LESSON 5 CASTING PROCESS: CASTING DEFECTS

5.0 Objectives

After going through this lesson, you will be able to understand:

1. Various defects found in cast products.

5.1 Defects in sand casting

Several types of defects may occur in castings, considerably reducing the total output of castings besides increasing the cost of their production. Defective castings offer an ever-present problem to the foundry industry. A defect may be the result of a single clearly defined cause or of a combination of factors. It is therefore essential to understand defects and the causes behind these defects so that they may be minimized or eliminated. The common types of defects found in castings, their causes and remedies are discussed below.

Blowholes

Blowholes as shown in figures 5.1 generally appear as smooth walled, round voids or cavities opened to the casting surface. Blowholes are caused by the entrapped bubbles of gas with smooth walls. Blowholes may occur in clusters or there may be one large smooth depression. Blowholes are caused due to excessive moisture in the moulding sand, low permeability of sand, hard ramming of sand or gas producing ingredients in the mould.

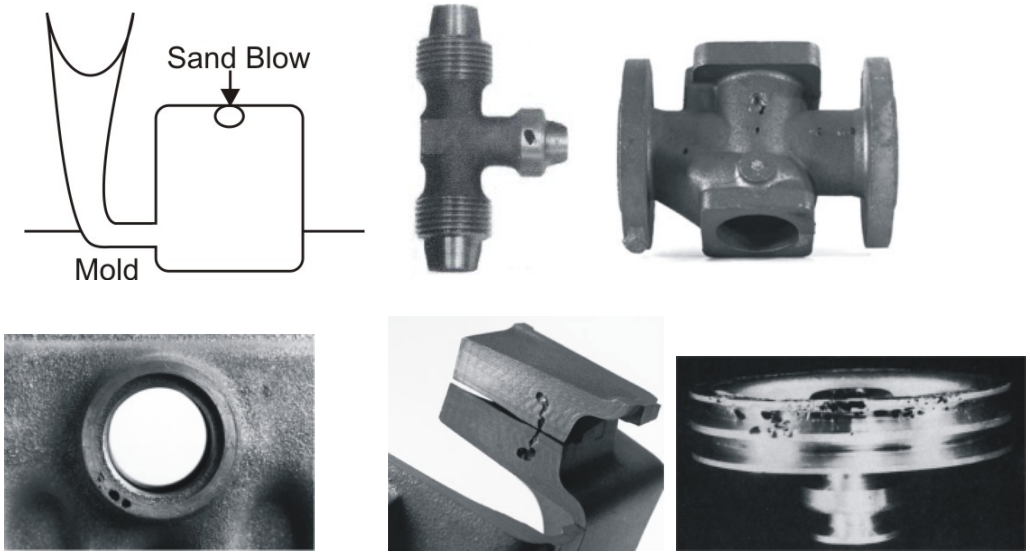

Fig. 5.1 Blowholes

Scab

Splattering during pouring forming solid globules is called scab as shown in figures 5.2. Redesign of pouring procedure or gating system is needed.

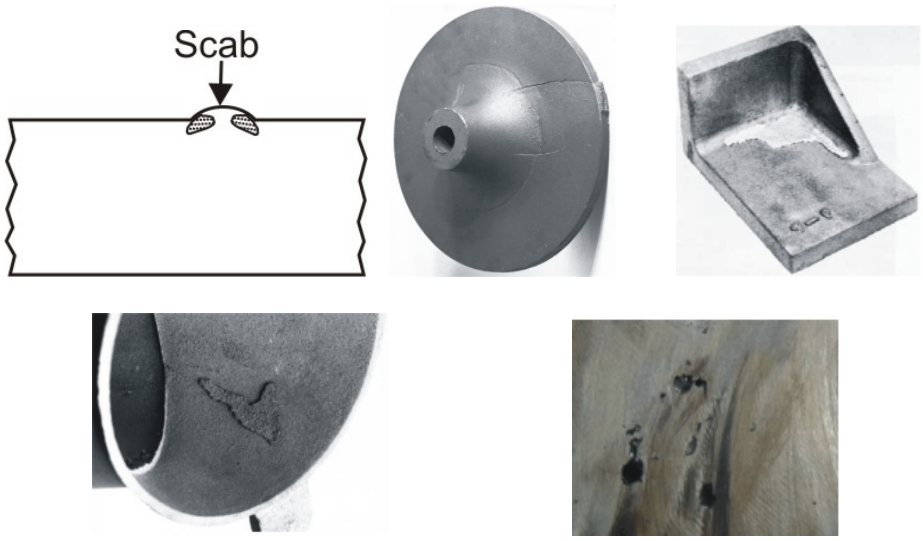

Fig. 5.2 Scab

Misruns

A misrun casting is one that remains incomplete due to the failure of metal to fill the entire mould cavity. This can happen when the section thickness of a casting is too thin or the metal temperature is too cold, so that the entire section is not filled during pouring before the metal solidifies. Thus formation of an empty space in casting as shown in figures 5.3. This defects is called a misrun.

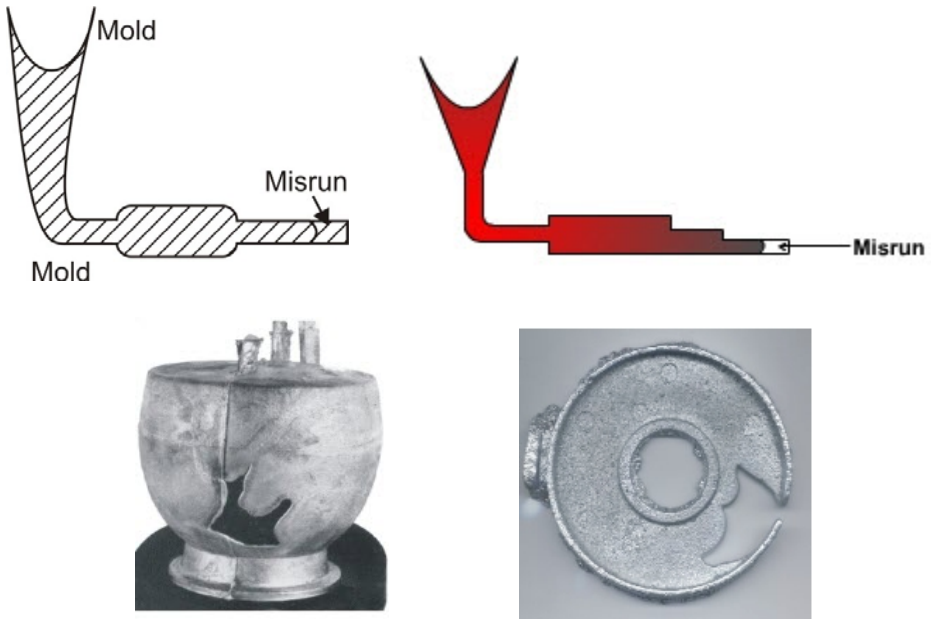

Fig. 5.3 Misrun

Cold shuts

When two streams of metal, meet in side the mould cavity and do not fuse together, the defect is known as cold shut. In cold shut, a discontinuity is formed due to the imperfect fusion of two streams of metal in the mould cavity and the defect may appear like a crack or seam with smooth rounded edges as illustrated in figures 5.4.

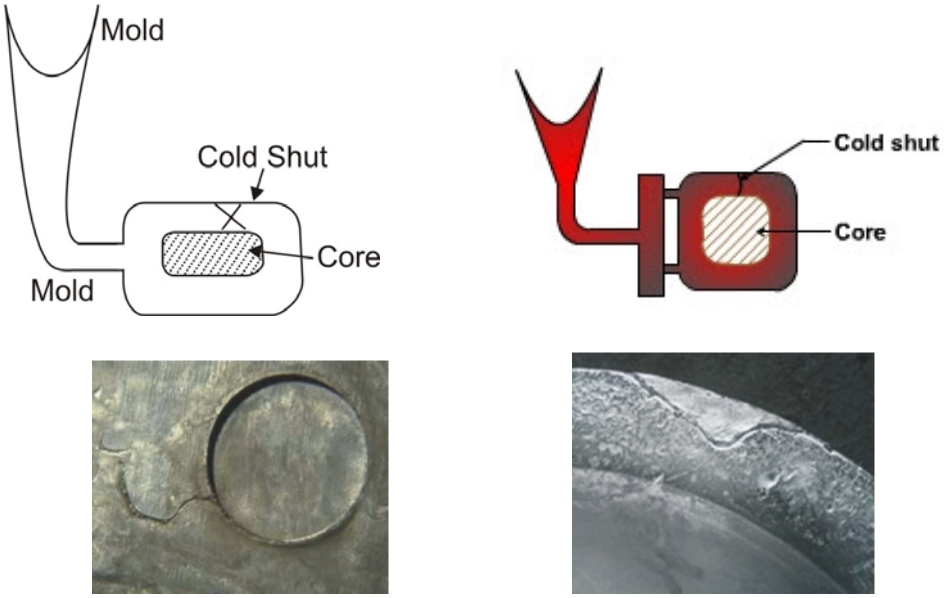

Fig. 5.4 Cold shuts

Shrinkage defects

When metals solidify, there is a volumetric shrinkage, and if adequate feeding does not compensate for the shrinkage, voids will occur inside the casting. It was discussed above and shown in figures 5.5. This defect can be prevented by adequate feeding of molten metal and designing a gating system to enable directional solidification.

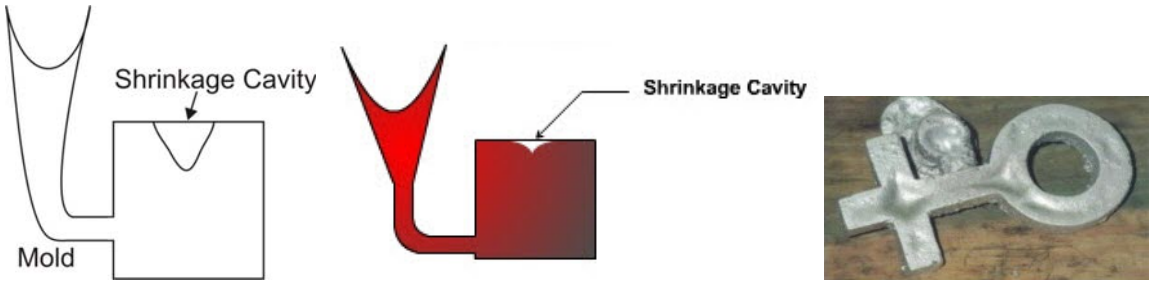

Fig. 5.5 Shrinkage defects

Microporosity

Network of small voids caused by localised solidification shrinkage. Here are caused by the freezing manner of the alloy as shown in figures 5.6.

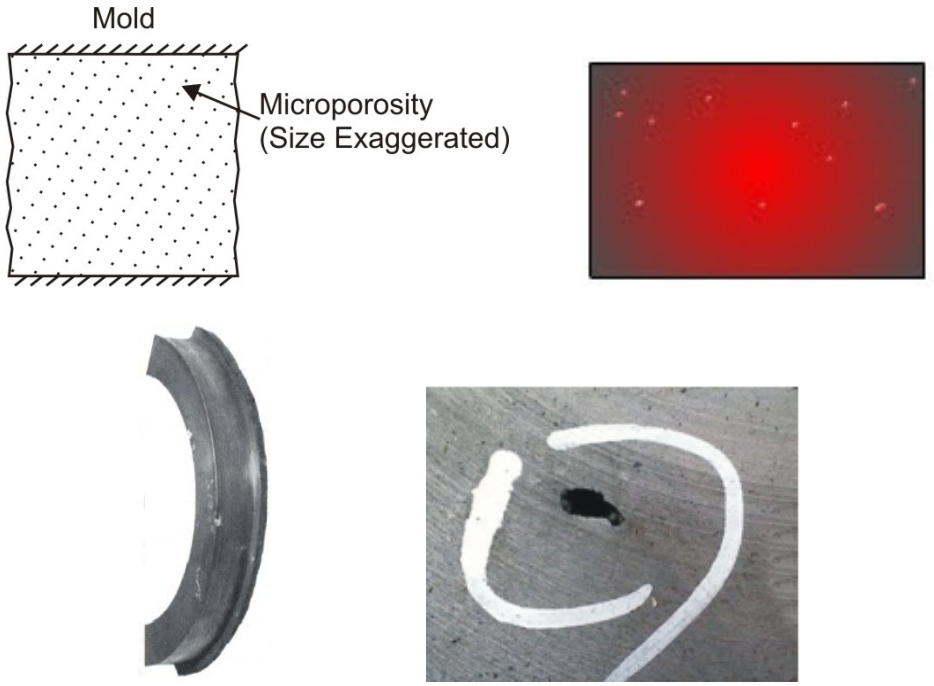

Fig. 5.6 Microporosity

Hot tears

Hot tears are internal or external cracks or discontinuities on the casting surface. Hot tearing occurs at location with high stress because the casting cannot shrink freely during cooling, owing to constraints in various portions of the moulds and cores. These are shown in figures 5.7.

Hot tears can also be due to hard ramming, too much shrinkage of metal during solidification etc. Exothermic (heat producing) compounds may be used (exothermic padding) to control cooling at critical sections to avoid hot tearing.

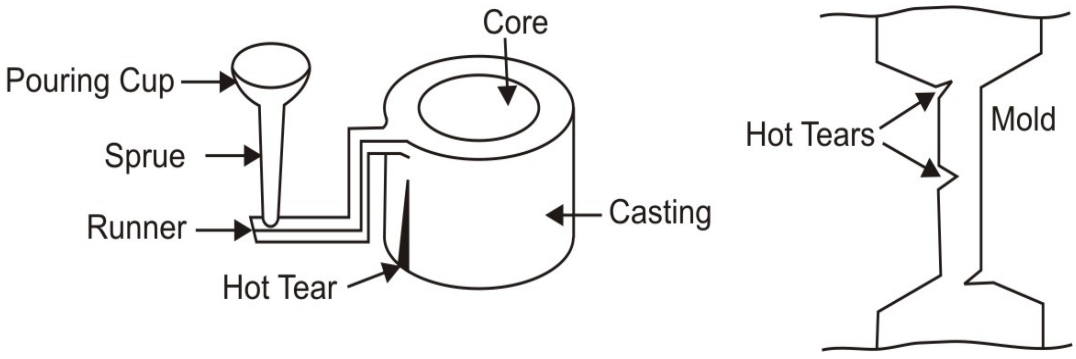

Fig. 5.7 Hot tears

Pin holes

Pin holes are small gas cavities that are formed during casting as indicated in figures 5.8.

Fig. 5.8 Pin holes

Sand wash

Erosion of sand mould during pouring is termed as sand wash and in shown in figures 5.9.

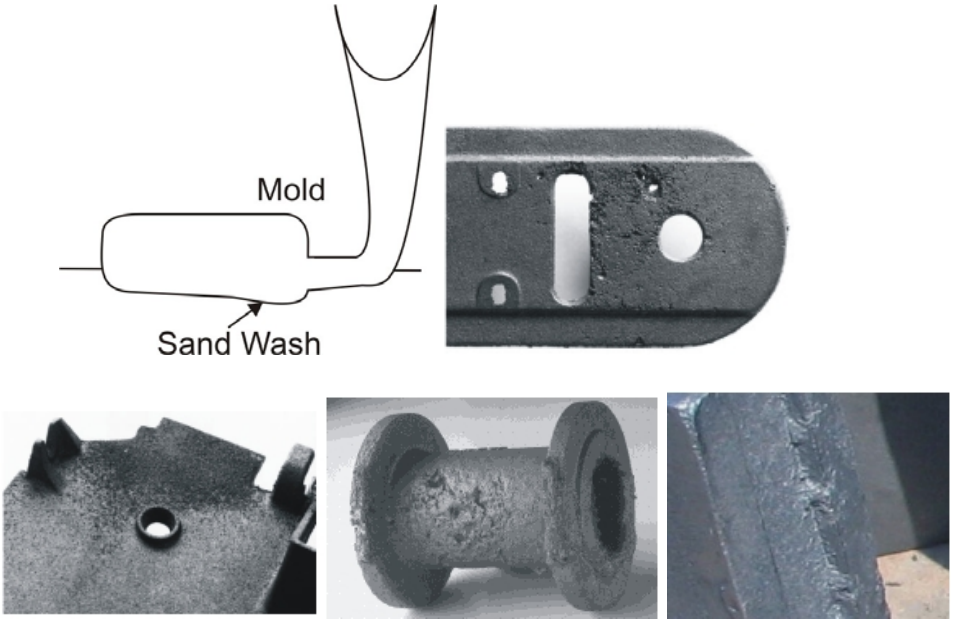

Fig. 5.9 Sand wash

Penetration

Penetration of molten metal into the sand. Harder packing of sand is needed to avoid this defect, which is illustrated in figures 5.10.

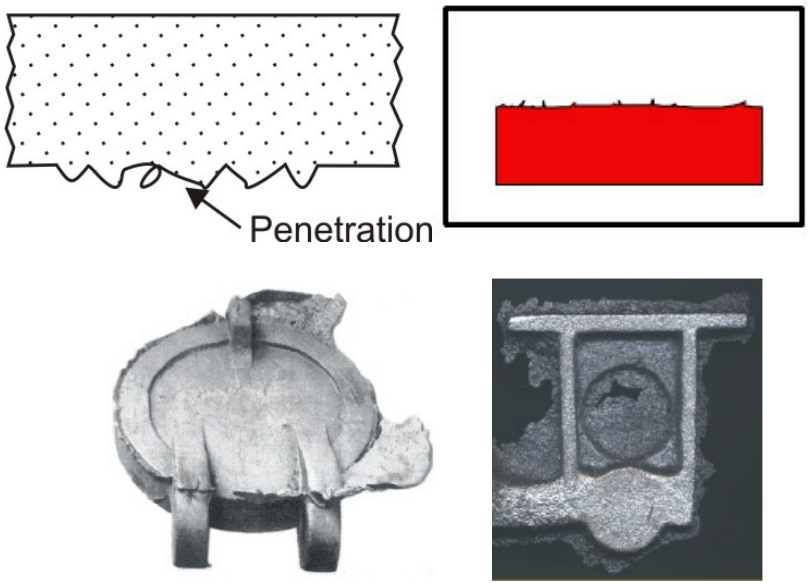

Fig. 5.10 Penetration

Mould shift

Shift of the cope relative to the drag is called mould shift as shown in figures 5.11.

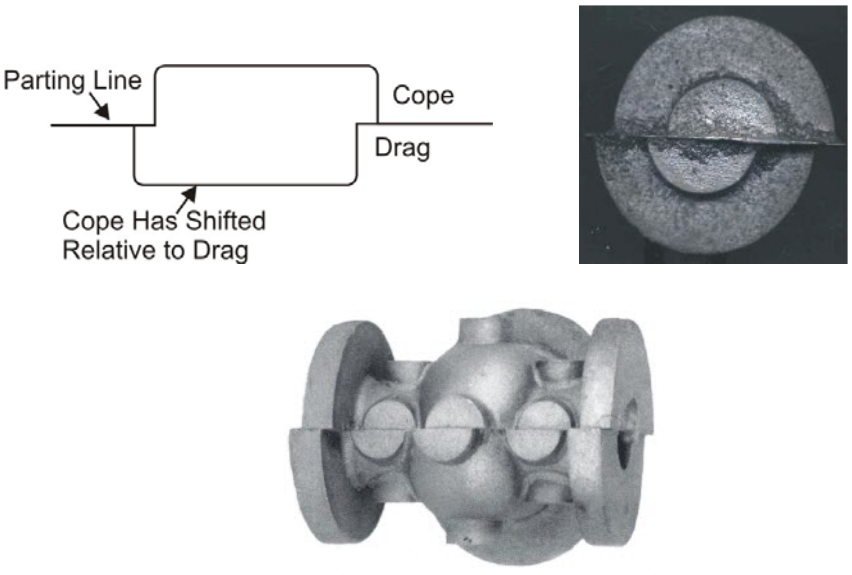

Fig. 5.11 Mould shift

Core shift

Shift of the core, usually vertical, from its intended position as illustrated in figures 5.12.

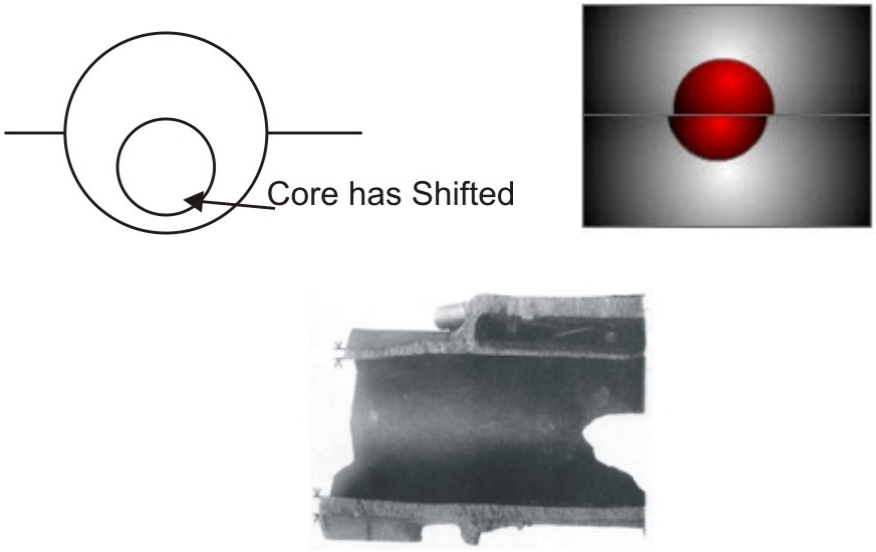

Fig. 5.12 Core shift

Mould crack

When mould strength is insufficient, liquid metal form is a fin in the final casting as shown in figure 5.13.

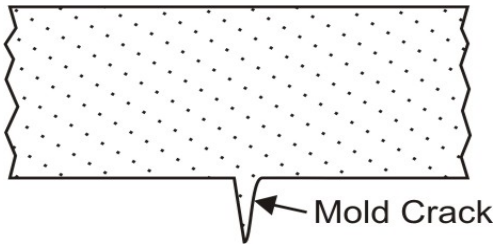

Fig. 5.13 Mould crack