# Fundamentals of Casting

# Four Families of Shape-Producing Manufacturing Processes

1. Casting
2. Material Removal
3. Deformation Processes
4. Consolidation Processes

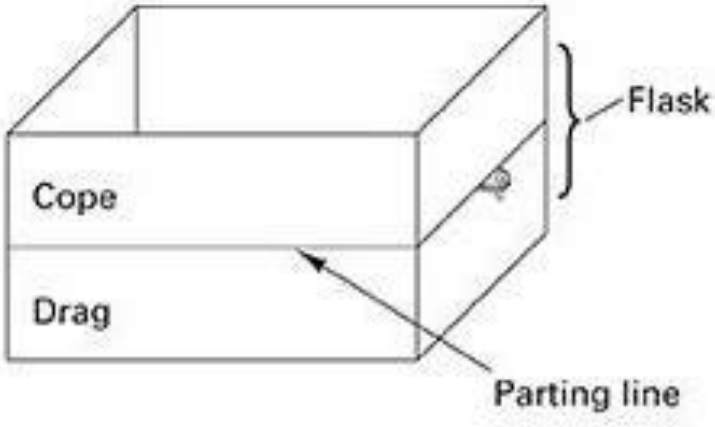
# Two Types of Sand Casting

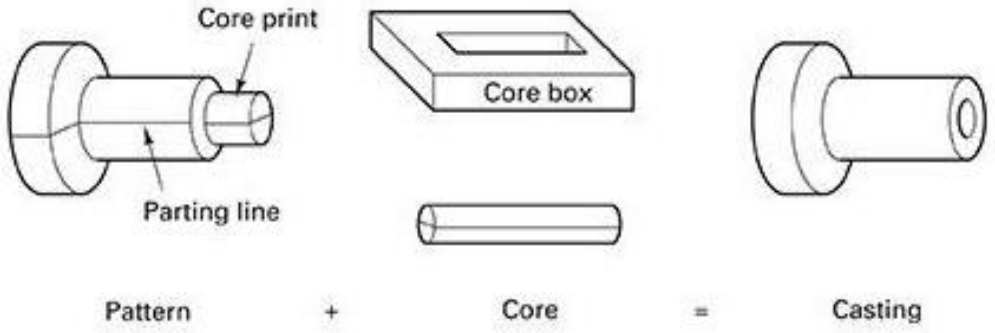
1. Expendable mold
   - Sand
   - Shell
   - Investment
   - Lost foam
2. Multiple-use mold
   - Die
   - Permanent mold

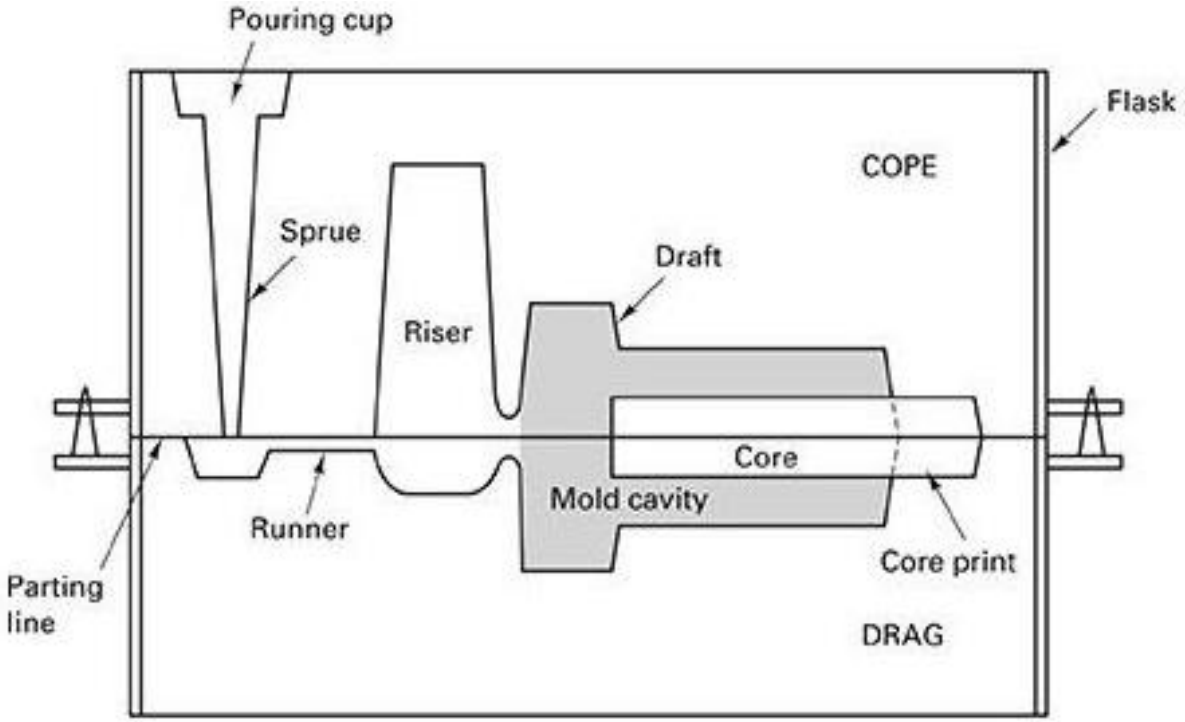
# Six Requirements of Casting Processes

1. Mold Cavity
2. Melting
3. Pouring
4. Solidification
5. Mold Removal
6. Cleaning, Finishing, and Inspection

# Two-part sand mold



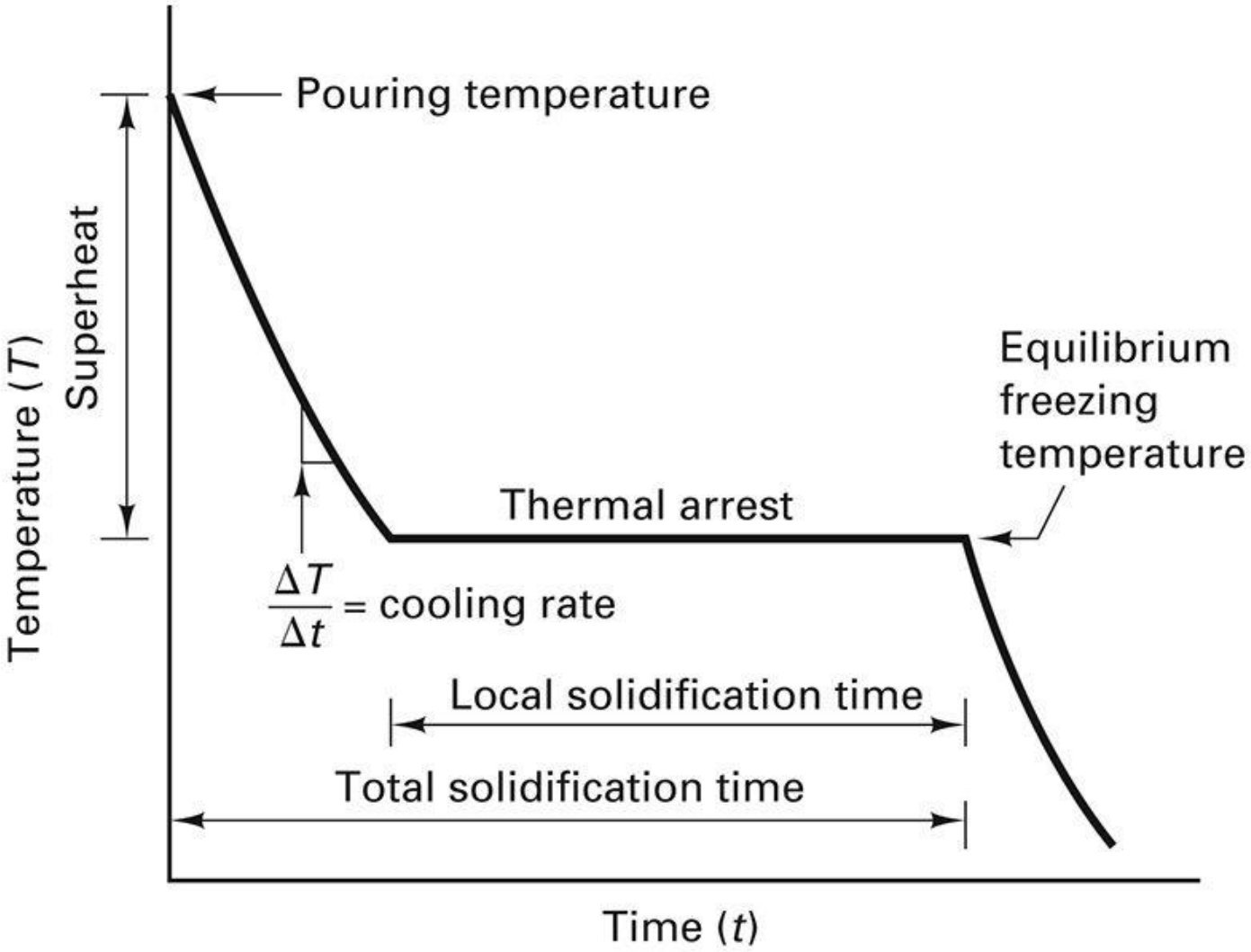



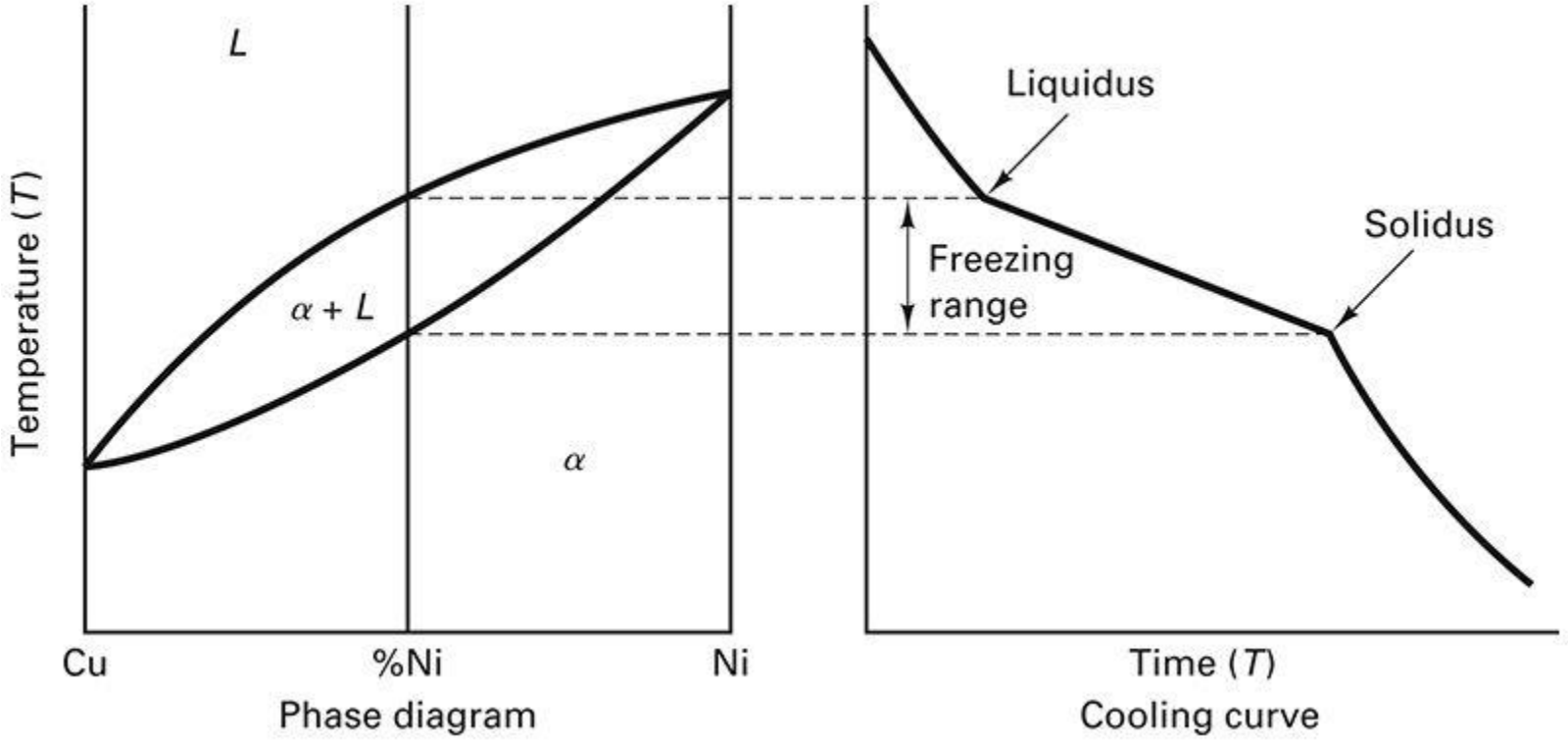
# Solidification Stages

1. Nucleation
   - Begins at mold walls
   - Each nucleation site produces a grain
   - Introduction of impurities promotes fine grains
2. Grain growth
   - Growth of nucleated grains
   - Control direction to assure solid casting
   - Smallest grains at casting wall

# Metal cooling curve eutectic composition

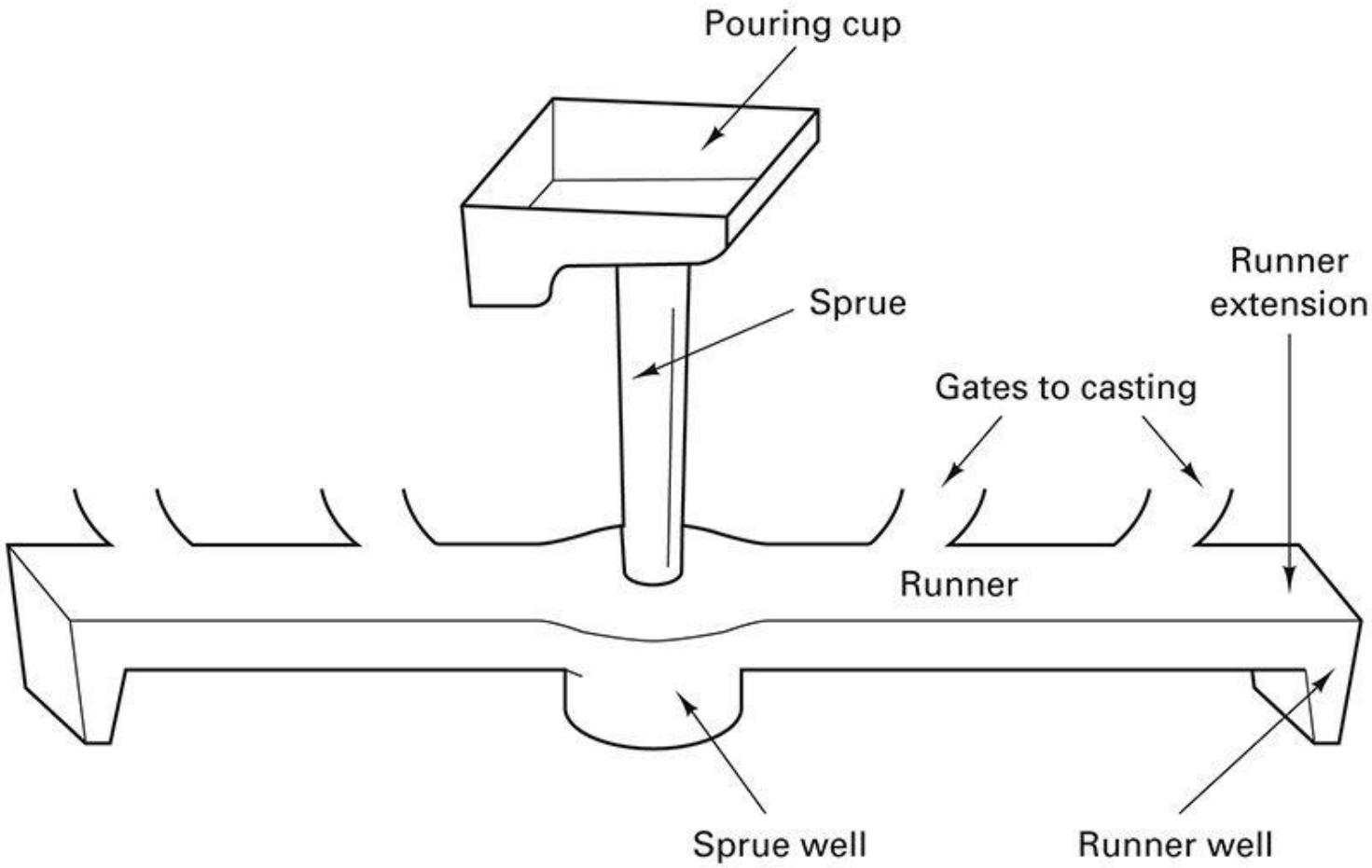


# Phase Diagram and Cooling Curve Cu-Ni

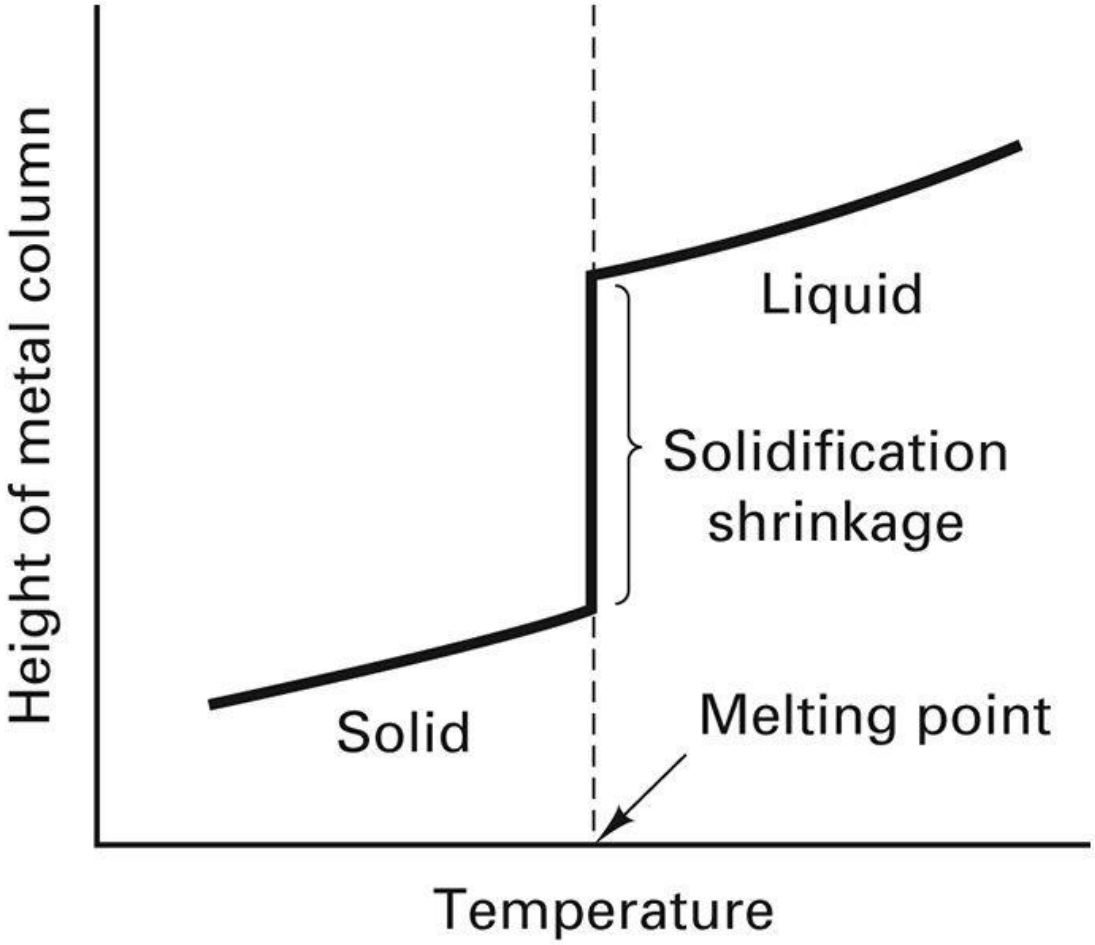


# Internal structure of cast metal bar

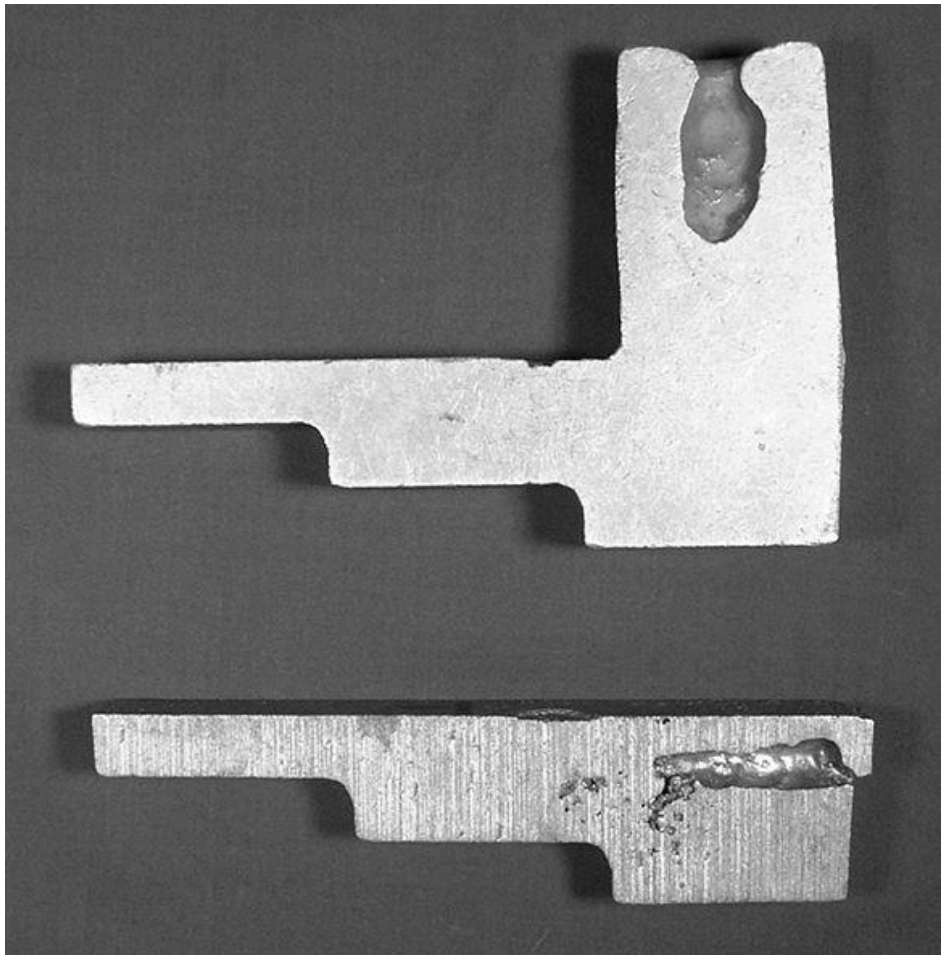
# Gating system for sand mold



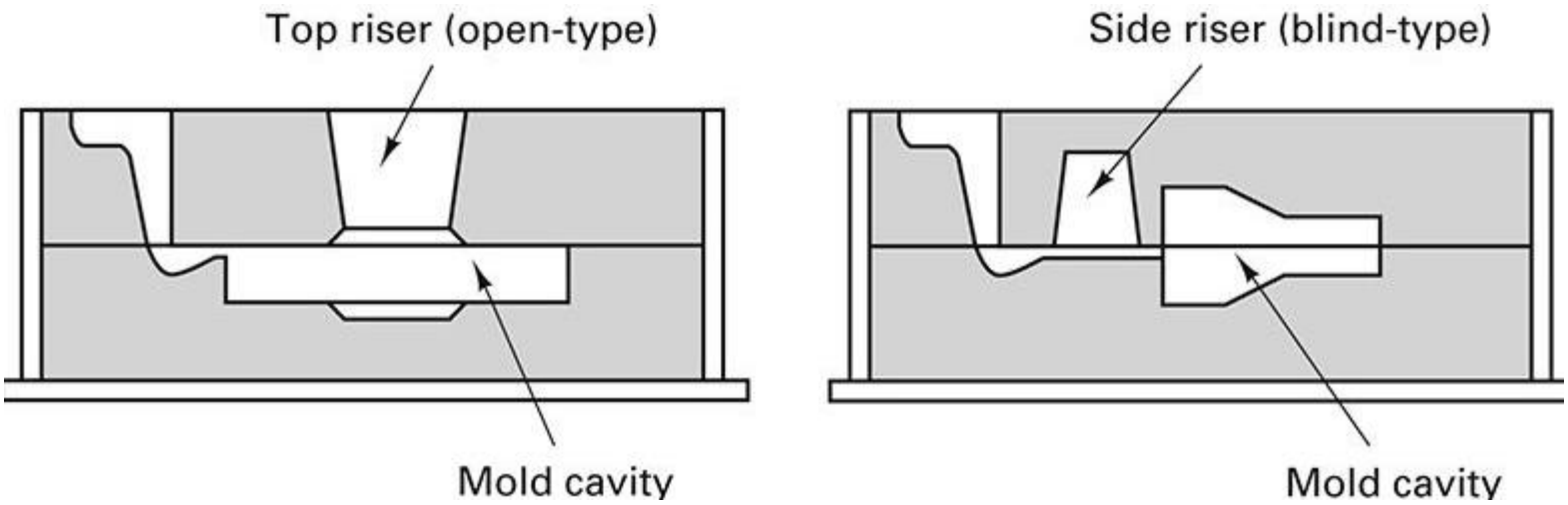
# Dimensional changes of metal column



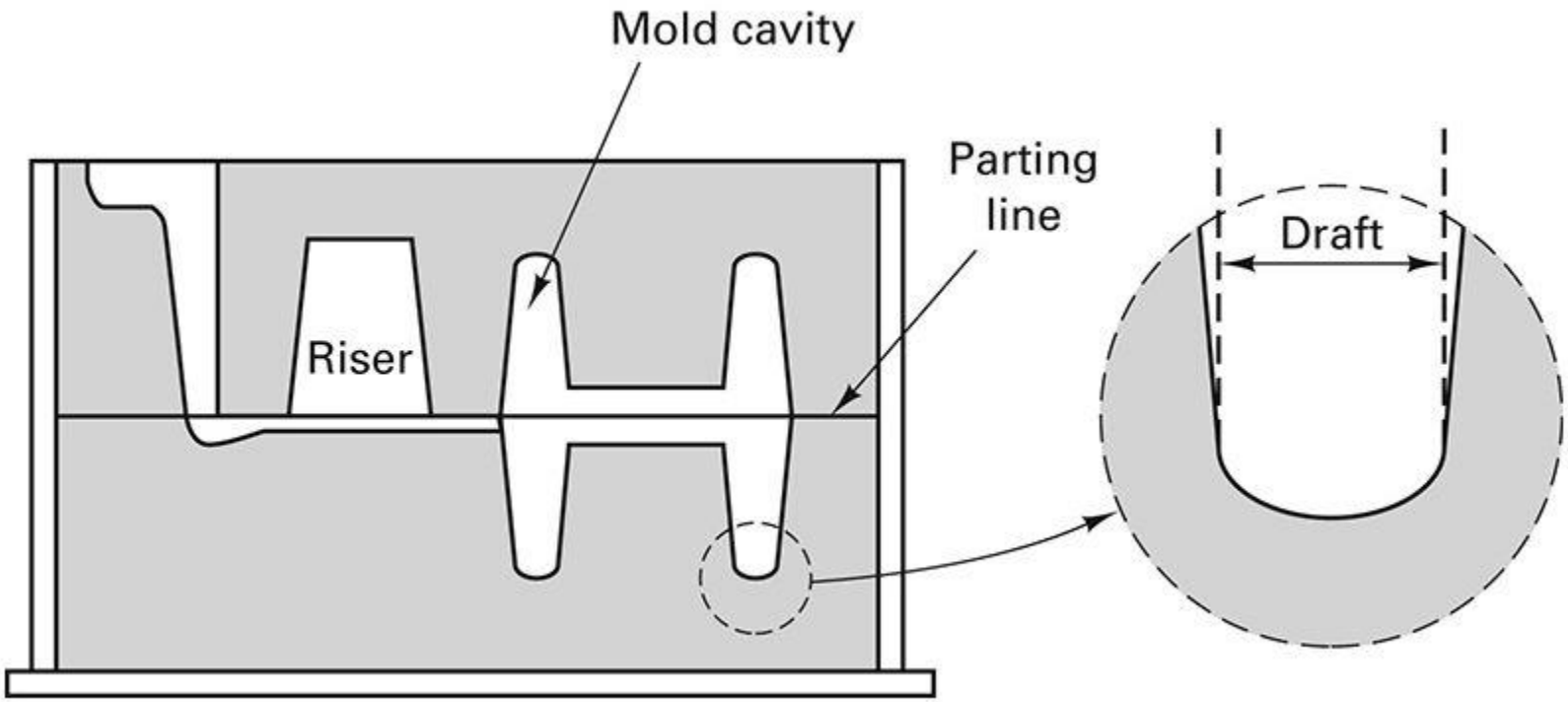
# Shrinkage shift to riser



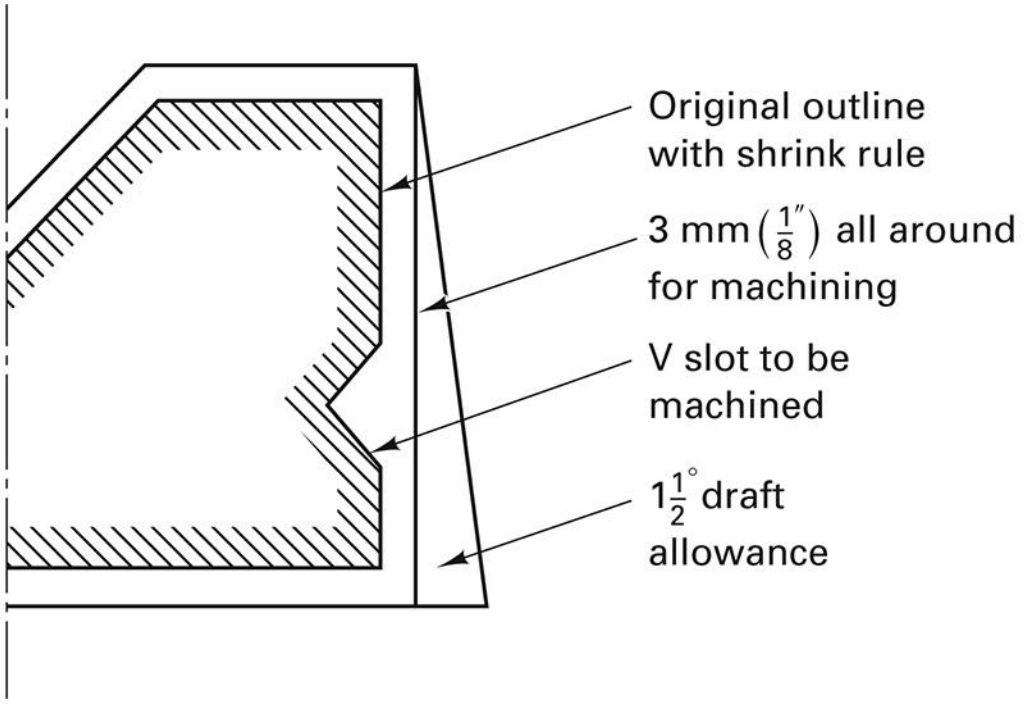
# Riser types


Top riser (open-type)
Mold cavity
Side riser (blind-type)
Mold cavity

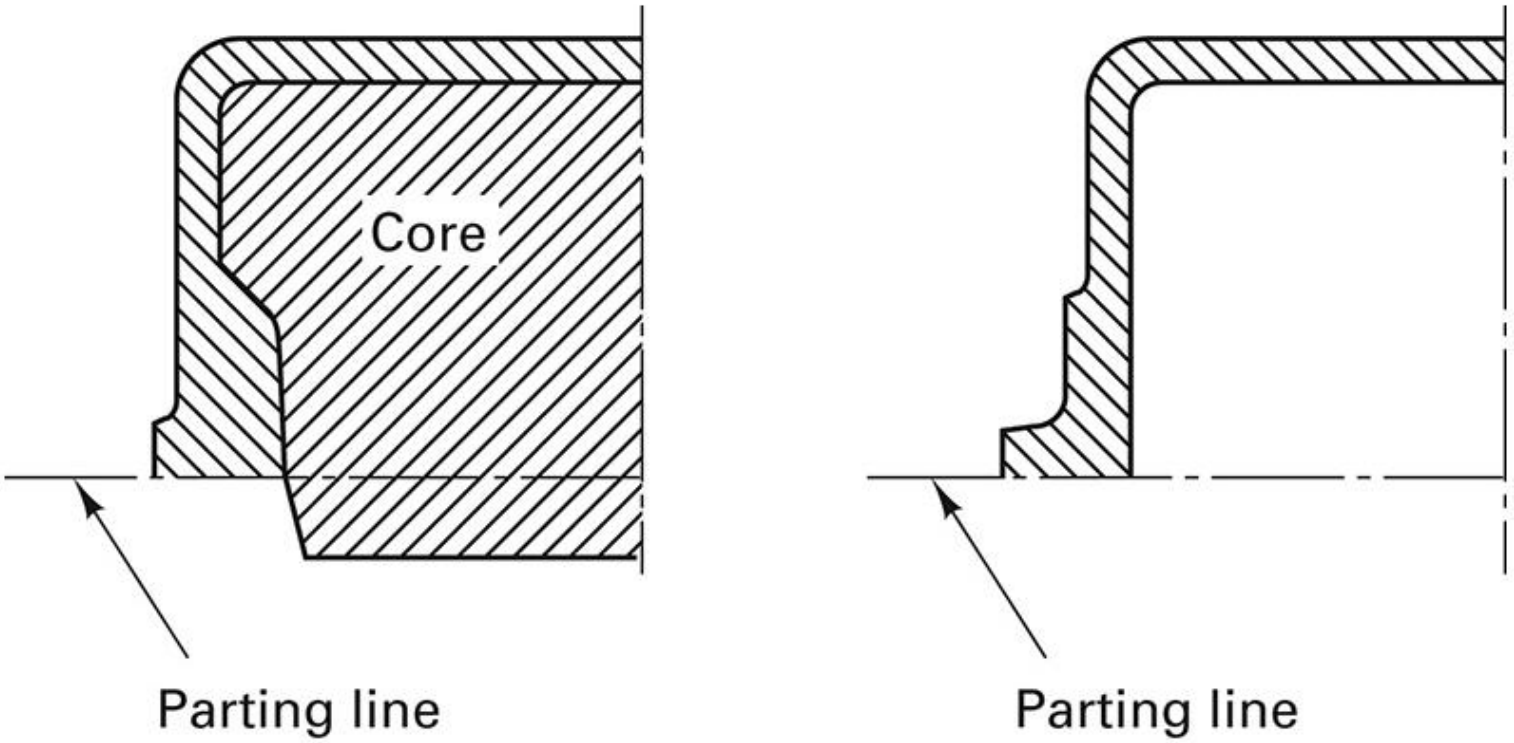
# Draft allowance



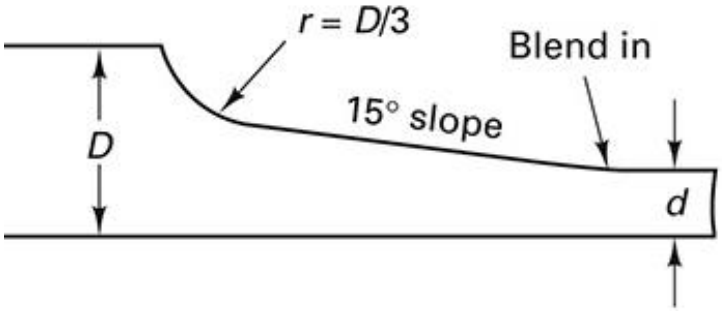
# Machining Allowance



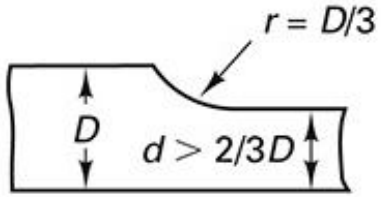
# Eliminate Dry-sand Core



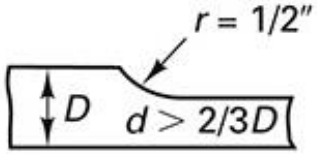
# Section Change Transition




If $D > 1.5''$ and $d < 2D/3$, then $r = D/3$ with a 15° slope between the two parts

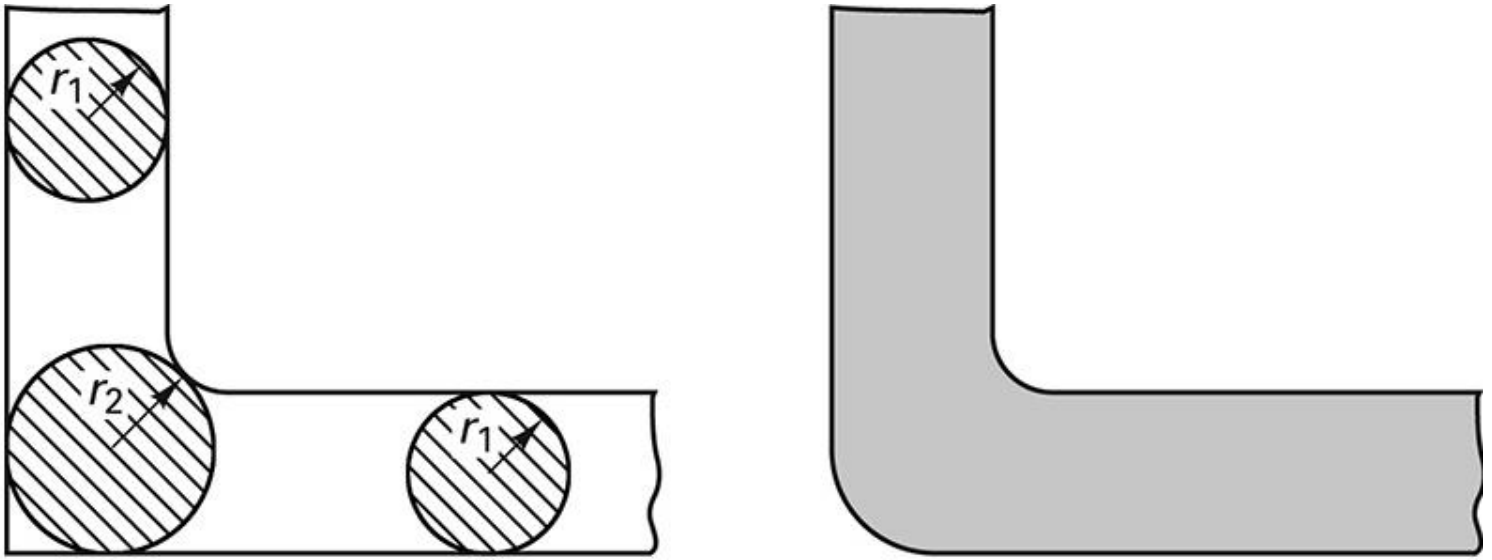



If $D > 1.5''$ and $d > 2/3\ D$, then $r = D/3$

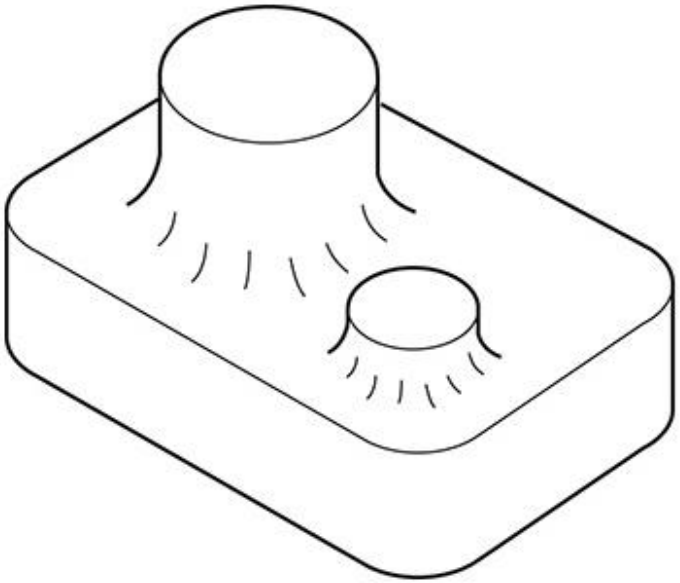


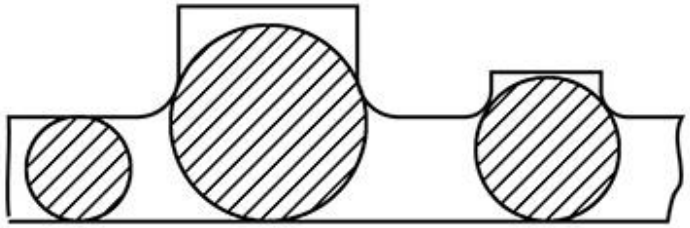

If $D < 1.5''$ and $d > 2/3\ D$, then $r = 1/2''$

# Hot Spots



# Intersecting section hot spots





# Attached Riser