

A Review of Gating System for Sand Casting

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Abstract: Water modelling of a gating system in a foundry can be used to improve the quality of the castings produced to thrive in the global competitive environment, minimize the cycle time, reduce the cost, as well as meet its delivery times. So, from a customer and an economic point of view foundries cannot afford production of series of trial castings with routine changes in the gating system and choose the most economical option amongst all by testing the quality of castings obtained from each trial. This is because the time and cost implications would adversely affect the survival of the organization. All of these factors indicate the necessity of a scientific approach to the design of gating systems to increase the quality and yield in a foundry. Hence, this project is being built to deal with the flow analysis through the various gating systems.

Keywords: water modelling

1. Introduction

The project of water modelling of a gating system is focused on the study of gating systems to understand its hydraulics using acrylic water models. Similarity between water and liquid metal was known through the application of the principles of similarity from the fluid mechanics by choosing the most relevant non-dimensional numbers.

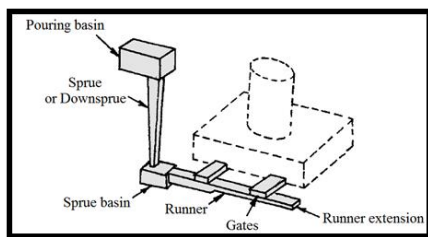


Fig. 1. Gating system

Most suited manufacturing methods, tools and specially made wooden dies were employed as the fabrication of acrylic model posed a challenge due to the fragile nature of the material and its tendency to crack during manufacture. Tests of the acrylic models will be conducted with water, due to its cost efficiency when compared to the cost of liquid metal.

A. Elements of gating system

- Pouring cap: It's a funnel shaped opening, made at the top of the mold. The main purpose of the pouring basin is to direct the flow of molten metal from ladle to sprue.
- Sprue: It's the vertical passage which connects the pouring

basin to runner or ingates.

- Runner: It's a long horizontal channel which carries molten metal and distribute it to the ingates.
- Gates: These are small channels connecting to the mold cavity and the runner. The gates used may vary in numbers depends on the size of casting
- Sprue well: It's also designed to limit the free molten metal fall, by directing the correct angle to the runner. The sprue well aids in minimizing the turbulence and aspiration. Ideally, it has to be cylindrical in shape having the diameter, two times than that of sprue exit and depth twice as that of the runner.



Fig. 2.

2. Objective of project

The objective of the project is to do analysis on the flow of fluid in the gating system which will help in proportionate supply of required in effective time for reduction in the time required for production in castings.

3. Literature survey

After conducting an intensive literature review, it was found that the ratio of flow rates from two gates depends upon the other two dimensionless ratios (gate to runner area ratios and discharge coefficient ratios). It implies that flow ratios are apparently independent of the distance between the gates, or the length of the runner between the gates.

So, there are no. of types of gating system models can be produced with some dimensional or shape and size difference in them to study or analyze the characteristics of flow of the fluid.

Work which is done regarding this concept could be extended by conducting more experiments with different ratios of cross section areas of gates and runners, varying cross section areas of runner (reducing after each gate), and full/partial venting. In order to fulfil the above part, nine different setups with different

Table 1
Literature analysis

S. No.	Title of Research Paper	Published Year and Author	Conclusion
1	Flow Rates in Multi-Gate Systems: Experimental and Simulation Studies (Indian Foundry Journal, Vol.58, No-4, April 2012)	K.H Renukananda Akash Chavan Dr. B. Ravi	This is needed to balance the flow through multiple gates (by adjusting their position and cross-sectional area), and to ensure that the mold cavity is filled in an optimal time.
2	Optimization of gating system in a multi gate runner: a simulation approach (April 2016)	Irfan Ahmed Ansari Mohammed Bilal Naim Mohammed Imran Akhter Hussain Ansari	It is very difficult to investigate fluid flow phenomena through experimentation, since both the metal and mould are opaque. When they used 4 ingates in the runner it turned out that the flow wasn't uniform and using three ingates will give best results in both deciding criteria (i.e. flow rate and Velocity).

cross-sectional areas, different shapes of pouring basins, different shapes of runners will be designed in order to get variety of results.

Fabrication of the setup in a clear acrylic plastic will optimize the gating system as it is no more opaque in nature. Since, three gates are recommended for best results in a 2016 study the fabricated setup will surely consist of three gates so as to optimize the results.

4. Conclusion

As the model which we are making is made up of clear and transparent acrylic so that we can study the behavior of fluid in different provided cross-section and observe what's happening during the process by providing correct location of various elements of the systems the flow of discharge through the gates can be increased. Due to this system the casting will become more cost effective.

5. Future Scope

The casting is a method to produce the intricate, complex shaped components or parts with fine accuracy. So, the analysis of fluid flow through various models of the gating system we are doing will help us to provide the better and efficient flow of fluid for producing greater accuracy products with fine surface.

So this can be helpful for designing the gating system for various castings with reduction in the costing of the production without compromising the quality in future.

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