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Reduction of Blow Holes Defects in Foundry

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ABSTRACT

This paper presents a study of defects in casting. Foundry industries suffer from poor quality and productivity cast product due to casting defects. It is very difficult to produce castings without any defects. Defects in casting are observed. In order to identify the problem related to casting the study is aimed in the research work. This will help to enhance the yield of casting. In this paper a attempt has been made to list cause and their possible remedies of the casting defects majorly due to blow holes as seen in C.P. FOPUNDRY.

Keywords : Metal Casting, Casting Defects, Blow Holes, Foundry Defects.

I. INTRODUCTION

Casting is the economical manufacturing process used in industries. Which involves considerable metallurgical and mechanical aspects. It is a complicated production process which carries risk of failures occurrence during all the process of accomplishment of the finished products. Hence, it is needed to take action while manufacturing the casting so that defect is less in cast product.

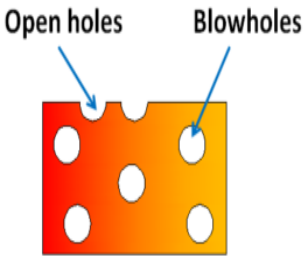
For the research work we have visited C.P. Foundry. And found various defects occurring in cast products like blow holes, shrinkage, sand drop, poor dimensional accuracy and surface finish. But the defects which are causing major rejection is blowhole due to which the productivity of the foundry was decreasing and they were facing financial loss as the castings were being rejected by Clint.

The defects occurring in the cast products are because of the process parameter, sand quality, moulding process etc. to overcome the defects, in this paper we will suggest changes like proses parameters sand quality, sand grain, mould design or gating system respectively.

Different types of blowholes defects are as follows:-

1.1.1 Blow Holes:-

Blow holes are entrapped bubbles of air/steam/gas and beneath (under) the surface of the casting. The casting material that is cast iron contains carbon, this carbon reacts with slag and produces and liberates CO. this gas gets entrapped in the mould, due to this blow holes are produced

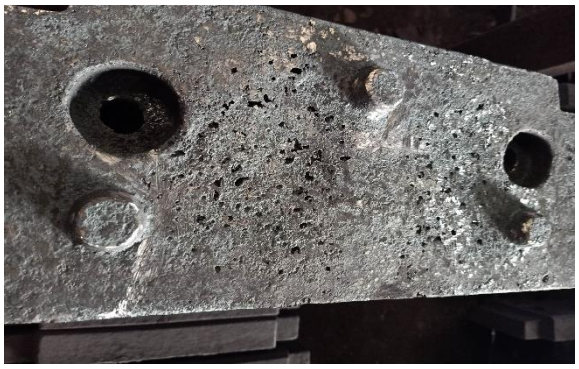


1.1.2 Open blows :

Open blows are the types of blow holes which is causess by entrapped gasses on the surface of mould are have smooth surface.

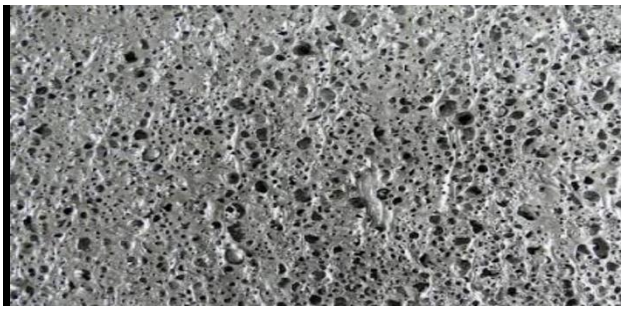
1.1.3 Pin holes:

Pin holes are the types of blow holes which are very tiny holes on the surface of cast product. These are caused because the exhaust gasses can not escape the mould cavity because of a high cohesiveness, improper venting, etc.



1.1.4 Porosity:

Porosity is caused due to the absorption of gases like hydrogen, oxygen or nitrogen in the molten metal pool which is then released on solidification to become trapped in the solodified metal. This defect caused because of very high pouring temperature.



1.2 Causes of Blow Hole defect

The various causes of blow-holes defects are as follows:

- Improper Venting.
- Hard Ramming.
- Fine Grain Size of Moulding Sand.
- Very High Pouring Temperature of Molten Metal.
- High Moisture Content in Moulding Sand.
- Low Permeability of Moulding Sand.
- Excessive Use of Organic Binder.
- Improperly Backed Cores.

II. METHODOLOGY

The various test performed to find the properties of moulding sand like moisture content, green compression, grain size and permeability.

2.1 Moisture content test:

The water content affects every property of grain moulding sand, with the exception of grain fineness number of base sand. Excess water produces an oxidising atmosphere in the mould, excess gas evolution, lower permeability, high dry and hot strength, low mould hardness, excessive steam generation and poor flow ability. The moisture content of green sand must be maintained within a narrow range

Procedure:-

The percent moisture is determined by completely drying a given amount of sand (100g). The sand and the drying container area weighed before and after drying. The weight loss is doubled to arise at the percent moisture. The amount of moisture content present in the given sample is found to 8% which is not ideal.

For effective casting it is suggested that the moisture content should be 3% to 4%.

2.2 Permeability test:

The permeability is an important property of mould, which hep in escaping of evolved gases away from the mould. The mould material should be porous enough so as to allow the gases to escape freely.

Process: -

First keep the lever on the right of the equipment on d position and ensuring D positon, lift the air-drum till "0" marking. Also ensure that, water level in manometer on the test of the equipment is a zero (0). Keep holding the drum and rotate the lever to "0" position, this will hold the drum in place. Fix the tube with permeability testing specimen on the Rubber Boss firmly then rotate the lever to "p" position. The water in the manometer has risen to 6.3 cm level eyesight with the water and observe lower meniscus. Look up the chart on the equipment, depending upon the orifice that we have chosen (1.5 mm being large and 0.5 mm being small). The reading in the last column to be "300" permeability. Now move the lever to "D" position that shall lower the air drum, remove the specimen tube and clean the equipment. So the permeability of given sample has found to be"300".

2.3 Green compression test:

Green compression has been most widely used as control tool to measure the rate of clay addition to a sand moulding. Clay content, compatibility range and types of additives have significant effect on green compression. The compression reading should be read at comparable compatibility range. Moulding sand at higher or lower compatibility will produce varying green compression strength.

Procedure:-

The green compressive strength of the moulding sand is the maximum compressive stress of the sand. When prepared, rammed and broken under standard conditions. The rammed cylindrical specimen (2 in. diameter and 2 in. long) which is formed by placing a weighed amount of sand in a tube and ramming the sand three times. The instrument used to brake the specimen must continuously register the increasing load until the specimen fractures. The green compressive strength is found to be 250 N/mm2..

2.4 Grain size test:

AFS clay indicates the amount of fineness and water-absorbing material in the sample of sand. AFS Clay may contain active clay, dead clay, silt, sea coal, cellulose, cereal, ash, fines and all materials that float in water.

Procedure:-

A known amount of moulding sand which is first dried and weighed on a weighing scale. Then it is placed in the sieve shaker apparatus. Then the apparatus is ON and allowed to shake the sample for 5 minutes. The apparatus have various sieves according to different sizes. After 5 minute the apparatus is OFF and the sand settles in different sieves. The sand is weighed according to the sieves respectively and the weight are noted down.

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The readings are shown in the table below.
Size of sample: 100 grams

U.S. Sieve Number	Sand A	Sand B
20	0.0	0.0
30	1.0	0.0
30	24.0	1.0
40	22.0	24.0
50	16.0	41.0
70	17.0	24.0
100	14.0	7.0
140	4.0	2.0
200	1.7	0.0
270	0.3	1.0
Pan total	100.0	100.0
AFS grain Fineness number	28.0	28.0

The Grain size of moulding is found to be 28.0 AFS.

III. RESULTS AND DISCUSSION

The study performed in the foundry and the problem identified as casting defect which is majorly due to 'blow holes in casting'. For this various tests were performed on the sand for which the results are mentioned below.

SR. NO	**Title of test**	**Test outcome**
1	Moisture content test	8%
2	Permeability test	300 mm/sec
3	Green compression strength test	250 N/m^2
4	Grain size test	28 AFS

By the study we have found that the cast product are having 80% blow hole defect in them. To overcome this the foundry first grind the finished product, than fill the material on the defected area, than they again grind it and then it goes for the short blasting. This consumes a lot of time, material, labour and resources. Many parts were rejected by the Client. Because of this the profit of the foundry is low. Therefore it is needed to reduce the defect to increase the profit of the foundry.

IV. CONCLUSION

The particular study for this paper was done in C.P. Foundry, Nagpur, Maharashtra. The main objective of the study was to find the problems being faced by the foundry industry, especially about the casting defects which is majorly due to blow hole defect and to suggest possible remedies to reduce the blow hole defect in the casting.

The results of the tests that were performed are mentioned in the above table. Suggestions and remedies to reduce the blow hole defect are as follows.

- The moisture content found to be 8% is very high, which is the major cause of the defect. For optimum casting it should be 3% to 4%.
- Venting should be done properly.
- Grain size should be 30-60 AFS.
- Permeability should be high.
- Ramming should be done properly.
- The pouring temperature of molten metal should not be very high. It should be 100^0 to 200^0 C higher than the melting temperature so as it should not solidify before pouring.
- Controlled use of organic binders.

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