

A review on yield improvement in gating system

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Abstract- Yield is the ability of a foundry to manufacture acceptable casting in an effective manner. Improving yield offers many commercial as well as financial benefits to the foundry. The casting process is optimized there will be very lesser wastage thus it results in yield improvement. For improving cast metal yield, optimize the gating system design, optimize mold filling, avoid shrinkage scrap, voids, hot tears etc. This paper review casting produced by foundry improper design of gating framework and riser system result in internal shrinkage which is a major defecting cast product. So good design of gating system reduces defects and increase yield.

Keywords:- Casting design; Optimization; Optimized casting design; Gating system; gating and riser design; yield ratio.

I. INTRODUCTION

Castings are one of the foremost metal shaping techniques known to mankind. In casting design the gating & riser system design has a direct influence on quality of cast component. Two major considerations in the casting design are the quality of the final product and the yield of the casting. Casting design is done on trial and error basis. Casting as a manufacturing process to make complex shapes of metal materials in mass production may experience many different defects such as porosity, shrinkage, blowhole and incomplete filling. Improving the casting quality is important. There are hundreds of casting processes, for thousands of metals and alloys for millions of parts which can be produced through castings.

In the casting manufacturing process solid metal is melted, which is then poured into the cavity which can also be termed as mold. The mold holds the molten metal which then solidifies and forms the desired component. Thus designs and shapes of high intricacy and detail can be achieved in a single step using casting process. Hence a designer can design and make any desired shape he wishes using metal casting process.

In casting there are two main stages, which are filling process and solidification process. In filling process consist of gating system composed of pouring cup, runner, sprue, and gate. Risers serve dual function, they compensate for solidification shrinkage and heat source so that they freeze last and promote directional solidification. Risers provide thermal gradients from a remote chilled area.

To the riser casting process design is important for production quality and efficiency. It is unavoidable that many different defects occur in casting process, such as porosity and incomplete filling. Casting quality is heavily dependent on the success of gating/riser system design, which currently is conducted mainly relied on technician's experience. Therefore there is a need for the development of a computer-aided casting process design tool with CAD, simulation, and optimization functions to ensure the quality of casting. Gating system is referred as all channels by means of which molten metal is delivered to mold cavity.

II. IMPORTANCE OF YIELD

Yield is usually defined as the total weight of good, saleable castings expressed as a percentage of the total weight of metallic of metallic materials melted to produce them. This can be represented by,

$$\text{Yield ratio} = \frac{\text{Total weight of castings}}{\text{Total weight of metal melted}} \times 100$$

Actual yield of a foundry is always less than 100% because weight of the metal melted always exceeds that of the good quality castings dispatched. Most of the cost incurred to a foundry is the cost of energy required for melting of the metal. So even though the runner-risers of the castings and the defective castings can be melted again and the metal can be reused, improving yield helps reduce a foundry's overall operating cost significantly. Along with direct energy savings it offers, high yield is also associated with better process control, and therefore improved cost control. In addition it also offers direct savings to sand, non-recoverable metal, consumable items and effort. This is reflected in reduced cost together with a significant reduction in greenhouse gas emissions.

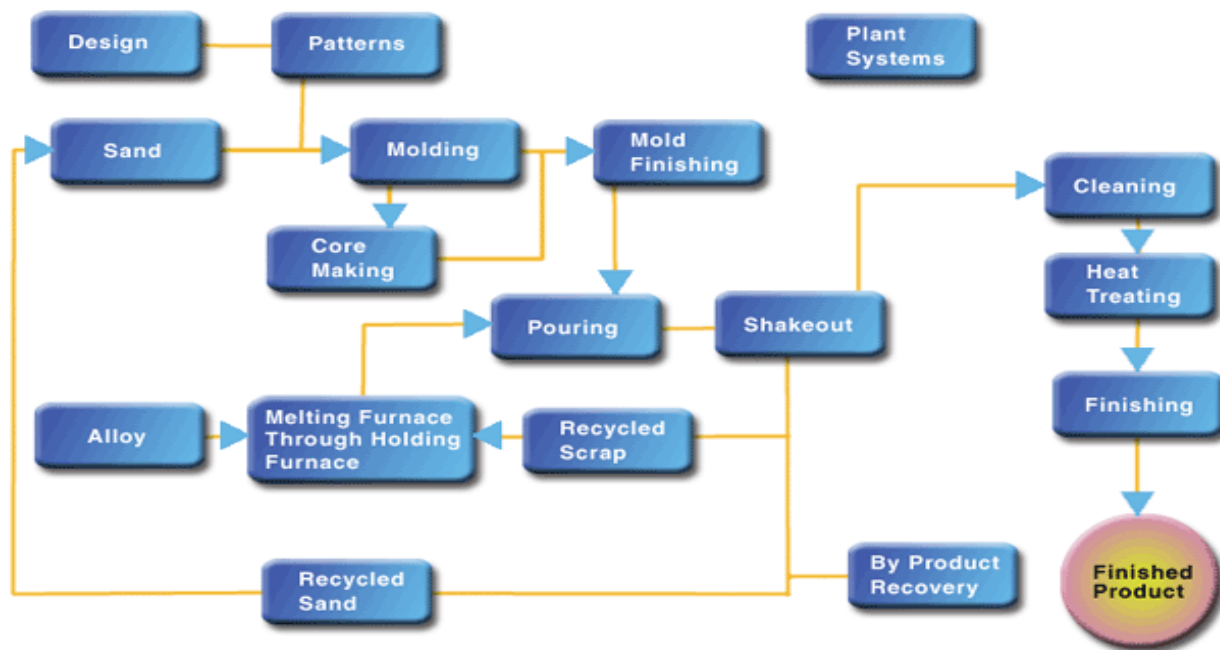


Figure No.1: Block diagram of casting process

III. LITERATURE REVIEW

Table 1 Literature Review

Sr No.	Title	Author	Published	Work done	Remark
1	Review paper on simulation based casting.	Vishal S. Jadhao , Prof. J.J.Salunke	Vol. 3, Issue 11, November 2014	With casting simulation technique, casting method and design optimization is possible.	Yield is 48% and the casting is acceptable.

2	Yield Improvement of Castings using Computer Aided Simulation	Dhruva Sadekar, G.R. Bharath Sai Kumar	Volume -3, Issue-3, 2014	By carrying out trials with the help of computer simulation, a lot of metal, time, labour and money were saved.	The box yield was reduced from 75.37% to 67.82%.
3	Review of Optimization Aspects for Casting Processes	Yazad N. Doctor, Dr. Bhushan T. Patil, Aditya M. Darekar	Volume 4 Issue 3, March 2015	We also need to acknowledge the formation of front end integration for casting Industries in the form of engineering workshops to machine castings.	To achieve a reduction in shrinkage porosity by 15% and improved yield strength by 5%.
4	Optimization Of Gating System Using Mould Flow Software: A Review	N.A.Dukare, R.M. Metkar, N.A. Vidhate S.D.Hiwase	Volume 4 Issue 1 (January 2014)	A proper runner and gating system is very important to secure good quality of die casting through providing a homogenous mould filling pattern.	The gate area was increased and the gating speed was slightly reduced.
5	Analysis and Optimization of Investment Castings to Reduce Defects and Increase Yield	Arunkumar P, Anand.S.Deshpande, Sangam Gunjati	May 2015, Volume 3	In the current work the shrinkage in the casting has been removed and the subsequent iterations in the design have resulted in an increase in yield	It has reduced the lead time for the sample casting and improved productivity.
6	Design and Development of Casting by Simulation Technique for Yield Improvement in Foundry Industry	Swaroop S. Magdum, Baliram R. Jadhav	Volume 3 Issue VI, June 2015	By using this technique the wastage of the resources is minimized which is used in trial and error method	The yield of gating system is increased from 73.33% to 85%.

7	Optimization In Green Sand Casting Process For Efficient, Economical And Quality Casting	Raghwendra Banchhor, S.K. Ganguly	Vol. V/Issue I/Jan.- March,2014/	There is great progress of green sand castings production, but it is still far away from optimal design	Tools can be used to solve the problems in casting industry especially to reduce the Defect percentages to reasonable levels.
8	Gating Design Modification Using 3D CAD Modeling and Casting Simulation for Improving the Casting Yield	Utkarsh S. Khade and Suresh M. Sawant	Volume 4, Number 7 (2014),	The productivity as well as profit is increased due to properly designed gating system.	After modification in the gating system and risers the yield improved is 7 % with the Sound casting of brake disc.
9	Simulation of shrinkage defect-A review	ViperVaasa, Havel Joshi	Volume 4 Issue 6- June 2013	This paper describes the benefits of casting simulation and how to reduce shrinkage defect in casting part with Simulation process	In the casting, mostly shrinkage defect occur in Most of part. these defects are eliminated by Designing proper gating system.
10	Effects of Improved Gating System by Using Standard Gating Ratio	Shashank V. Gulhan, A. D. Shirbhate	Volume 22 Number 4- April 2015 ISSN: 2231	To reduce weight of gating system in order to achieve maximum productivity which is most essential for every manufacturing industry	With % of yield increases from 86% to 92%, with keeping flow laminar through all sections of gating system which is most essential to reduce casting defects.

IV. CONCLUSION

Process improvement for scrap reduction are important with the use of optimization techniques, gating system of the casting are improved and increase the yield percentage. In this paper review on yield improvement in gating system is studied.

REFERENCES

- [1] Vishal S. Jadhao, Prof. J.J.Salunke, "Review Paper on Simulation Based Casting", Vol. 3, Issue 11, November 2014.
- [2] Dhruva Sadekar¹, G.R. BharathSai Kumar, "Yield Improvement of Castings using Computer Aided Simulation – A Case Study", Volume -3, 2014.

- [3] Yazad N, Dr. Bhushan T. Patil, Aditya M. Darekar, "Review of Optimization Aspects for Casting Processes", Volume 4 Issue 3, March 2015.
- [4] N.A. Dukare, R.M. Metkar, N.A. Vidhate, S.D.Hiwase, "Optimization of gating system using mould flow software: a review", Volume 4 Issue 1, January 2014.
- [5] Arunkumar P, Anand.S.Deshpande, Sangam Gunjati, "Analysis and Optimization of Investment Castings to Reduce Defects and Increase Yield", Volume 3, May 2015.
- [6] Swaroop S. Magdum, Baliram R. Jadhav, "Design and Development of Casting by Simulation Technique for Yield Improvement in Foundry Industry", Volume 3, Issue VI, June 2015.
- [7] Raghwendra Banchhor, S.K. Ganguly, "Optimization In Green Sand Casting Process For efficient, Economical And Quality Casting", Vol. V/Issue I, Jan-March, 2014.
- [8] Utkarsh S. Khade and Suresh M. Sawant, "Gating Design Modification Using 3D CAD Modeling and Casting Simulation for Improving the Casting Yield", Volume 4, Number 7 2014.
- [9] Vipul Vasava, Dhaval Joshi, "Simulation of shrinkage defect-A review", Volume 4, Issue 6- June 2013.
- [10] Shashank V. Gulhane, A. D. Shirbhate, "Effects of Improved Gating System by Using Standard Gating Ratio", Volume 22, ISSN: 2231, Number 4- April 2015.

