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Review on shrinkage defect – A case study

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ABSTRACT

Purpose:- Purpose of this paper is to shown the application of removal of shrinkage defect in ϕ 480 casing for the prayas casting limited.
Methodology:- Data ware collected from company manual, using the past record, various option generated by changing gating system.
Finding:- These paper finds the clear guidance for removal defect for ϕ 480 casing by using the trial and error method with help of pro- e software.
Limitation :- This paper may have limited application as it is for only specific product.
Practical implication:- This paper focuses on single factory and results may very from one foundry to another foundry.
Originality :- This paper is combines theoretical and practical ideas to cover the scope foundry technology by using cad model.

Keywords : Foundry Engineering, Shrinkage Defect, ϕ 480 Casing, Prayas Casting

INTRODUCTION:-

prayas engineering limited, have two dept. ferrous and non ferrous. its non ferrous capacity is 80 metric ton and ferrous have 700metric ton. Company produce a casting like impeller, runner, casing, gear, company have induction furnace, gas fired furnace, cutting tool, pneumatic tool. company use material as led, aluminium silicon zinc alloy, cast iron.

Shrinkage defect

Shrinkage is reduce the volume of the casting material when metal is cooling and solidifying. So produce the line, holes in the casting its called the shrinkage defect.

Shrinkage is a volumetric Differences between solid and liquid phase during solidification in casting . casting section is solidify later than surrounding section so metal flow not complete fill the casting area. [6]

Types of Shrinkage defect

- (1) Outer sunks (pull down)
- (2) Micro shrinkage
- (3) Macro shrinkage
- (4) Porosity

- (1) Outer sunks (pull down)



Figure. 1 Courtesy [2]

This defect is seen on the outside surface of The casting, also seen on thick section of casting part. There is some depression on surfaces. It's also called the " pull down" shrinkage defect. [2]

- (2) Micro shrinkage



Figure. 2

Courtesy [2]

These defect is seen in near the area of the heat. This defect is also called the " leak defect ". micro shrinkage defect is and irregular shape with dendrites and small cavity. Micro shrinkage is not seen with naked eye. It is seen after the machining of the part[2].

- (3) Macro shrinkage



Figure. 3

Courtesy [2]

Macro shrinkage is inside of the casting part and near of the heat area. This is like to hole in the casting a larger 5mm length. Its near to the ingate[2].

- (4) Porosity



Figure. 4

Courtesy [2]

Porosity is like small hole of 1mm size on the Surface of the casting part. Its hole seen in water testing of casting part. This defect is seen near the area of grain boundaries and heat area. [2]

Causes and remedies of shrinkage defect

(1) Outer sunks (pull down)

Causes :-

Liquidus temperature of metal is too high.

Insufficient clamping of mould. [2]

Remedies :-

Short flow length so pouring at low temperature.
High flow length so pouring at high temperature.
To minimize the volume contraction in the liquid state. [2]

(2) Micro shrinkage

Causes :-

Alloy have long freezing point.
Thermal conductivity of metal is high.
Mould temperature is high.
Mould thermal conductivity is low.
Its depend on change of phase. [4]

Remedies.

Reduce the riser contact modulus.
Modulus of the ingate feeder to the riser is reduce.
Need of many risers. [3]

(3) Macro shrinkage

Causes :-

Feeder modulus is too small.
Feeder position is Wrong.
Material liquidus temperature is,higher than normal temperature. [2]

Remedies :-

Increase the riser size. [3]
Feeder material is available to long. [2]

(4) Porosity

Causes :-

Incorrect spruing.
Flask temperature too hot. [5]

Remedies :-

Sprues should be attached to the heaviest piece of the casting. There should be sufficient sprues to ensure the casting is adequately fed.

The flask temperature should be just hot enough to achieve complete fill. [5]

A CASE STUDY

A company making of the $\phi 480$ casing by the permanent mould die casting. its use the aluminium silicon zinc(asz) alloy for casting of $\phi 480$ casing. in this casing have problem of shrinkage defect.

The process of permanent mould die casting.

1. Making of core
2. Gate –Riser Position
3. Die Heating
4. Core setting in die
5. Degassing treatment by N2 gas.
6. Pouring of metal
7. Proof machining.
8. Shot Blasting
9. Pressure Testing.
10. Balancing Of Part

(1) Making of core

Industrial company produce the $\phi 480$ casing with the permanent mould die casting. In this process making of core, use of dry sand, hardener , noback, synthem. This is shown in figure.



Figure.5 core making

(2) Gate –Riser Position



Figure. 6 gate, riser in core

(3) Die Heating

Die is heated at 200 deg. Celasius.by gas heating.



Figure.7 die heating.

(4) Core setting in die

Core is matched with the die.



Figure. 8 Core setting

(5) Degassing treatment by N2 gas.

There is liquid form of aluminium silicon zinc (ASZ)have some impurities in material so it removal by degassing. And hydrogen removed by degassing. Degassing time is five minutes.



figure.9 degassing.

(6) Pouring of metal

There is liquid metal is pouring in mold. Mold filling time is 30 second. Use of metal for pouring is 36kg.



Figure. 10 metal pouring

(7) Proof machining.

Knock out the casting part from die and chipping of casting part Then after Proof machining of casting part by lathe machine.



Figure. 11 Proof machining

(8) Shot Blasting

Casting part surface is not smooth, so casting part put down in the shot blasting machine.



Figure. 12 shot blasting

(9) Pressure Testing.

All process is completed after hydro testing of the casting part.



Figure. 13 Pressure Testing.

(10) Balancing Of Part



Figure. 14 balancing machine

DIFFERENT CAD MODEL OF CASTING.

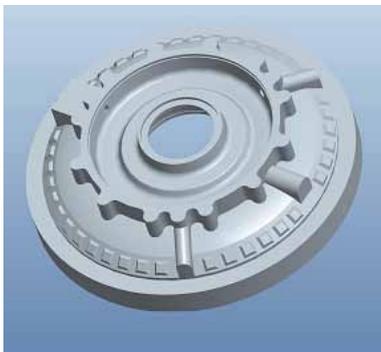


figure. 15 ϕ 480 Casing part

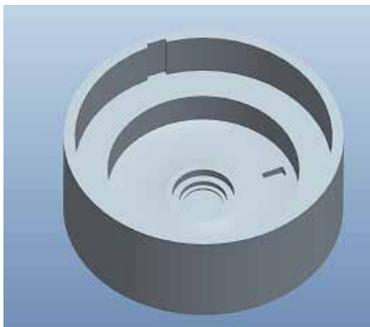


Figure. 16 core box

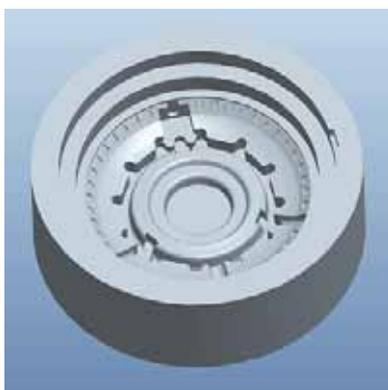


Figure. 17 die box

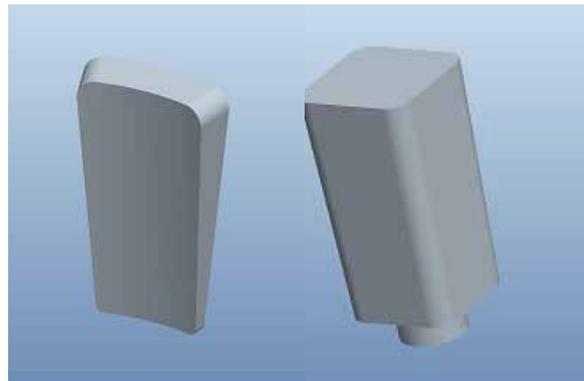


Figure. 18 sprue and riser

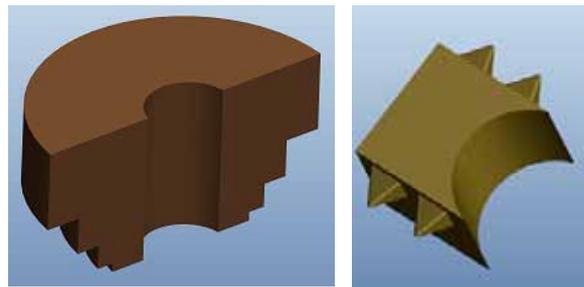


Figure. 19 chill

Shrinkage defect in ϕ 480 casing

There is a part of the ϕ 480 casing. The ϕ 480 casing have 35% rejection of total part .There is shown in figure 20 that small holes on the upper side of the casing part.

In figure 21 shown that hole size is big. This hole is inner side of the casing part.

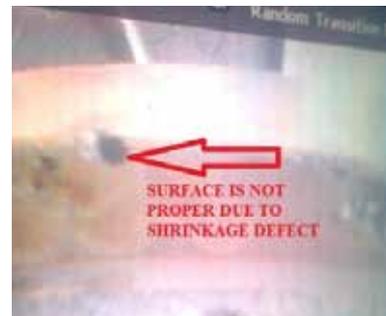


Figure. 20 shrinkage defect..



Figure. 21 shrinkage defect

There is in old system , round chill and rectangle chill are used but shrinkage problem is continued. this shown in figure 22.

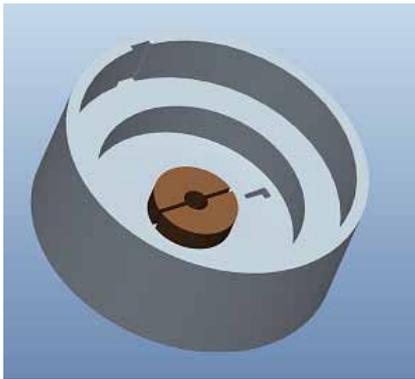


Figure. 22 Round chill

In figure 23 shown the change the location of rectangle chill and try and error method is used. Reference point is taken as the deep hole under of gate in core box. Two chill are arranged as 45 degree to both side of the deep hole and third chill is arranged opposite side of the deep hole. Improved the result, shrinkage defect is removed. This enabled rejections to be reduced 10 %. Pro-e software is used for change the location of chill at different degree. In figure 24 shown the sand core with chill.

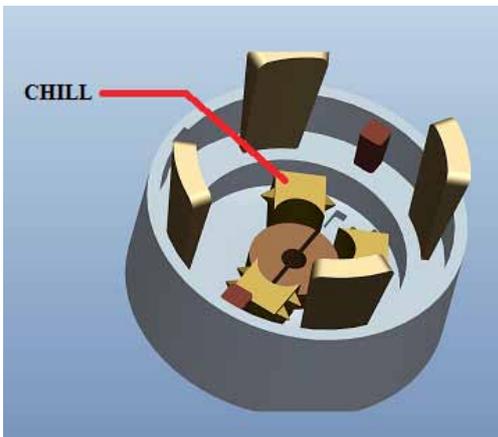


Figure. 23 Different angle of rectangle chill

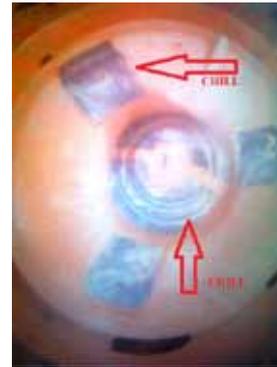


Figure. 24 Rectangle chill at different angle and round chill in the core

CONCLUSION

Producing casting without defect is very difficult task, it requires repetative effort. in this regard we have removed defects by using pro-e software. With the head of exiting set of knowledge, from company peoples with minimum efforts.

It has been observed that company people are not much aware of pro-e software, there is need of interaction between industry and education.

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