**Riser Design**

The riser is a reservoir in the mold that serves as a source of liquid metal for the casting to compensate for shrinkage during solidification. The riser must be designed to freeze after the main casting in order to satisfy its function.

Riser Function As described earlier, a riser is used in a sand-casting mold to feed liquid metal to the casting during freezing in order to compensate for solidification shrinkage. To function, the riser must remain molten until after the casting solidifies. Chvorinov’s rule can be used to compute the size of a riser that will satisfy this requirement. The following example illustrates the calculation.

The riser represents waste metal that will be separated from the cast part and re-melted to make subsequent castings. It is desirable for the volume of metal in the riser to be a minimum. Since the geometry of the riser is normally selected to maximize the V/A ratio, this tends to reduce the riser volume as much as possible.

Risers can be designed in different forms. The design shown in Figure below is a side riser. It is attached to the side of the casting by means of a small channel. A top riser is one that is connected to the top surface of the casting. Risers can be open or blind. An open riser is exposed to the outside at the top surface of the cope. This has the disadvantage of allowing more heat to escape, promoting faster solidification. A blind riser is entirely enclosed within the mold, as in Figure below.
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

Also we must consider the following

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)

Also and the most important rule is riser solidification time must be longer than casting solidification time by Chvorinov’s rule

\[
T_r = C_m \left( \frac{V}{A} \right)^2 \\
T_r > T_c \\
\left( \frac{V}{A} \right)_R > \left( \frac{V}{A} \right)_C
\]

(V/A) Ratio also known as the modulus, Another ratio is important is the (H/D) Ratio between 1:1-1:1.5
**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.

The ability to achieve such directional solidification will depend on:

- The alloy and its mode of solidification
- The mold medium
- The casting design

**Riser Shape**

1. Cylindrecal
2. Spherical (Ideal) impossible by Manufacture (Hemi-Spherical Actually)

**Necking & Pipe**

- 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 solidification