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The Influence of Gate Location in a Vertical Injection Moulding Part Connecting Plate

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Abstract - *Gate is an important flow path in feed system .It is the connection between runner and the component .The feed system in injection moulding consist of spur, runner system and gate these are the stream in which flow of polymer takes place. To get dimensionally accurate component gate location plays very important role. Here analysis was conducted on connecting plate by increasing the number of injection point using moulflow analysis tool and results were studied to know how gate location influence other parameters when inserted component is considered .To get an good quality of product designer should know the detailed view of designing the gate*

Key Words: **Mouldflow, Gate location, Fill time, Weld lines, Air traps**

1. INTRODUCTION

In an over moulding process, the designer as to be careful in all parameters related to the mould design and its process. Considering the thermo plastic injection moulding process for a component known as connecting plate some results were taken using mould flow analysis software.

In which 3D model was created using solid works software and imported in IGS file of the model to analyze in mould flow insight .steps were carried out starting from meshing the model ,assigning the material, selecting the best gate location as all this in first step.

When best gate location was studied from the result as seen in fig [3], the blue region was show as best injection point, but as per difficulty considered in the component blue regions are not good for injection point so some of the iterations were carried out with other area of the component as second step, were gate location are given by considering the machine pressure and also the inserts which are to be placed inside the mould. When it comes to inserts there are 3 wire forms to be placed in between the component to be completed, in a vertical moulding process when inserts are placed pressure should be taken care so that injection of polymer with more pressure should not tend to move or miss match the inserts position inside the mould.

Therefore 3 iterations were carried out with increasing the injection points to get the best result and one of the results was considered to be suitable for all parameters which made designer to carry further machining process and steps.

1.1. Component Study

Component taken to study here is a inserted type one, in which an arrangement of different inserts are shown in fig [1].Material of the component is PA66 (polyamide) with 33% glass filled, Which enhance the property of the plastic, connecting plate is used as one of the part in alternator for outer protection of motor in automobile.

Fig-1: 3D Component with inserts

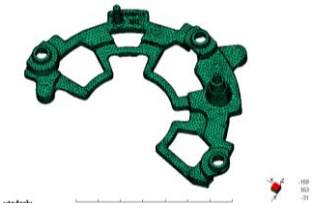

Fig -2: Meshed view of component without inserts

2. Experimental Analysis

How gate position effects the other related parameters are seen using mould flow software, by increasing the number of gates different results were observed like fill time, temperature to flow front, weld lines, air traps, share index and furthermore, in which some results are taken from all the 3 iterations and difference was studied with respect to the selected machine parameters .The type of gate considered here is edge gate.

The results studied by increasing gate location are

Fill time: It predicts the flow of polymer inside the closed mould in filling phase, which means total time taken to fill complete cavity and core.

Temperature at flow front: It gives the temperature of the polymer when flow reaches certain point in center of

thermoplastic cross section, during the fill and should not drop below 20%.

Air trap: The lockdown air inside the mould which traps into the component and make the strength of the component less due to shot fill in internal area, it can be prevented by providing suitable air vents.

Weld lines: The region which makes the component break and also it effects the surface appearance, due to the formation of line known as weld lines.it is formed when flow is distracted due to the uneven surface and meets at particular closing/ending point .These weld lines can be decreased by varying the temperature in mould or changing the injection point but it cannot be eliminated completely.

Gate location

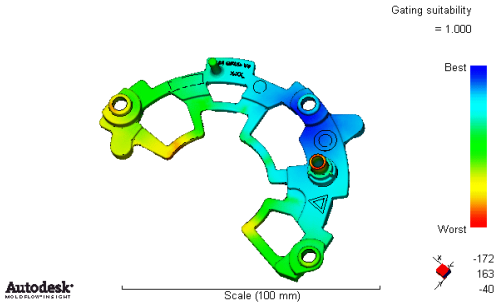

Fig-3 Best gate location

Above fig [3] shows the component, in which region the gate location is suitable

The color indication from best to worst tells that which is the most suitable area for gate to be given, gate location is nothing but the injection point at which the flow enters and starts to fill, gate is channel between component and runner system. The region which is selected here is seen in fig[4], this was taken by considering the difficulty of placing the inserts and the varying thickness of component. The designer should know that not only the color indication can be taken as best gate location many other parameters also influence for the successful of output product with less defects. Keeping this in consideration the component detail study was done and location were selected for injection point, by increasing the number of gate, results were noted

1st Gate Location

It was given at the center of the component as shown in fig (4)

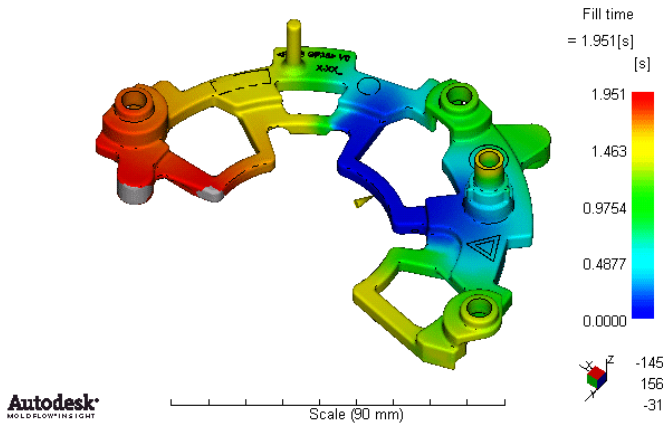

Fig-4 First injection location showing fill time

Result

Short fill was seen which means no completely filled component, therefore further results were not considered.

2nd Gate Location

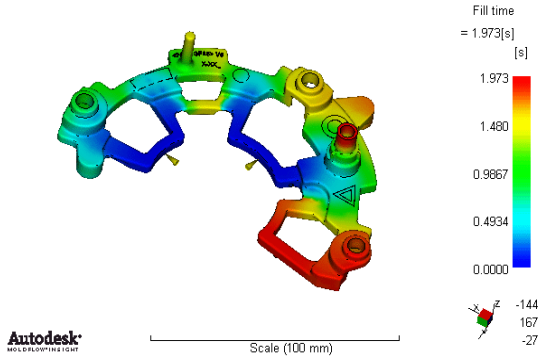

Fig 4.1: Fill time

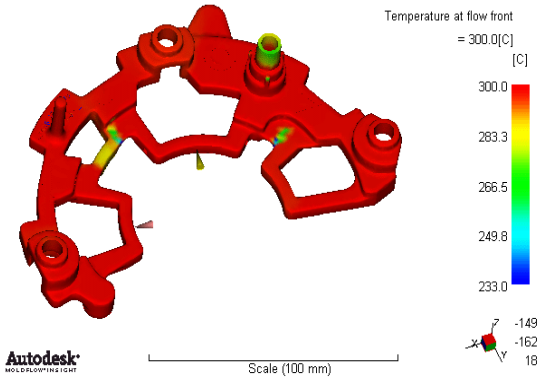

Fig-4.1 :(a) Temperature at flow front

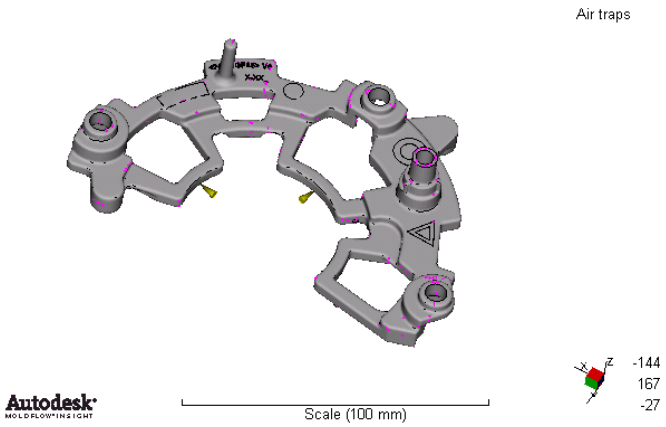

Fig 4.1 :(b) Air traps

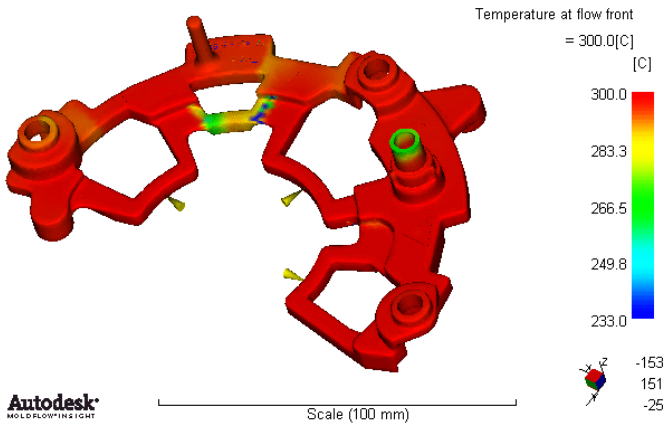

Fig 4.2 :(b) Temperature at flow front

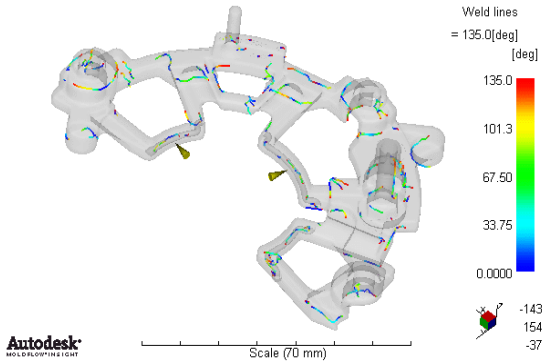

Fig 4.1 :(c) Weld lines

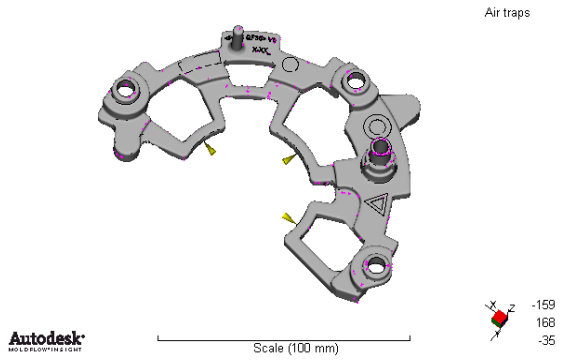

Fig 4.2 :(c) Air traps

Result
Fill time is 1.973
Air traps are seen in stepped area
Weld lines are more
Temperature at flow is 300^{0}c
3rd Gate Location

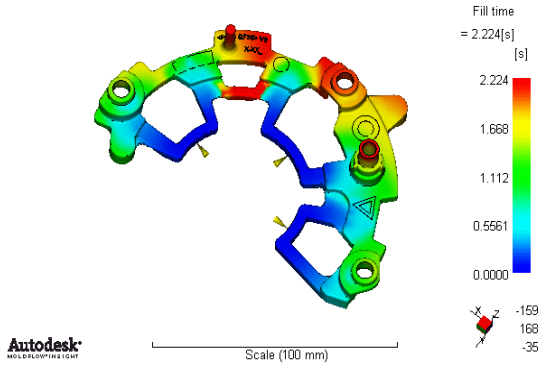

Fig 4.2: (a) Fill time

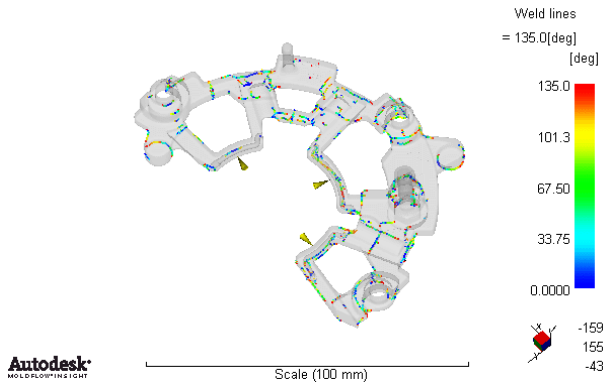

Fig 4.2 :(d) Weld lines

Result
Fill time is 2.224
Air traps are less when compared
Weld lines are more
Temperature of flow front is 300^{0}c

Table -1 comparison of all experimental analysis

Gate location	Fill time In sec	Temperature at flow front In ^{0}c	Air trap	Weld lines
1	1.951	-	-	more
2	1.973	300	More	more
3	2.224	300	medium	more

DISCUSSION AND CONCLUSIONS

From table 1 the obtained results were compared in which single gate cannot completely fill the mould and the 2 gating provides good results in which injection pressure required to fill should be high. This is not suitable for this component due to critical arrangement of inserts

The 3rd gate location was selected as best one in which fill time is 2.224sec and air traps which are seen near the bosses and edges can be eliminated by providing air vents, .by varying mould temperature weldlines which are weak gets fused .3 injection point was selected due to the pressure variation in the mould, high pressure from the nozzle tends to move the inserts placed, hence by providing 3 gates, injection pressure can be lowered, thus the output component will be in best quality.

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