Casting Defects

Casting defects, *they errors appear when a liquid material turns into a solid material during casting operations. More than 95% of casting defects occur in the products these produced by sand casting,* the most of these defects are as follows:

Shrinkage

Shrinkage of molten metal during solidifies, it is an important issue in casting. It can reduce the 5-10% volume of the cast. *To solve this problem, must design pattern and mold to compensate for this amount of volume decreasing is important. Shrinkage defect can be reduced by good design the riser and pattern and molds*.

Porosity

It is a phenomenon that occurs in materials, especially castings, as change of state from liquid to solid during the manufacturing process. Casting porosity which either effects on the surface finish or as a leak path for gases and liquids. The pouring temperature should be maintained properly to reduce porosity. *To minimize these defects of casting, can do the following; the adequate flux of metal, controlling the amount of gas-producing and materials in the molding, core making and sand mixes.*.

Hot tear

Hot tears are internal or external discontinuities or crack on the casting surface, caused by rapid contraction directly after the metal solidified. They may be produced when the casting is poorly designed and sudden sectional changes occur. Incorrect pouring temperature and improper placement of gates and risers can also create hot tears. *Method to prevent hot tears may improving the casting design, achieving directional solidification and even rate of cooling, selecting proper mold and materials to suit the cast metal, and controlling the mold hardness in relation to other components of sand.*

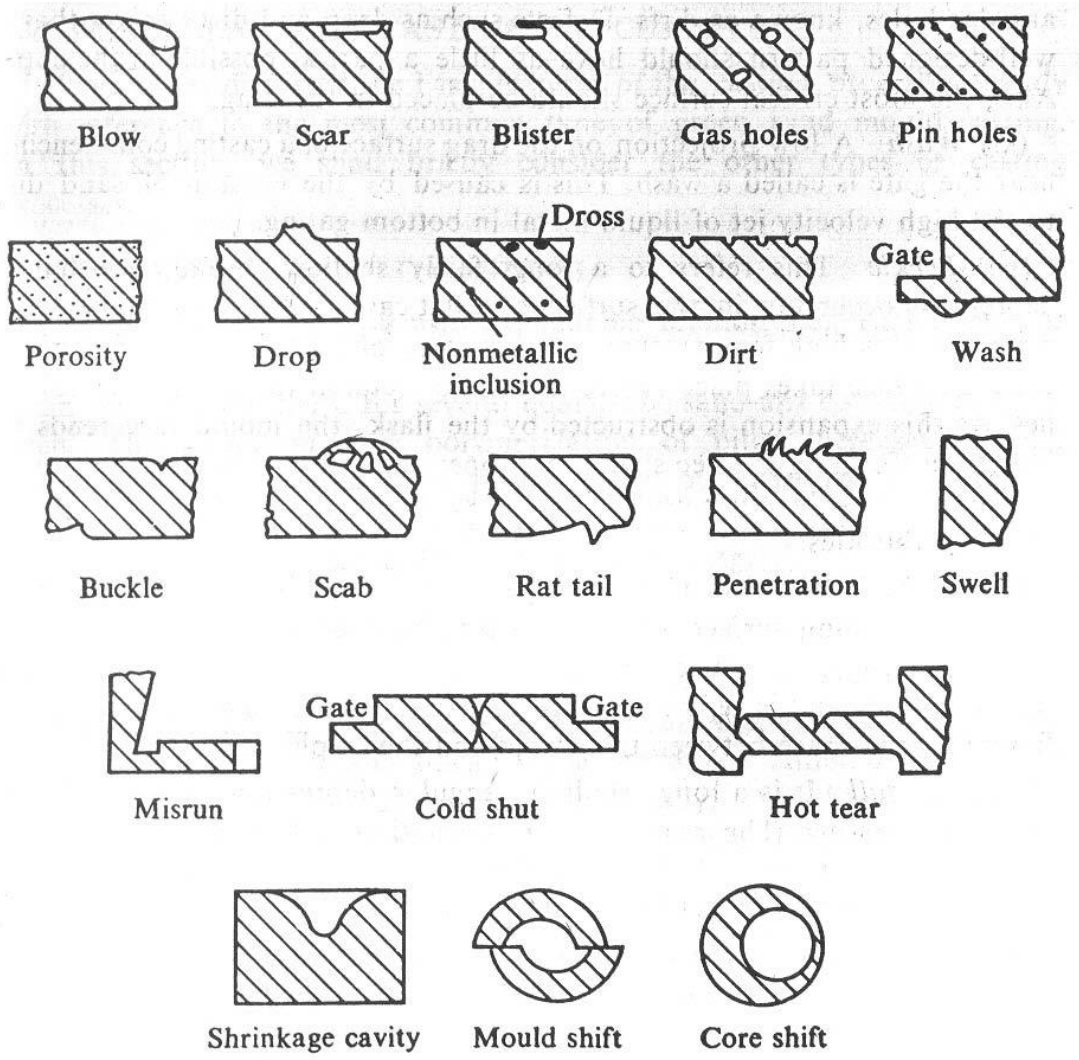

Fig.26: Schematic of various casting defects.

Blowhole

Blowholes are smooth round holes that are clearly on the surface of the casting. *To prevent blowholes, moisture content in sand must be well adjusted, proper grain size of sand should be used, ramming should not be too hard and venting should be adequate.*

Shift

A shift results in a mismatch of the sections of a casting usually as a parting line. *This defect can be prevented by ensuring proper place of the pattern for die parts, molding boxes, and checking of pattern locating pins before use.*

Warped casting

Warping is an undesirable deformation in a casting which occurs during or after solidification. Wrap edge occurs in large and flat sections especially. *Wrap edge may also be due to insufficient gating system that may not allow rapid pouring of metal or due to low green strength of the sand mold or inadequate tolerance in the pattern / mold cavity.*

Metal Penetration and Rough Surfaces

This defect appears as rough external surface of the casting. *It may be caused when the sand has too high permeability, large grain size, and low strength. Soft ramming may also cause metal penetration.*

Fin

A thin projection of metal, this not part of casting, is called a fin. Fins occur at the parting of the mold or core sections. *Molds and cores incorrectly assembled will cause the fin. Insufficient weighing of the molds or improper clamping of flasks may again produce the fin defect*.

Cold Shut

A cold shut is a defect in which a discontinuity is formed due to the imperfect fusion of two streams of metal in the mold cavity. *The reasons for cold shut may be too thin sections and wall thickness, improper gating system, damaged patterns, slow and discontinuity pouring, poor fluidity of metal caused by low pouring temperature, improper alloy composition, etc*.

Inspections of Casting

There are more method to detect the flaws or defects of casting, some of these as follows;

X-Ray Radiography

In all the foundries the flaw detection test are performed in the casting where the defects are not visible. This flaw detection test is usually performed for internal defects, surface defects etc. These tests are valuable not only in detecting, but even in locating the casting defects, that present in the interior of the casting. Radiography is one of the important flaw detection for casting. The radiation used in radiography testing is a higher energy (shorter wavelength) than of the electromagnetic waves that we see as visible light. The radiation can come from an X-ray generator or a radiation source.

Magnetic particle inspection

This test is used to detect the location of cracks that extend to the surface of iron or steel castings, which are magnetic nature. The casting is first magnetized and then iron particles are sprinkled all over the path of the magnetic field. The particles are moved in the direction of the lines of force.

Fluorescent dye-penetration test

This method is very simple and applied for all cast metals. It is applying a thin penetration oil-base dye to the surface of the casting and allowing it to stand for some time so that the oil passes into the cracks by means of capillary action. The oil is then completely wiped and cleaned from the surface. To detect the defects, the casting is painted with a coat of powdered and then viewed under ultraviolet light. The oil being fluorescent in nature, can be easily detect under this light, and thus the defects are easily detected.

Ultrasonic Testing

Ultrasonic testing used for detecting internal voids in casting is based on the principle of reflection of high frequency sound waves. If the surface under test contains some defect, the high frequency sound waves when emitted through the section of the casting, will be reflected from the surface of defect and return in a shorter period of time. The advantage this method of testing over other methods is that the defect, even if in the interior, is not only detected and located accurately, but its dimension can also be quickly measured without in any damaging or destroying the casting.