Casting Defects - Blow holes:

It is only through extensive research that it is possible to share this type of information. One needs to understand that in the age of the internet all of the information that one desires is at ones fingertips. We are truly in an information era. With this being said all of the information that is contained in this document is taken from various sources and in no way is the author of this document trying to take credit for any of the information. The Author of this document is merely trying to share information and put it in the hands of those who need it.

Defects that are up for discussion include:

1. **Blowholes:**
    a. Wet Sand
    b. Surface
    c. Sub Surface Slag Reactions holes
    d. Sub Surface
    e. Mould or core gasses (Steel Castings)
    f. Mould or core gasses
    g. Entrapped air – Steel Castings
    h. Entrapped air
    i. Chaplet

1. **Blowholes:**
    a. **Wet Sand:**

Localised patches of round or irregulars happed cavities of significant size. The walls of the casting are smooth and often coloured with oxidation tints. The two examples on the left represent:

a) 6`` Ø gunmetal flange connection.
b) Grey iron valve body casting.

Cause:
Excessive moisture in the sand

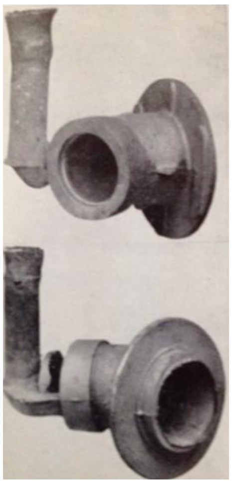
Suggested Remedy:
Reduce the moisture content or ensure even mixing. Avoid "sleeking" (being the use of a water brush) or excessive moisture when finishing the mould.

b. **Surface:**

This defect is characterised by localized areas of small cavities or pits on the surface of a casting. The example given below shows defects located on the inner diameter (the core side) of a small Phosphor-bronze casting containing 10%Sn, 0.3% P:

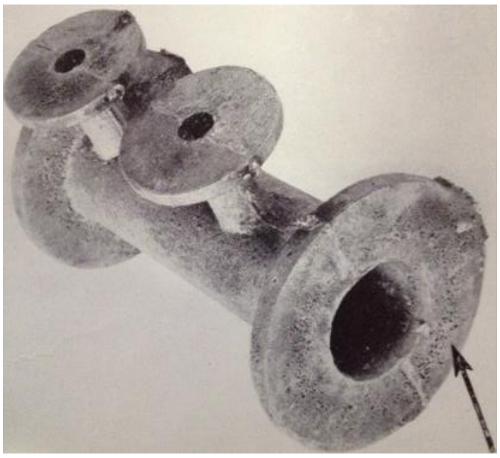
Possible Cause:

Local overheating of the mould or core surfaces



Suggested Remedy:

Avoid local overheating of mould or core sand by the utilization of proper running methods. (Illustrations below show good running method bottom with the top one being a bad running method). Use of good refractory dressing. Check the pouring temperature.



Localized areas of small cavities/pits on the surface of the casting. The picture on the left shows defects on the flange of a 4`` bore branch pipe in Ni-Cr Iron alloy cast in dry sand. This defect usually occurs on heavier sections of castings which solidify at a slower rate than the thinner sections. Rule of thumb suggests that it is most commonly experience on castings ½`` and over. Stainless and other high alloyed steels are susceptible to this defect.

Possible Cause:

Reactions between the molten metal and the water vapour in the mould or mould dressing is the most likely culprit contributing to this type of defect.

Suggested Remedy:

Use a mould dressing that will not evolve water vapour when heated. Mould dressings bonded with such materials such as ethyl silicate provide satisfactory results. Defects may also be minimized by the use of permeable well dried moulds made from either oil bonded sand or synthetic sand containing a minimum amount of clay bond. Avoid local overheating of the mould or core sand by proper methods of running.

The above picture is a. enlargement of the above picture of which the area expressed is indicated by the arrow.

c. Sub Surface Slag Reactions holes:

This type of blow hole is unique in appearance as it consists of small holes with rounded or irregular shapes which may at times contain shot/grit at or just below the casting surface. These blowholes mainly occur particularly on top surfaces and below cores. They may be revealed on cleaning or after machining. These holes have discoloured surfaces which are often associated with slag inclusions and sand grains.

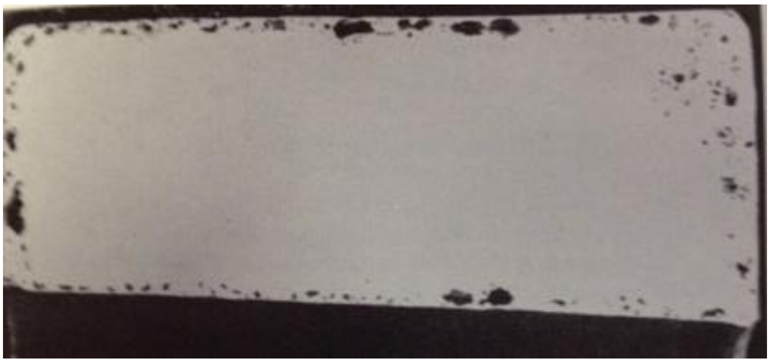
<u>Possible Cause:</u>

Fluid containing slag and manganese oxides entering the mould could react with the metal. High manganese content and high sulphur contents coupled with low pouring temperatures favour this kind of defect.

<u>Suggested Remedy:</u>

Avoid very fluid slags formed by oxidation of the metal in the ladle, or coming from low melting point refractories such as botting clays. Skim the metal thoroughly, use strainer cores, slag traps and good gating practices. Keep the runners full of metal. Reduce the manganese content to a level just adequate to balance the sulphur content (Mn = 1.7 x S% + 0.3), reduce the sulphur content and raise the pouring temperature.

d. Sub Surface:



Small cavities adjacent to the surface of the casting (and usually on all surfaces of the casting). In many cases the surface of the casting appears to be normal (which makes this a difficult defect to identify in the as cast condition. In some cases however, surface pitting may be present as illustrated below:

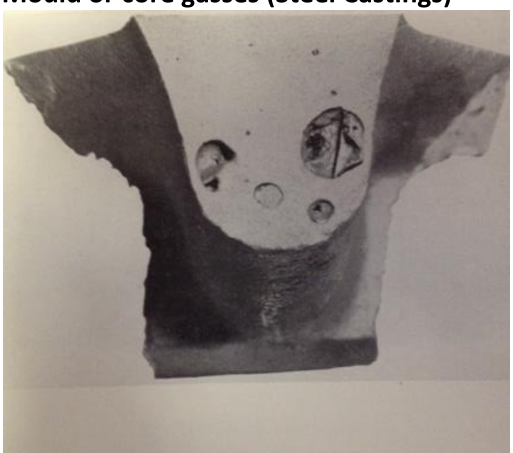
Possible Cause:

This type of defect is caused by a reaction of the molten metal with the moisture in the moulding sand. This is mostly associated (but not always) with high pouring temperatures and is encouraged by insufficient de-oxidation, insufficient permeability in the sand and insufficient ventilation

Suggested Remedy:

Reduce the volatile contend in the mould cores and dressing. Ensure that the material is sufficiently de-oxidized. Increase the level of ventilation and increase the permeability of the sand. Reduce the pouring temperature if possible.

e. Mould or core gasses (Steel Castings)



BLOWHOLES (*Moulds or Core Gases—Steel Casting*).

Round shaped holes with bright smooth walls which normally present themselves once the casting is sectioned as shown above. In some cases where blowholes has appeared from concentrated pellets of other materials such as clay in the mould, the defect may migrate to the surface of the casting.

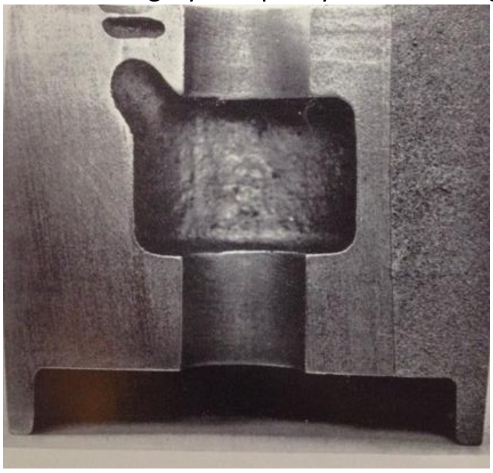
Possible Causes:

Significant/excessive evolution of gases from the mould or core sand together with low permeability and insufficient venting of the mould or core. It may also be the result of improperly mixed mould and core sand.

Suggested Remedy:
Make sure that the sand is properly mixed and milled and that the materials (i.e. bonding) are dispersed uniformly throughout the mix. Ensure that the cores are dry and properly baked. Make use of less organic binders or additions and increase the permeability/ventilation of the sand/mould.

f. Mould or core gasses

This defect appears with smooth walls and a round orientation. The source of the issue is often difficult to identify unless the casting is sectioned. The picture below is a 100mm Ø grey cast pulley wheel casting showing blowholes from the core.

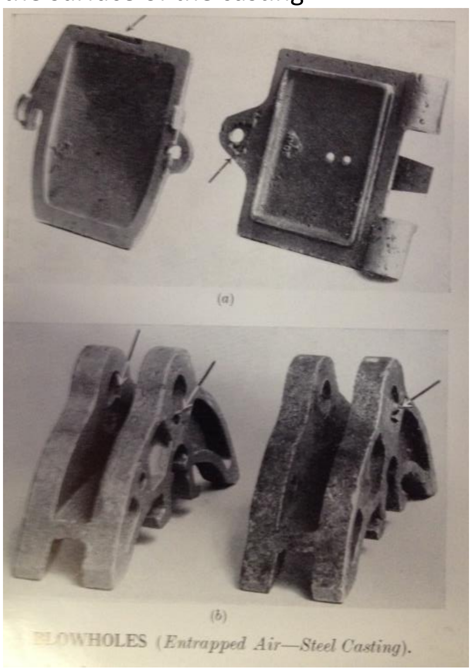


Possible Cause:
Excessive gas build up from the moulding or core sand coupled with insufficient permeability or venting. Mat also be a result of metal entering the core vents.

Suggested remedy:
Use less oil binder. Ensure that the cores are sufficiently dry and properly baked. Increase the permeability of the sand and ensure that the mould and cores are properly vented. Ensure that the sand is properly mixed and free of local contractions of core binder, coal dust, etc

g. Entrapped air – Steel Castings:

These blowholes appear to be round with smooth out walls found on or just under the surface of the casting



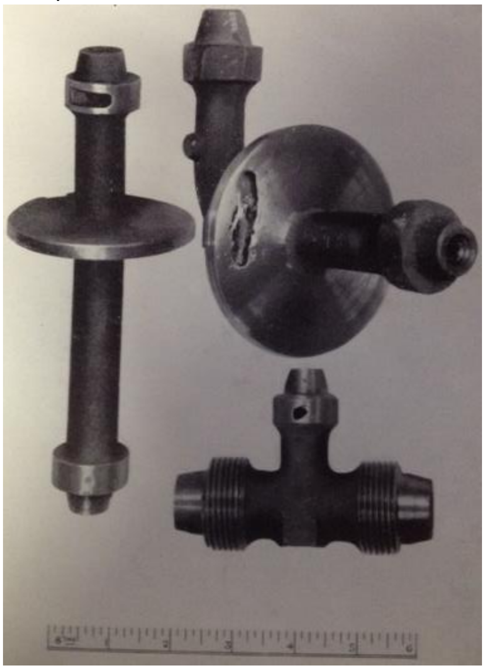
BLOWHOLES (*Entrapped Air—Steel Casting*).

Both of the pictures (a) and (b) are small castings with wall thicknesses ranging from 6 – 19mm in cross section. Both items were cast in green sand.

Possible Cause:
Entrapped air

Suggested Remedy:
Increase the permeability of the sand as well as the venting of the mould. Try and avoid fast and turbulent metal flow into the mould.

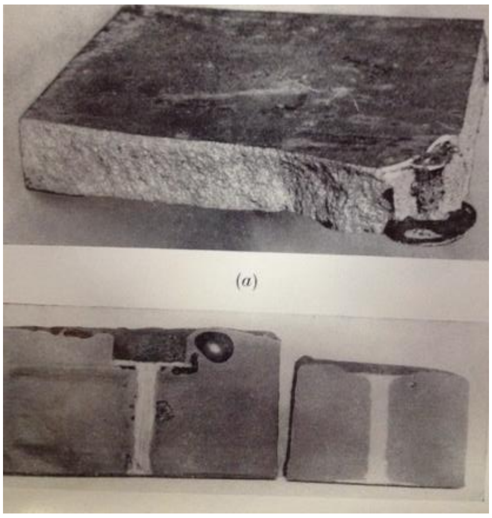
h. Entrapped air:
Elongated cavities of appreciable size consisting of smooth walls located on or just below the surface of the casting located near the highest part of the cast component.



Possible Cause:
Entrapped air

Suggested Remedy:
Make use of a vent in the affected area. Wire may be used to increase the permeability of the sand should the surface finish of the product allow for it. Check the degree of ramming or mould hardness at the affected areas.

i. Chaplet:
Smooth-walled cavities adjacent to Chaplets which are round or elongated in appearance. This defect is more often than not associated with issues associated to the fusion of the chaplet with the casting and may cause leakage when exposed to pressure.
Picture (a) and (b) show blowholes and imperfect fusion of the chaplet in a grey cast iron. (c) shows good fusion of chaplet with metal.



(a)

Possible Causes:
Rusty, Dirty, Damp or improperly coated Chaplets

Suggested Remedy:
Make sure that the Chaplets are clean, dry and free of contamination. Bright iron steel chaplets are deemed to be satisfactory when used immediately. However they may cause blowing if allowed to stand in the mould (long enough for rust to develop. The use of Tin-coated or Copper coated chaplets is recommended to avoid this issue. Zinc or alloys containing Zinc are problematic for chaplets as they will also cause “blowing”

Reference materials:
Atlas of Defects in Castings – Institure of Brittish Foundrymen
Various Internet sources