University of Technology
Materials Engineering Department

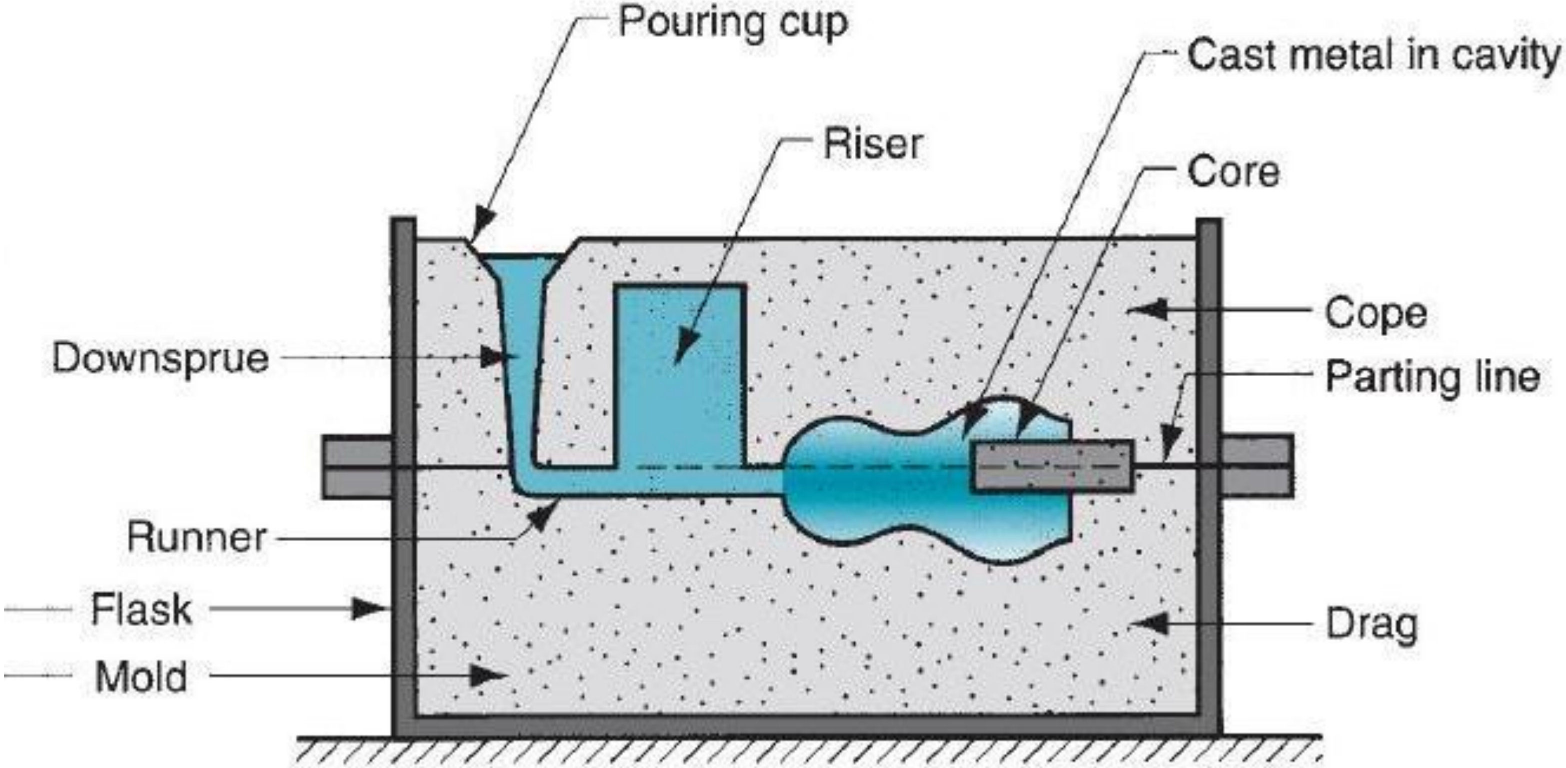
General Materials Branch

Casting Technology I

Fourth Class

Lecture Four :Riser Design

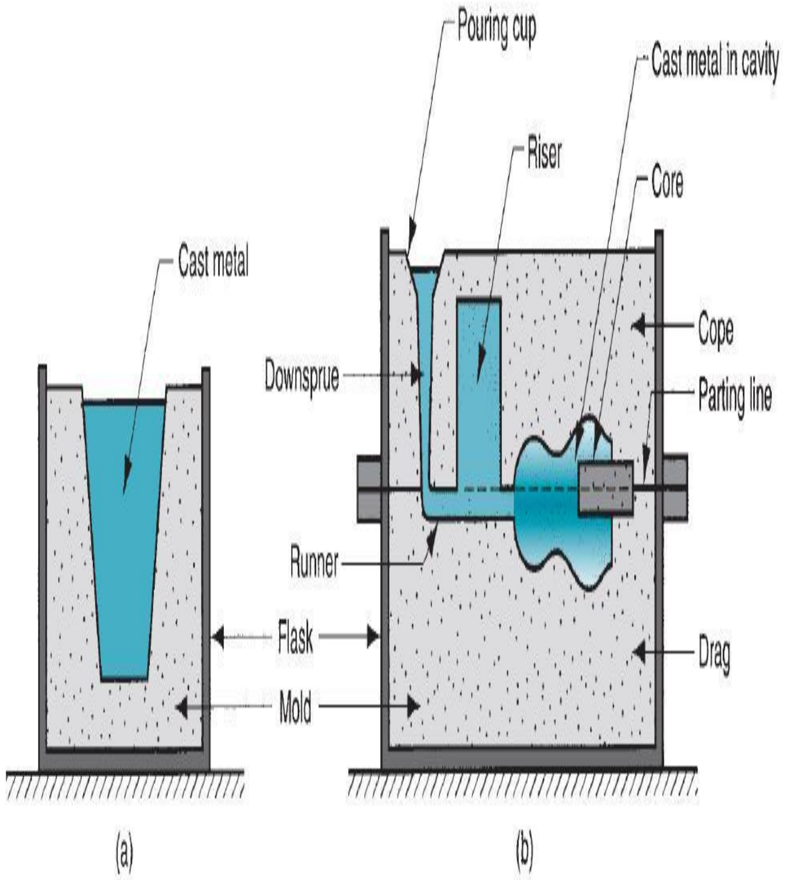
Riser Design



(b)

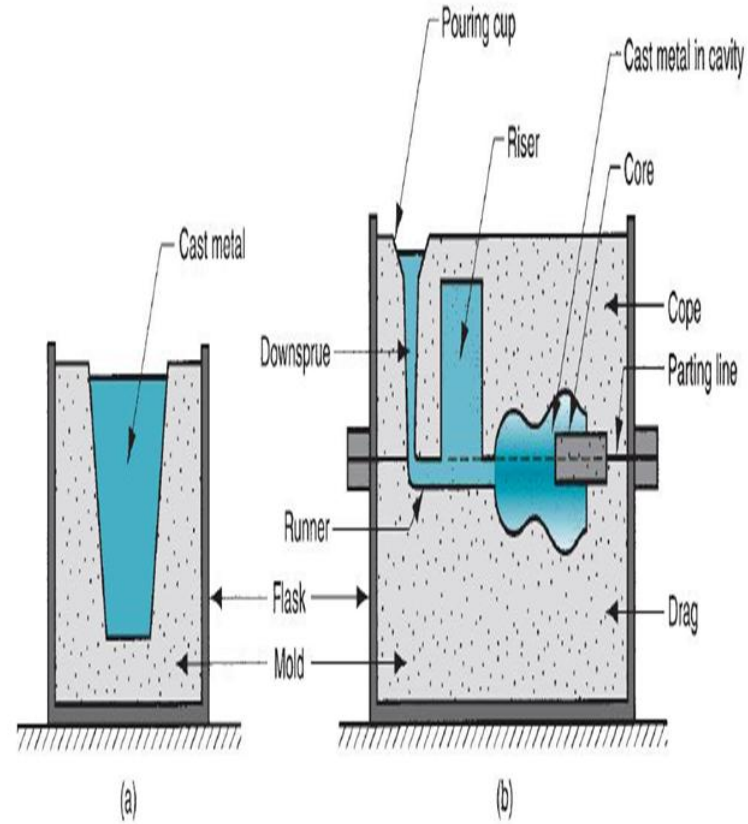
Riser Type

- There are two categories of Riser type
- By location (Top , Side)
- By Connection to Air (open ,Blind)



Secondary Riser Functions

1. A Vent of Gases
2. It's help to know when the mold is completely filled
3. It help to force metal into mold cavity by pressure Head



Optimum Riser Design

The role of the methods engineer in designing risers can be stated simply as making sure that risers will provide the feed metal:

- · In the right amount
- · At the right place
- · At the right time

Riser Design.

1. The riser must not solidify before the casting. This rule usually is satisfied by avoiding the use of small risers and by using cylindrical risers with small aspect ratios (small ratios of height to cross section). Spherical risers are the most efficient shape, but are difficult to work with.
2. The riser volume must be large enough to provide a sufficient amount of liquid metal to compensate for shrinkage in the casting.
3. Junctions between the casting and the riser should not develop a hot spot where shrinkage porosity can occur.
4. Risers must be placed so that the liquid metal can be delivered to locations where it is most needed.
5. There must be sufficient pressure to drive the liquid metal into locations in the mold where it is needed. Risers therefore are not as useful for metals with low density (such as aluminum alloys) as they are for those with a higher density (such as steel and cast iron).
6. The pressure head from the riser should suppress cavity formation and encourage complete cavity filling.

Optimum Riser Design

1. The riser/casting junction should be designed to minimize riser removal costs
2. The number and size of risers should be minimized to increase mold yield and to reduce production costs
3. Riser placement must be chosen so as not to exaggerate potential problems in a particular casting design (for example, tendencies toward hot tearing or distortion)

Riser Location

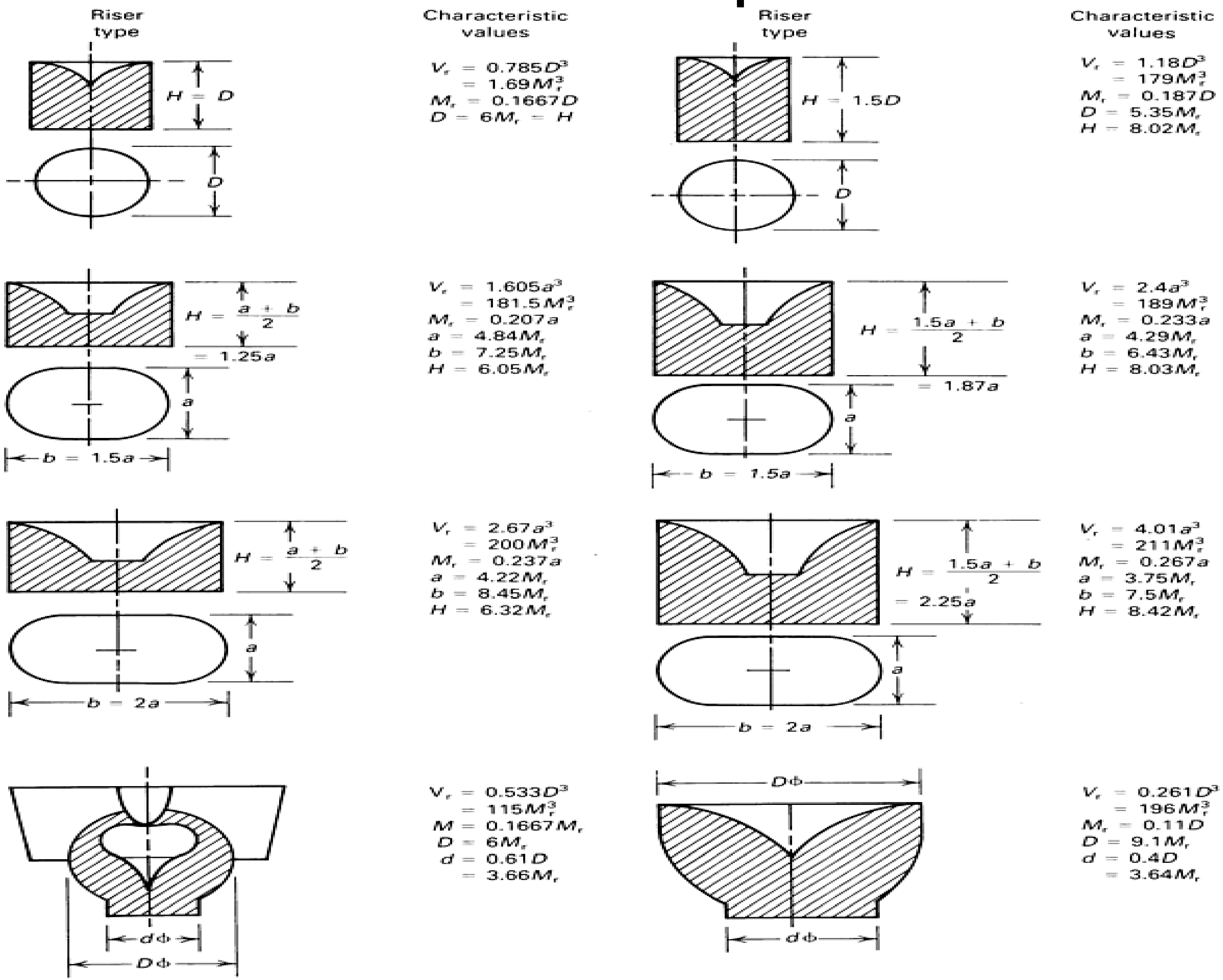
- To determine the correct riser location, the methods engineer must make use of the concept of directional solidification. If shrinkage cavities in the casting are to be avoided, solidification should proceed directionally from those parts of the casting farthest from the riser, through the intermediate portions of the casting, and finally into the riser itself, where the final solidification will occur. Shrinkage at each step of solidification is thus fed by liquid feed metal being drawn out of the riser.

Riser Location

The ability to achieve such directional solidification will depend on:

1. The alloy and its mode of solidification (Long range or short range)
2. The mold medium
3. The casting design (complex or Simple)

Riser shape


Riser type
Characteristic values
H = D
D
V_r = 0.785D^3
= 1.69M_r^3
M_r = 0.1667D
D = 6M_r = H
Riser type
Characteristic values
H = 1.5D
D
V_r = 1.18D^3
= 179M_r^3
M_r = 0.187D
D = 5.35M_r
H = 8.02M_r
H = (a + b)/2
= 1.25a
a
b = 1.5a
V_r = 1.605a^3
= 181.5M_r^3
M_r = 0.207a
a = 4.84M_r
b = 7.25M_r
H = 6.05M_r
H = (1.5a + b)/2
= 1.87a
a
b = 1.5a
V_r = 2.4a^3
= 189M_r^3
M_r = 0.233a
a = 4.29M_r
b = 6.43M_r
H = 8.03M_r
H = (a + b)/2
a
b = 2a
V_r = 2.67a^3
= 200M_r^3
M_r = 0.237a
a = 4.22M_r
b = 8.45M_r
H = 6.32M_r
H = (1.5a + b)/2
= 2.25a
a
b = 2a
V_r = 4.01a^3
= 211M_r^3
M_r = 0.267a
a = 3.75M_r
b = 7.5M_r
H = 8.42M_r
dΦ
DΦ
V_r = 0.533D^3
= 115M_r^3
M = 0.1667M_r
D = 6M_r
d = 0.61D
= 3.66M_r
DΦ
dΦ
V_r = 0.261D^3
= 196M_r^3
M_r = 0.11D
D = 9.1M_r
d = 0.4D
= 3.64M_r

Casting Yield

- An important factor do discuss while Riser Design it's the ratio between the casting weight and the total weight of metal
- The energy is wasted and runner and risers so reduce the riser volume is a way to increase the yield
- $Y = \frac{W_c}{(W_{c+W_r+W_g+W_{ru}})}$

Pipes and Necking

- Necking is used to slow down the Liquid metal into the Mould cavity
- It is important that piping occur in the riser not in casting
- We can use either exothermic or endothermic material to preserve Heat in riser avoiding early solidification of riser