectangular Gates

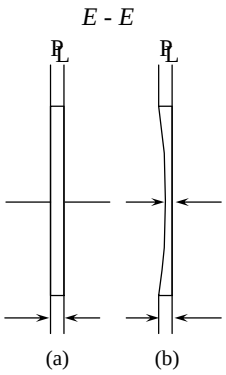


Rectangular Gate Design

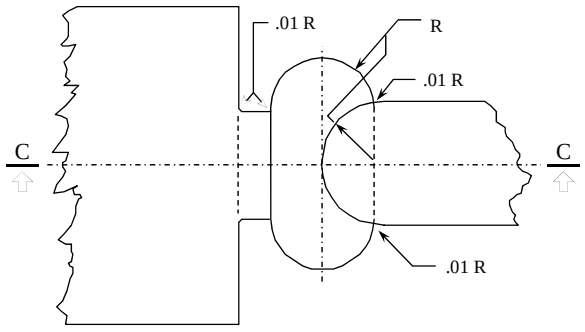


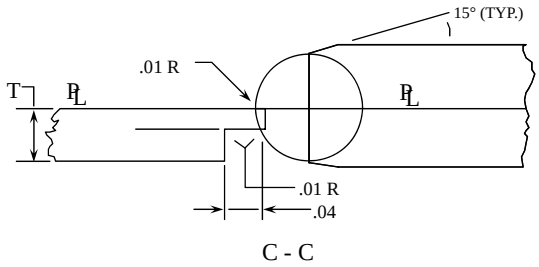
Fan Gate with Round Runner





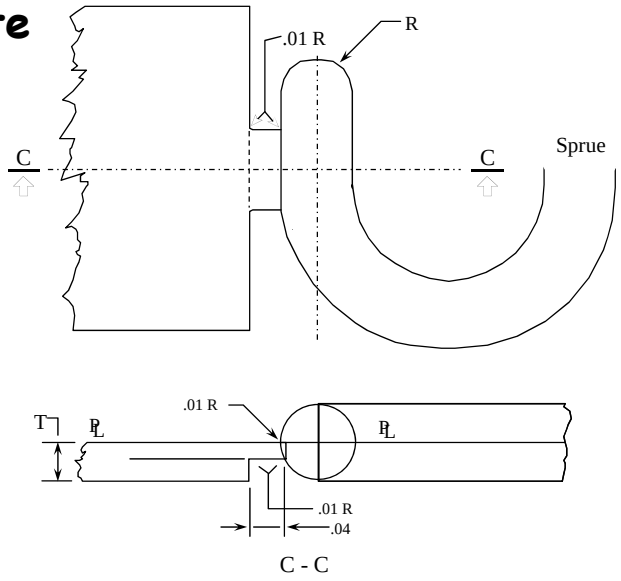
Flash Gate with Round Runner



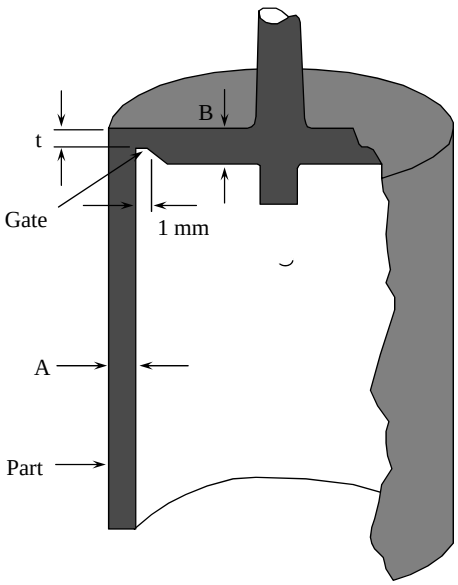


C - C

Flash Gate with Round Runner



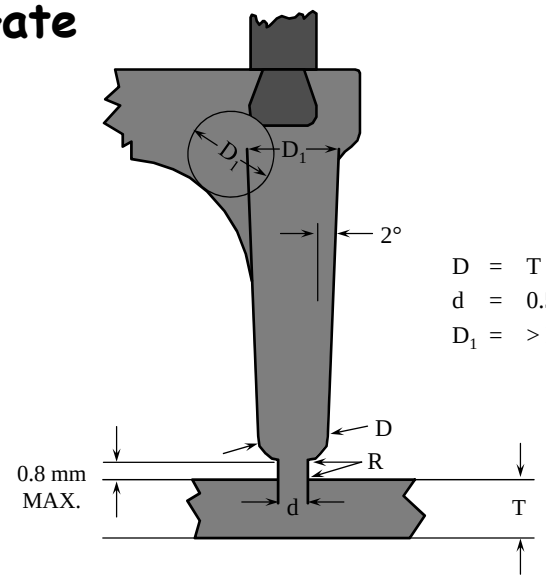
Diaphragm Gate



t = 0.5 A

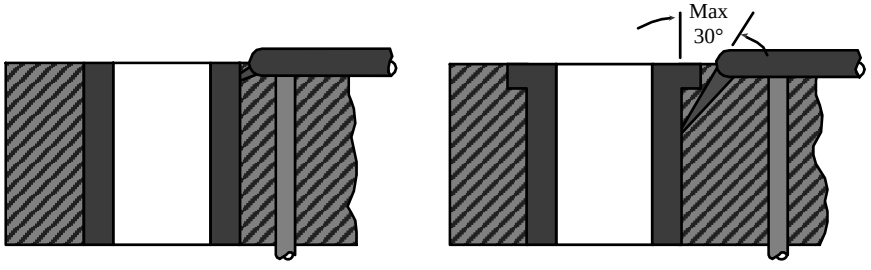
B = A + 1 mm

Pin Gate



D = T + 1 mm
d = 0.5 - 0.6T
D_1 = > D

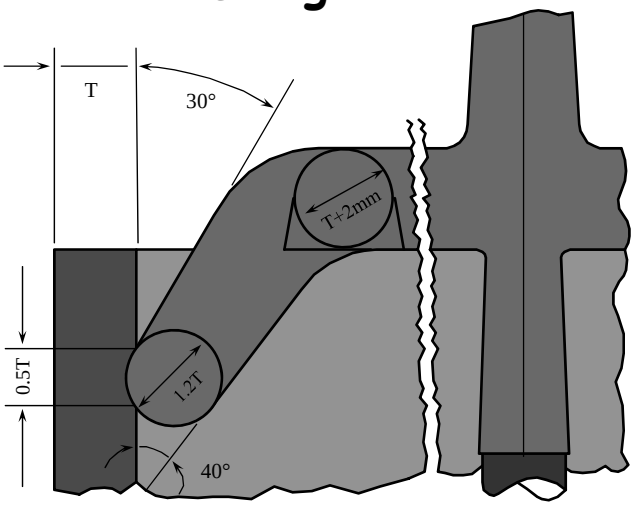
Types of Tunnel Gates



Short Tunnel

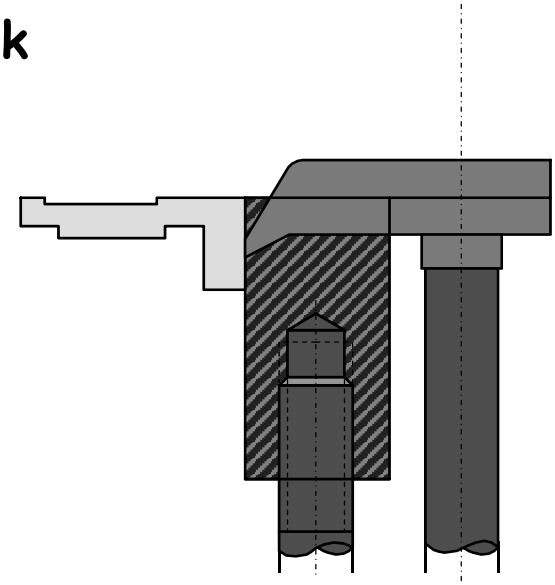
Long Tunnel

Tunnel Gate Design



This is the preferred tunnel gate design for semi-crystalline resins

Gate Block Design



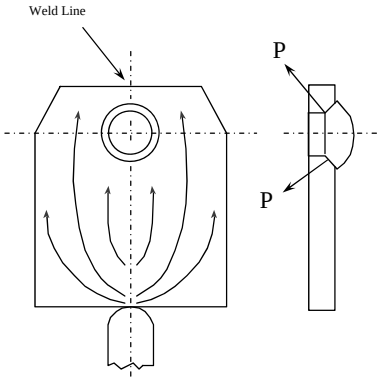
Considerations when using subgates

- Must be a converging design for easy ejection. This may lead to uneven filling or premature freeze-off.
- A short shot may not eject cleanly causing a plugging of the subgate.
- Subgates have a high stress concentration. This could cause fracturing of the part at some later time.
- Effective range of gate dia. .020" to about .080".

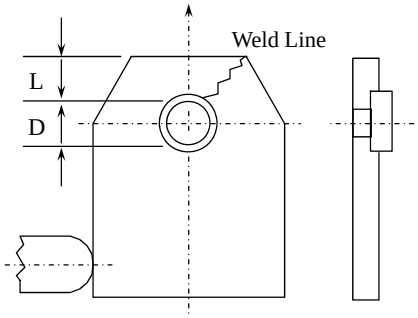
Gate location

The gate location is often more important than the type or size of gate used. It may affect:

- Part dimension
- Weld line quality
- Location of welds
- Air trapping
- Core shifting
- Surface finish



The weld line is at the weakest cross section.



Change gate location and keep L larger than D.

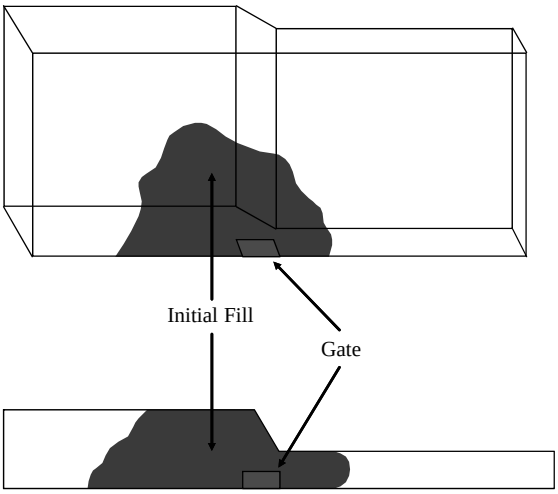
Gate location is influenced by:

- Resin characteristics
  - Viscosity
- Part geometry
  - Wall thickness
  - Flow distance
- Surface aesthetics
- Mold type and cavity layout

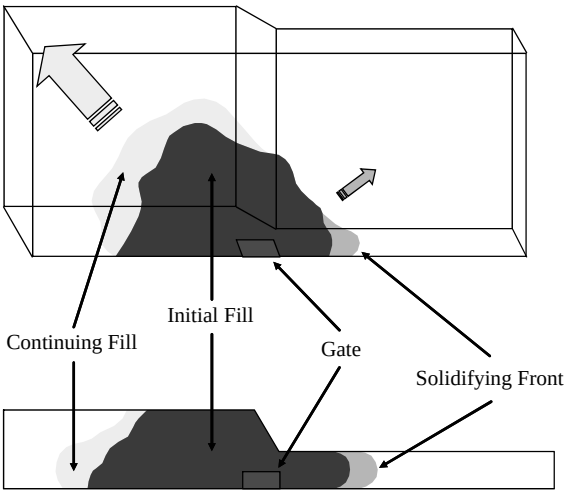
Do Not Put the Gate:

- At point of impact or flexing
- Where jetting can occur
- At a high visibility location
- Where it will bend cores or move inserts
- Where the weld line will receive impact or flexing
- Where melt has "choice" of flow paths

Thick Section "Steals" Flow



Thick Section "Steals" Flow



Vent

Vents

- What are vents?
- Why are they needed?
- Where should they be located?

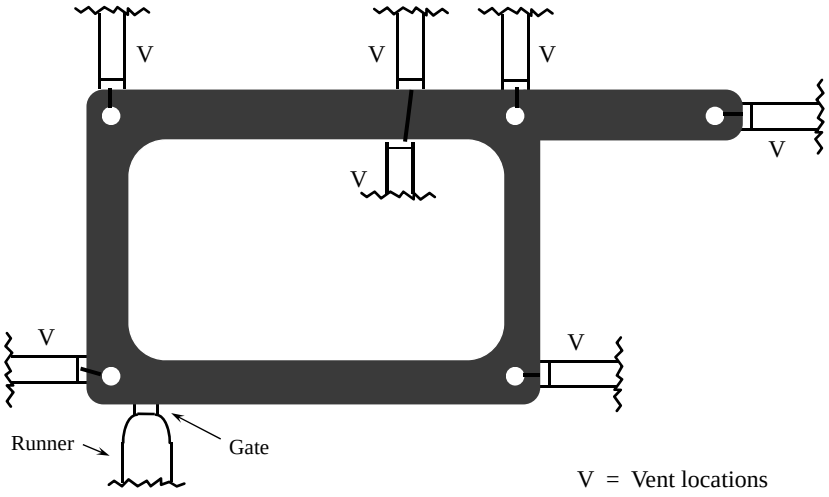
Vents

- Escape path for:
  - resin volatiles
  - cavity air
- Location:
  - end of fill
  - where weld lines occur
- Must be large enough (area) to permit rapid gas evacuation
- Thin enough to prevent plastic flash

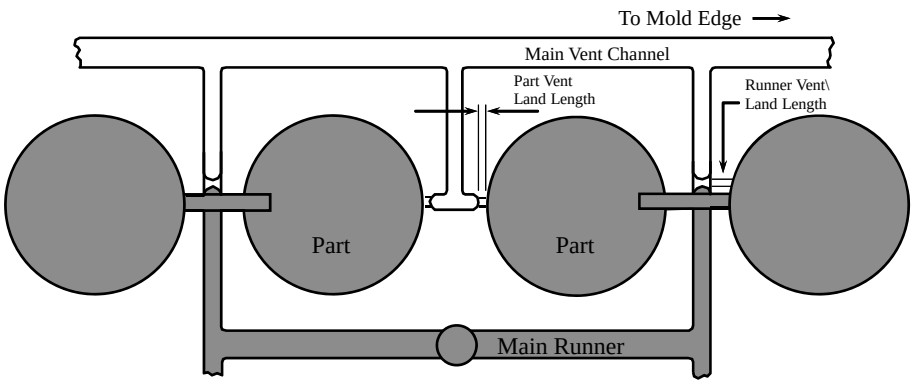
Poor Venting Causes

- Burn marks
- Bubbles or blisters
- Poor filling
- Weak weldlines
- Flash
- Mold deposit
- Corrosion
- Erosion

Vents at Weld Lines

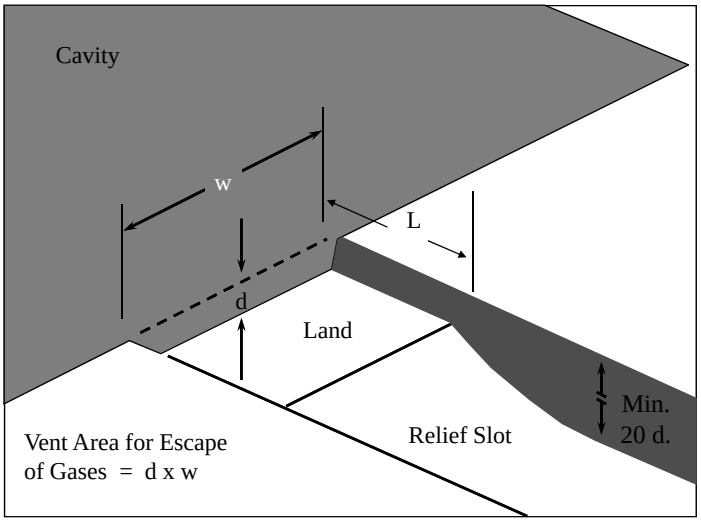


Venting



All vent channels 0.8mm (0.03") deep.
Runner vent land length 1mm (0.04"), max. depth 0.06mm (0.0025").
Part vent land length 1mm (0.04"), max. depth dependant on resin used

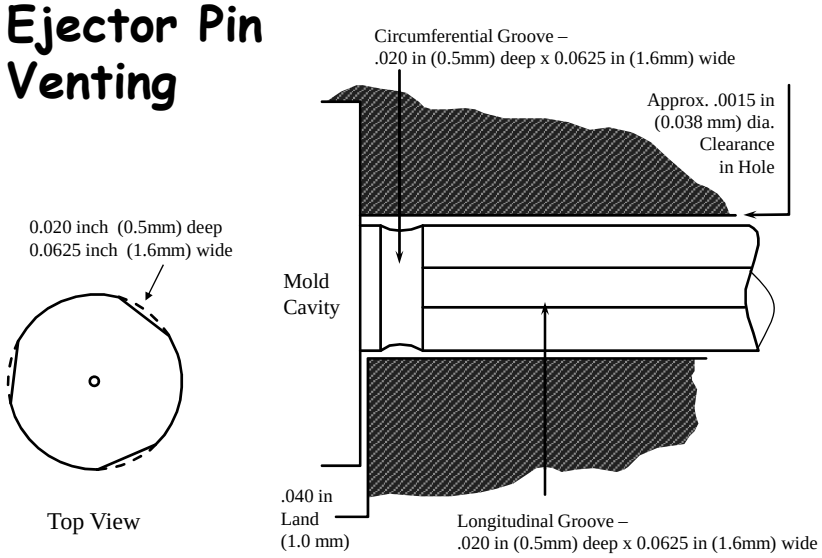
Parting Line Venting



Venting Problems

- Consider:
  - Vent pins (must be self-cleaning)
  - Overflow tabs
  - Secondary parting lines (inserts)
  - Porous metal inserts (Porcerax® II)
  - Mold vacuum (MoldVac®)
- Anticipate
  - Difficult to fix once tool is built
  - Fixing can result in chasing the problem

Ejector Pin Venting



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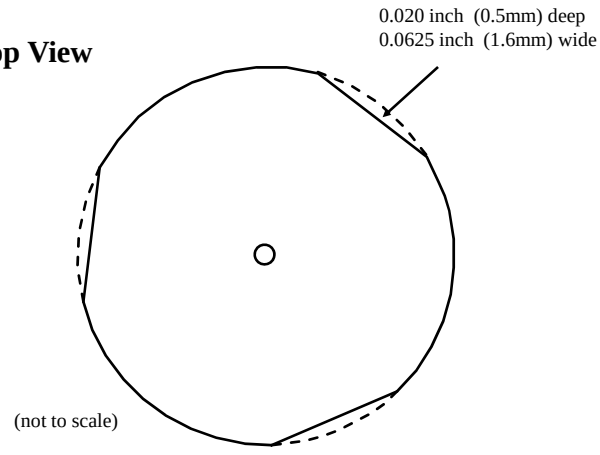

Thank you