

Common Metal Casting Defects

Introducing various metal casting defects with many pictures by Dandong Foundry in China. These are the common sand casting defects on the surface and inside of cast iron and cast steel parts.

1. Blowhole and Pinhole

This is a kind of cavities defect, which is also divided into pinhole and subsurface blowhole. Pinhole is very tiny hole, some could be seen on the surface. Subsurface blowhole only can be seen after machining or grinding. The most of subsurface blowholes could be found after machining or grinding. If the surface is flat, our foundry could inspect them by ultrasonic flaw detector.



Pinhole Defect

2. Sand Burning Defect

This defect includes chemical burn-on, and metal penetration. Normally, you could see extra metal materials at the corner positions. This is caused by the poor sand. The metal has penetrated into sand molds.



Sand Burning Defect

3. Sand Inclusion and Slag Inclusion

These defects are also called as scab or blacking scab. They are inclusion defects. Looks like there are slag inside of metal castings.



Sand Inclusion Defect

4. Sand Hole Defect

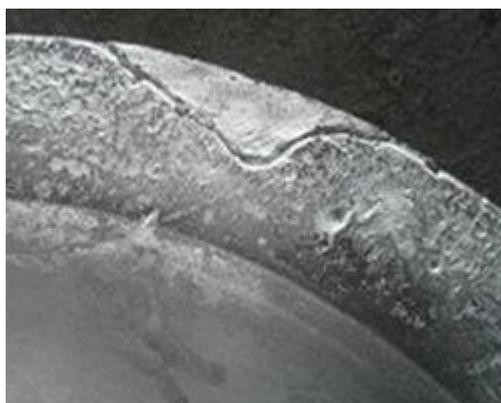
Sand hole is a type of typical shrinkage cavity defect. You could see the empty holes after sand blasting or machining process. The sand dropped from sand molds, rolling into the liquid metal, then caused sand holes. It is the problem of sand mold, or the flow speed of the metal is too high, so could be solved by foundries.



sand hole defect

5. Cold lap Defect

It is also called as cold shut. It is a crack with round edges. Cold lap is because of low melting temperature or poor gating system. This is not just surface defect. Normally, this position may cause air leakage, moreover, the material quality at this position will be very poor, so may be fragile.



Cold Lap Defect

6. Flash, Fin and Burrs

Joint flash is also called as casting fin, which is a thin projection out of surface of metal castings. Joint flash should be removed during cleaning and grinding process.

Sharp fins and burrs are similar problems as the flash. Actually, large flash is a casting problem, the foundry should improve it by modifying the patterns, but small fins and burrs are not casting defects, foundries just need to grind and remove them.



Flash, Fin and Burr

7. Misrun defect

This is a kind of incomplete casting defect, which causes the casting uncompleted. The edge of defect is round and smooth.



Misrun Defect

8. Porosity Shrinkage Defect

Shrinkage defects include dispersed shrinkage, micro-shrinkage and porosity. For large porosity on the surface, you could see them easily, but for small dispersed shrinkage, you may see them after machining. The following photo is showing the porosity shrinkage. The metal density is very poor, many small holes could be seen after machining.



Porosity Shrinkage Defect

9. Shrinkage Cavity Defect

These are also called as shrinkage holes, which is a type of serious shrinkage defect, you can see these holes easily on the rough surface of the metal castings. Foundries could improve their gating and venting system, then could solve these shrinkage problems.



Shrinkage Cavity Defect

10. Shrinkage Depression

This defect is also a type of shrinkage defect, which looks like depressed region on the surface of metal castings. This defect is not serious as shrinkage cavity, but still cause poor surface quality and may have some inside defects, so foundries should try their best to solve or improve it.



Shrinkage Depression Defect

11. Elephant Skin Defect

It is a type of surface defect, which cause irregular or wrinkle shapes surfaces. This defect is caused by the poor metal temperature melted, or poor sand molds.



Elephant Skin Defect

12. Veins Defect

It is also called as rat tail, which looks like many small water flow traces on the surface of metal castings. Sometimes, it is because of the low metal temperature melted, or unreasonable gating and venting system.



Veins Defect

13. Rough Surface

Coarse surface is also a kind of surface defect. Normal rough surfaces can not be judged as defects, but too rough and uneven in surface will be a defect.



Rough Surface Defect

14. Mismatch and Shift Defect

This mold defect is because of the shifting molding flashes. It will cause the dislocation at the parting line. Near the parting line, the left side may be several millimeters lower or higher than another side. The parting line is not defect, but if the left side has different height as the right side, it will be one casting defect. If there is no special requirement, mismatch smaller than 1mm is allowable. No any mismatch is impossible for sand casting process.

However, if the mismatch has affected the function of the castings, then the foundries have to control it, grind it or machine it to meet the requirement.



Mismatch Mold Defect

15. Mechanical Damage

This is not casting defect, but it is a real casting quality problem you may meet. It is the damage during machining or delivery processes. The workers should pay more attention to this problem.



Mechanical Damage Defect

16. Slag Inclusion Defect

This defect is also called as exogenous inclusion, entrapped slag. Normally, the slag is from melted metal. During metal melting process, foundries should remove the dirt and inclusion completely, otherwise, these inclusions will be poured into the castings.



Slag Inclusion Defect

17. Raised Mold Defect

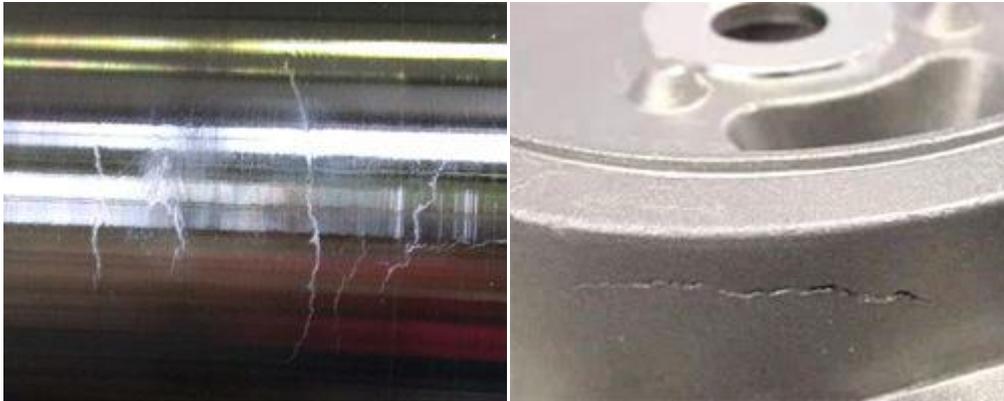
Because of the float of liquid metal, the mould flasks are raised, which caused the top part of casting become higher or thicker than lower part.



Raised Mold Defect

18. Crack Defect

Crack defect normally happens inside of metal castings. This defect will reduce the physical properties of metal castings. There are some crack on the surface too.

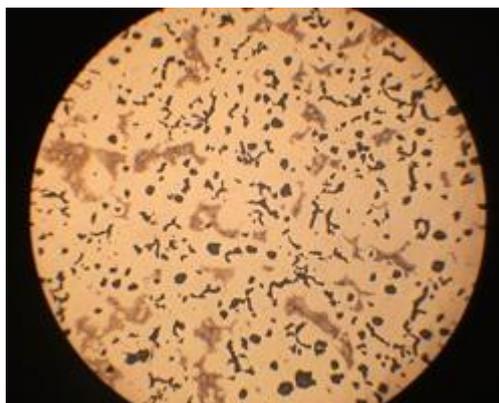


Crack Defect

19. Abnormal Nodulizing Defect

This is also called as under-nodulizing defect. Because of many reasons, the spheroidization of graphite for ductile iron will be affected, therefore, caused the bad spheroidization rate. By metalloscope, you can see very few graphite balls, and many worm-like graphite.

This is a material problem. If so, its mechanical properties will not meet the requirement of standard, so may cause casting products broken in service. Our Dandong Foundry has attached great importance to the inspection of spheroidization rate.



Abnormal Nodulizing Defect

20. Uneven Hardness Defect

It means the uneven hardness on the same surfaces. The hardness is not uniform, some positions may have extra high hardness. When machining to harder positions, the machining will become more difficult. The drill bit may be broken.

This is the material problem. The position with extra high hardness may become cold more quickly than local areas.



Uneven Hardness Defect

21. Sand Drop Defect

It is also called as sand crush. Some sand blocks dropped from the sand mold, so they will cause the similar shaped sand holes or incomplete. This is the problem of sand molds. The sand molds may not be tight enough.



Sand Drop Defect

22. Deformation Problem

This problem will cause the oversized tolerance for flatness and straightness. This is very common defect for long castings, and flat castings with thin wall thickness. The reasons are the natural deformation during cooling process in sand molds, or in air, sometimes, the overly sand blasting also could cause this problem.



Deformation Problem

23. Welding Repair Problem

After welding repair, even after machining or grinding, the welding marks will still be visual. As for unimportant casting surfaces, if the client allow welding repair, then these marks should be acceptable. But for high pressure-bearing positions, or the client has clearly forbidden any welding repair, then these marks will be taken as defects.



Welding Repair Marks

24. Chill Iron Marks

Chill iron could effectively reduce the shrinkage for the key positions, so using chill iron is very common in iron foundries. However, the edges of chill irons could be clearly found by visual inspection. Some clients will not require to grind them if these marks do not affect the appearance. However, the clients could require the casting manufacturer to grind them just for better surface looking. Please clearly notice that these marks should not be judged as the casting defects. Refer to iron-foundry.com.



Chill Iron Marks

25. Casting Chilling Defect

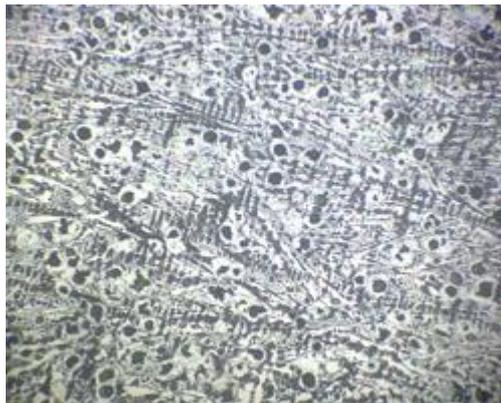
It is also called as "white iron". The surface of the castings with this defect will be extremely white, shiny and smooth. The defective castings will be fragile and crispy, so during machining, some edges and tips will be broken. This defect was caused by the low temperature of sand molds, and prematurely out of sand molds, so the hot iron become chilled quickly. The proper annealing heat treatment to them could solve this defect.



Casting Chilling Defects

26. Massive Free Carbide

On metallograph photo, you could see many fish-bone free carbide. This is a serious defect of cast iron material, normally happen to ductile iron. Because of inverse chilling defects and poor inoculation, there will be mass free carbide, which will cause fragile, poor welding property to ductile iron castings. High temperature annealing heat treatment could improve its quality.



Massive free carbide

27. Cold Short or Short Iron

This defect is also called as internal sweating. There are iron beans in the castings. This is because of unreasonable gating design, which caused some liquid iron became beans suddenly, then these beans were wrapped by other liquid irons. This is a surface defect, but will cause serious problem if they located in key positions.



cold short, short iron

28. Stripping Defect

There is very thin iron skin on the surface of castings. Two layers. This is because of unreasonable gating system, which caused very thin air layers existed. This defect is a surface defect, so normally it can be grinded off. However, it should be discarded if it is not just on the surface.



Stripping defect

29. Cast Iron Graphite Floatation

This defect is a kind of material problem. It is caused because of low pouring temperature and high content of carbon element. This defect is very harmful, will cause material very fragile. On the broken surface, you can see the obvious black surface caused by this defect.



Cast iron graphite floatation