

Study and Analysis of Casting Defects in Foundry

¹Prof A.Peramanan, ²N.Logesh, ³R.Jayakumar, ⁴M.Gunasekar, ⁵P.Kalaiprakash.

Dept. of Mechanical Engineering, Jay Shriram Group of Institutions, Tiruppur, Tamilnadu, India.

ABSTRACT: In developing country, foundry industries suffer from poor quality and productivity due to involvement of number of process parameters in casting process, which challenges explanation about the cause of casting defects. In order to identify the casting defects and problem related to casting, the objective of the paper is study and analysis of the casting defects in foundry. In this paper, an attempt has made to list different types of casting defects and their root causes of occurrence and hence to provide correct suggestion to quality control department for rectifying the casting defects.

KEYWORDS: sand casting; defects in casting ; causes and control of defects.

I. INTRODUCTION

Casting is an ancient metal heating process in the years of 3500B.C. It is the process of melting a metal into molten state and allow them to solidify in an atmospheric condition. Sand casting process is expressed over 90% in casting production of parts. It is also called sand molded casting and it is mainly characterized by using sand as mold material. India has now emerged as the third largest casting producer (9.34 million tons) only after China (42.5 million tons) and USA (12.8 million tons). Of the various casting processes sand casting accounts for 90% of total casting production.

Globally, 46% of iron castings produced are in gray iron, compared to 25% produced in ductile iron. Gray iron (the calculation includes malleable iron) continues to be the largest contributing material to global production, at 46 million of the 100.8- million-ton total. (MCS,2013) Of the various casting processes sand casting accounts for 90% of total casting production. Even though casting is a well established casting process still defects in typical casting ranges from 5-10%. These defects require careful selection of process parameters and slight variations in these parameters can cause increase in these defects.

Casting defects may be defined as the irregularity or imperfection in the sand casting products. Defects in casting must be corrected or replaced according to their tolerances, imperfections and discontinuity.

II. MOST COMMON DEFECTS FOUND IN FOUNDRY

In this paper presentation, the common casting defects are as follows: ineffective mould filling, porosity, shrinkage, cold shuts, hard spots, die soldering and deformation with porosities and cold shuts being the most common. The causes of casting defect can be summarized as follows:

- ❖ The shape and design of the casting
- ❖ Performance and parameters of the diecast machine
- ❖ Feed system design
- ❖ Operation of diecast machine

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❖ Diecasting alloys

During the process of diecasting, there is always a chance where defects will occur. Minor defects can be adjusted easily but high reject rates could lead to significant changes at a high cost.

Therefore it is essential for diecasters to have knowledge on the types of defects and be able to identify the exact root cause, hence eliminate further losses.

There are many casting defects found in the foundries according to their sources of casting methods. It may be classified into shape, filling, thermal and appearance. The most common defects in foundry are:

- i. Filling related defects
 - Blowhole
 - Sand dropping
 - Cold shut
- ii. Metallurgical defect
 - Sand fusion
- iii. Thermal related defect
 - Hot tear or cracks

i. Filling related defects

These defects can be mainly occurring in the melting section of foundries by various reasons.

Blow holes: It is a cavity defect, will be prevalent cause casting scrap. It can be smooth walled cavities, essentially spherical, and not contacting the external casting surface. There are two types of blowhole are pinhole and subsurface blow holes. Pin hole is seen to be tiny hole and subsurface blow hole is seen after machining. Gases will be entrapped from the solidifying metal on the casting surface, which examined as a oval or rounded blow holes cavities.

Surface blows or inter granular cavities appear in cope of the mould. Pinholes result when the hydrogen present in liquid metal evolves due to less solubility during solidification resulting in triangular appearances, prevalent mostly in thinner castings which are revealed after machining.

Causes of blow holes:

- Lack of core venting
 - Sudden release of gases from the core
 - Sudden moisture absorption by the cores
 - Permeability of low gas in sand cores

Control measurement for blow holes:

- Provide core vent channels and improvement in core vents
- Free dressing of core prints should be ensured
- Slow reacting binder can be used
- Use coarser sand to improve quantity of sand

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Sand dropping: Metal penetration and chemical drop on are including the sand dropping. It may occurring in the section of sand shop, a greater extent in the thick walled casting at high temperatures. Sintering of bentonite and silicate components can be caused by high temperature of the sand.

Causes of sand dropping

- Too low of lustrous carbon content
- Too high proportion of low melting point substances
- Mold compaction gating and pouring practice is uneven
- Distribution of inflowing metal with required heating is uneven
- Too high of liquid metal temperature

Control measurement for sand dropping

- Lustrous carbon producer should be increased
- Pouring rate should be reduced
- Metal flow incoming would be even out
- Amount of coke increases which results in the positive separation between mould and metal
- Use pure silica sand or new sand reduce dust content

Cold shut: It is also called cold lap, a crack with round edges. It occurs because of poor gating system and low melting point temperature. When two metal streams do not fuse properly is denoted as cold shut or lap.

Causes of cold shut

- Molten metal has lack of fluidity
- Design is faulting
- Gating is faulting

Control measurement for cold shut

- Proper pouring temperature is maintained
- Design should be modified
- Gating should be modified

ii. Metallurgical defect

This defect consists of internal stresses, improper alloy composition, melting temperature and mechanical properties.

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Sand fusion: It is a surface defect having a rough glassy appearance due to sand fused to the surface of casting. This defect is commonly confused with penetration.

- Proper time of cooling of metal should be given
- Pouring temperature should be reduced
- Feeders should be provided

Causes of sand fusion

- Lack of refractoriness of sand
- Too high molten metal temperature
- Faulting gating system
- Poor facing sand
- Too low of fusing point
- Insufficient coating

Control measurement for sand fusion

- High refractoriness
- Improvement in gating system
- Adequate control over pouring temperature of molten metal
- Choice of bentonite mixture should be properly used

iii. Thermal defect

This defect has a thermal expansion and heat occurrence could be analyzed in the casting of a metal products.

Hot tear or cracks: It appears only in die casting metal products .some of the tears or cracks could be obvious and may be visible to see in a naked eye. Others will be seen by magnification. It appears to be due to pressure of thermal stress in the thermal origin, incorrect heat removal rates and improper interaction fluids.

Causes of hot tear or cracks

- Lack of adequate fillets
- Lack of sufficient feeders to promote more uniform cooling
- Particular area may be more stress localized
- Thermal concentration is high
- Injection forces is excessive
- Die section have insufficient draft
- Die casting have shrinkages

Control measurements for hot tear or cracks

- Casting should be proper designed
- Use of chillers in casting area

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- Create round off corners and avoid sharp

corners

- By adding saw or cold dust will reduce die strength

III. CONCLUSION

The above casting defects are mostly occurred in foundry, that we are analyzing their causes and provide control measurements are suggested. This paper will highly useful for producing good quality of casting products and reduce their casting defects. Foundry professionals have a chance of improving the yield of casting.

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