

Optimum Gate Location in Injection Mold of Nasal Foreign Body Removal Cover

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Abstract— In plastic injection molding the quality of the plastic part depends on the gate location provided in the mold, hence by providing an optimum gate location the quality of the part can be improved. mold flow analysis is a tool that helps to optimize gate location and predict the flow and also helps to estimate the cycle time of each component which is very much required in mass production of plastic parts and also helps to minimize defects. Mold flow simulation saves time by avoiding trial and error method. The software used in here in this analysis is Autodesk moldflow insight. In this paper right handle of medical part is analyzed by number of iterations to locate optimum gate location and improvise fill time, weld lines, air traps.

Keywords— *Injection molding, gate locations, mold flow analysis*

I. INTRODUCTION

Injection molding is process where plastic parts of different shape and size are produced. In this process the molten plastic flows to mold and takes the shape of the cavity after solidifying. Usually there are two types of plastic are used in injection molding they are thermoplastics and thermoset plastics. Building a mold tool is expensive and time consuming so mistakes or alterations in mold causes loss of time, material, and also increases expense. Therefore, here mold flow analysis simulation is used to eliminate trial and error methods, selection of proper gate location and also to improvise parameters which helps in the production of good quality plastic parts.

II. COMPONENT DETAILS

Material used for this product ABS (acrylonitrile butadiene styrene) It has got a very good chemical and thermal stability, good dimensional stability and also good electrical property. Its wall thickness is 2mm, density of the material is 1.02g/cm^3 .

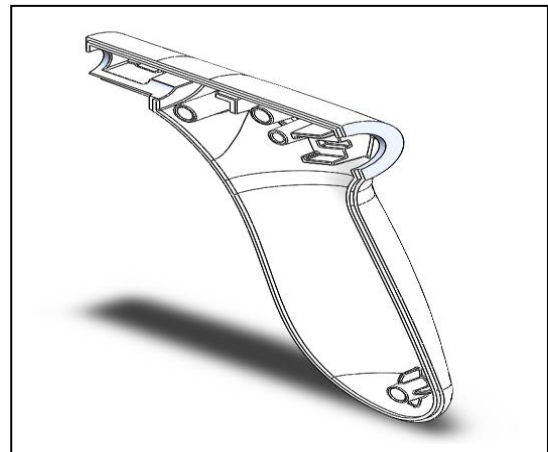


Fig. 1 Part

III. ANALYSIS

The main objective is to analyze about the gate position in the injection molding component. While positioning the gate we must consider few factors like the material used, the size of the material, the use of the part and the astatic looks. The parameters like gate position and the number of gates are varied. But here the component which have been selected is small and the need is only one. The software used for this analysis is Autodesk moldflow insight, this software is capable for analysis of fill time, temperature, gate location, weld lines, pressure, warpage and many more

A. Fill time

Fill time is a time consumed by the thermoplastic material in molten state to flow from injection point to mold cavity. It also analyzes the flow pattern.

B. Air trap

Air traps are formed when there is no gap for air to escape when thermoplastic material in mold from flows between flow front and the cavity wall

C. Pressure drops

Pressure drop is the pressure required to flow the material into the mold cavity until it is completely filled. It also indicates the max pressure required to flow through the different regions

D. Temperature flow front

The temperature flow front shows the temperature of the polymers when it reaches the specified points in the given region

E. Weld lines

weld lines are created when two flow front meets. Weld line indicates the weakness in the structure

IV. ITERATION

These iterations are made to find the optimum gate location to produce defect free and a good quality product

A. First iteration

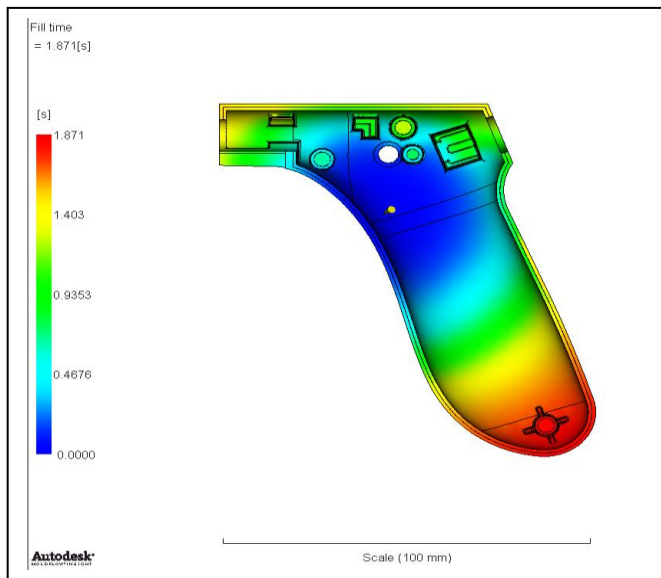


Fig 2.0 Fill time

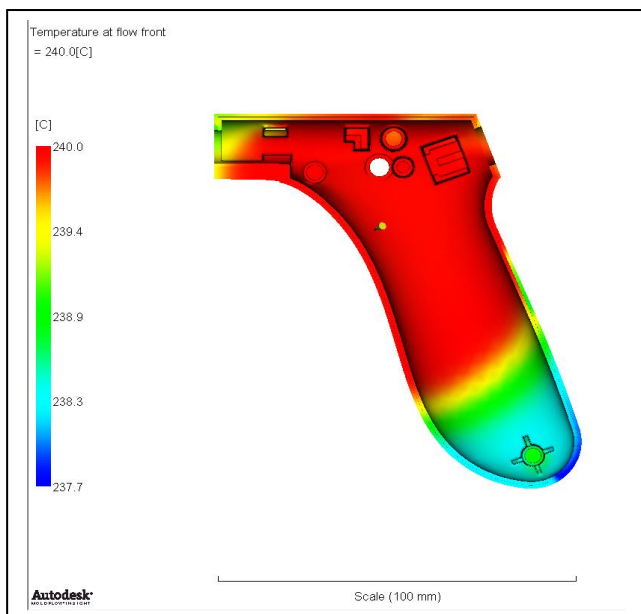


Fig 2.1 Temperature at flow front

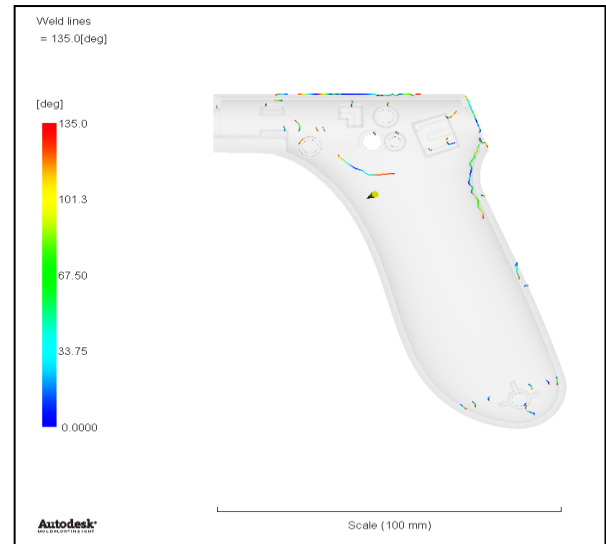


Fig 2.2 Weld lines

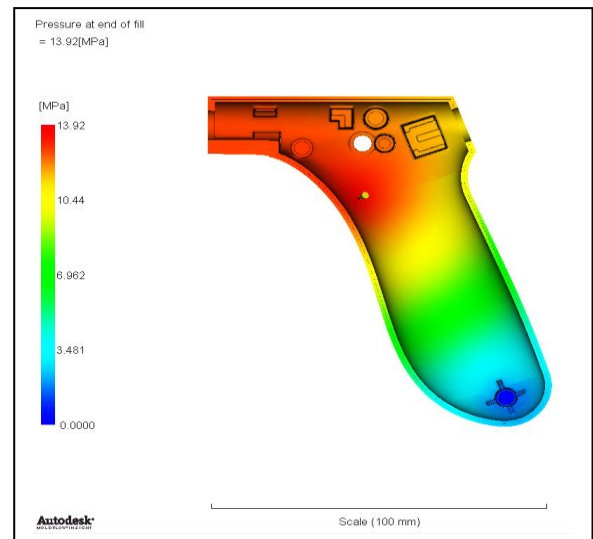


Fig 2.3 Pressure at end of fill

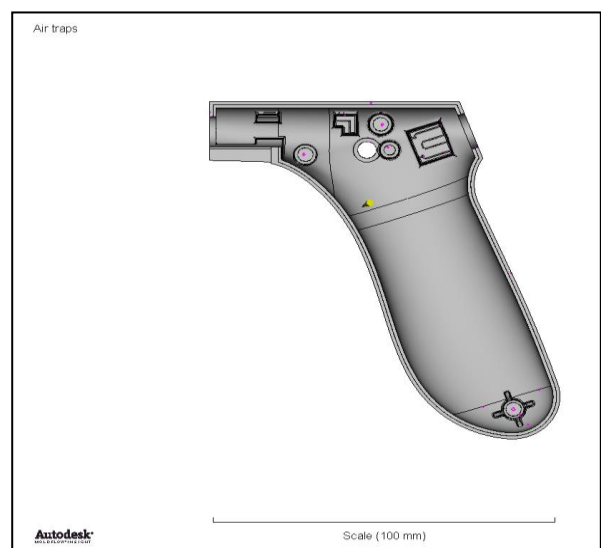


Fig 2.4 Air traps

Gate position 1, as shown in first iteration the results obtain are

- The fill time achieved is 1.871 achieved.
- The temperature at flow front achieved is 240°C.
- Weld lines are not numerous hence its accepted.
- Pressure at the end of fill achieved is 13.92 Mpa.
- Air traps are not critical.

B. Second iteration



Fig 3.0 Fill time

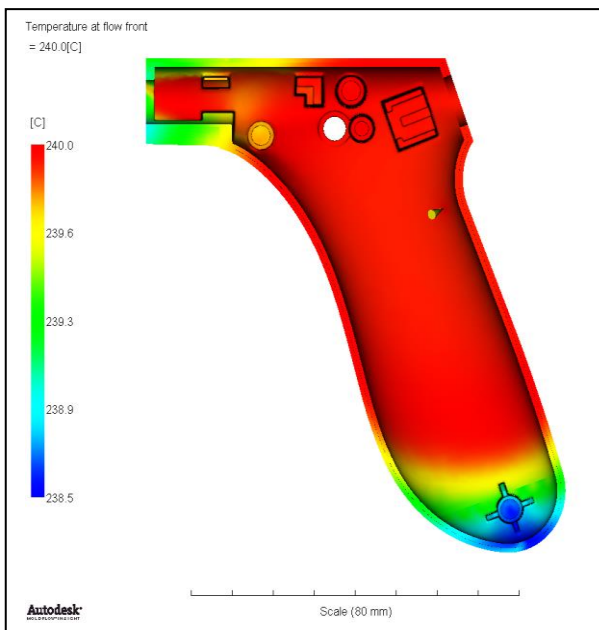


Fig 3.1 Temperature at flow front

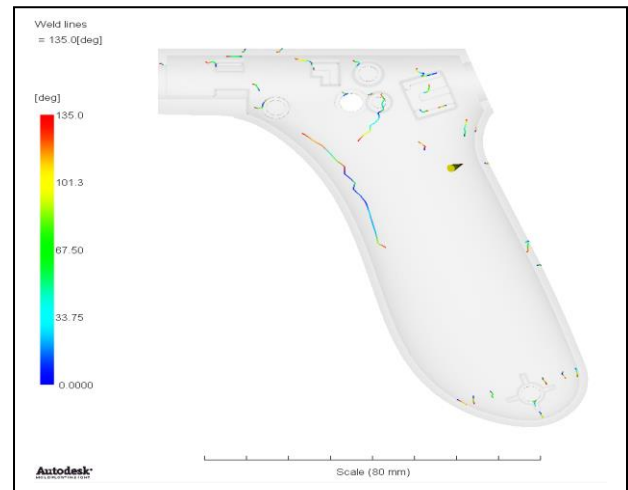


Fig 3.2 Weld lines

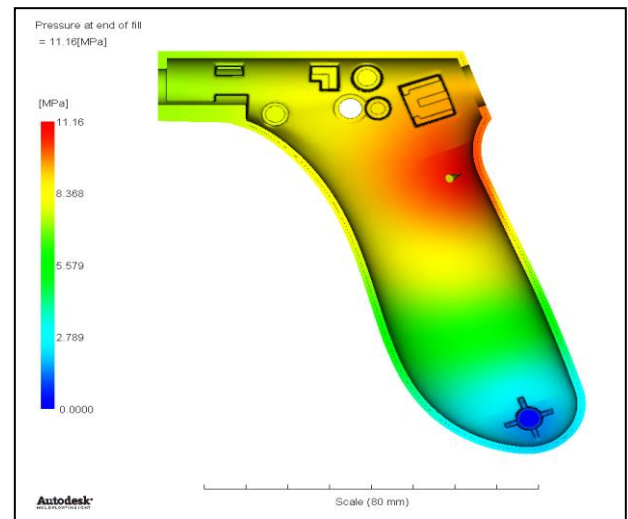


Fig 3.3 Pressure at end of fill

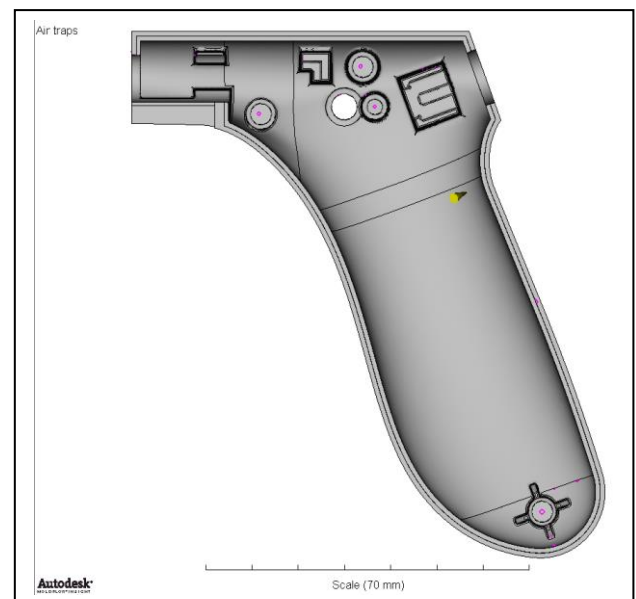


Fig 3.4 Air traps

Gate position 2, as shown in first iteration the results obtain are

- The fill time achieved is 1.665 achieved.
- The temperature at flow front achieved is 240°C.
- Weld lines are not numerous hence its accepted.
- Pressure at the end of fill achieved is 11.16 Mpa.
- Air traps are not critical

C. Third iteration

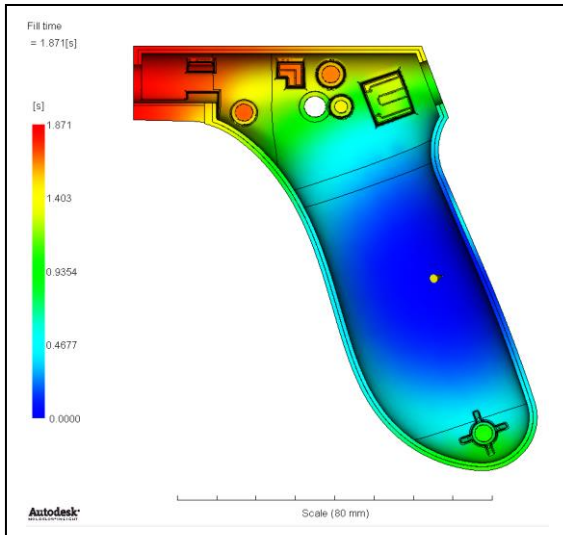


Fig 4.0 fill time

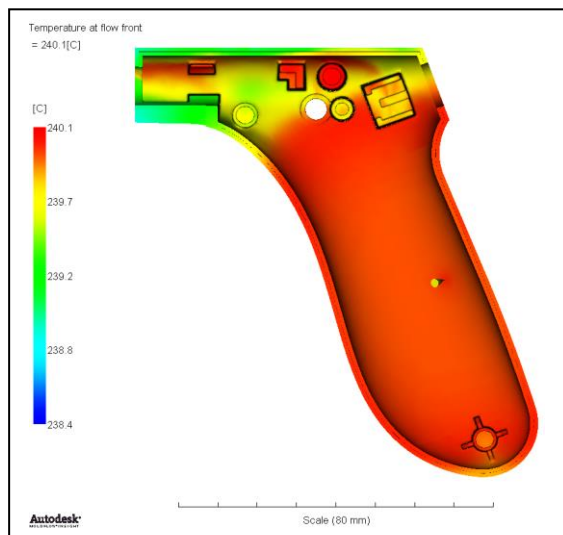


Fig 4.1 Temperature at flow front

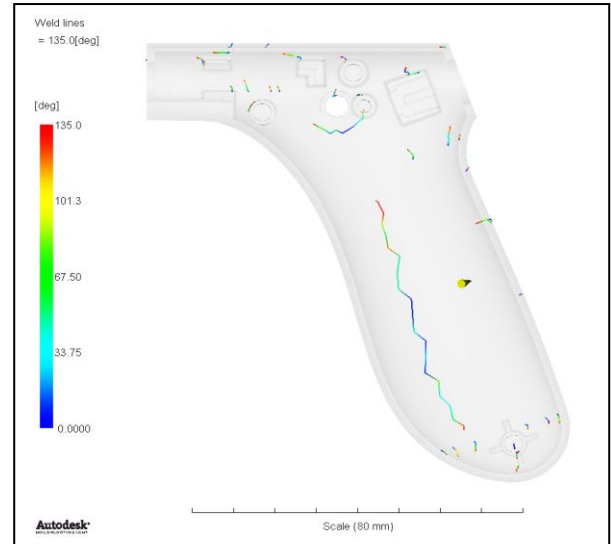


Fig 4.2 Weld lines

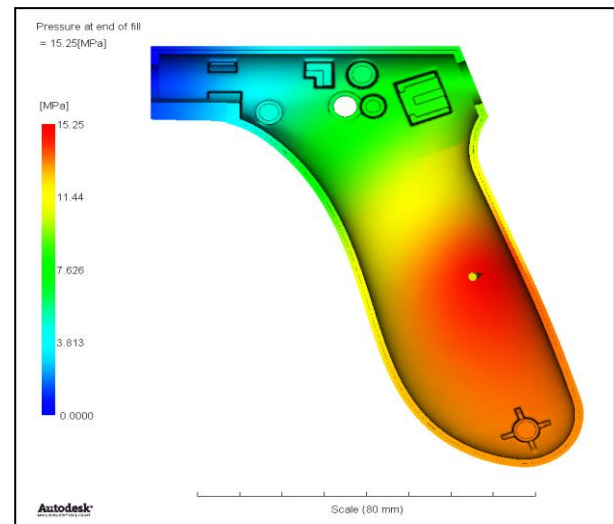


Fig 4.3 Pressure at end of fill

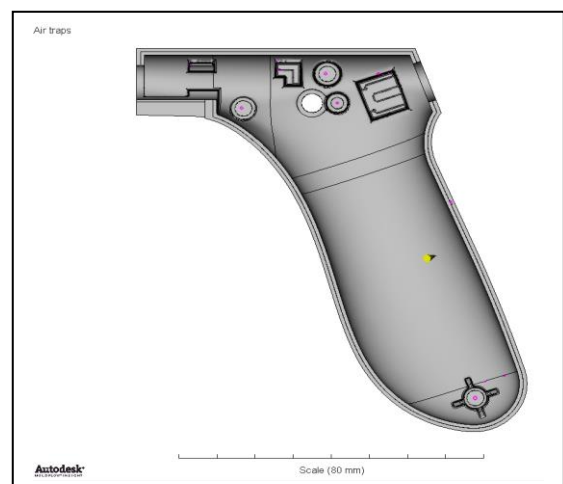


Fig 4.4 Air trap

Gate position 3, as shown in first iteration the results obtain are

- The fill time achieved is 1.871 achieved.
- The temperature at flow front achieved is 240.1⁰C.
- Weld lines more in critical region hence it's not accepted.
- Pressure at the end of fill achieved is 15.25 Mpa.
- Air traps are not critical

V. CONCLUSION

In this analysis of the component different gate location were consider. In above iterations results gate 3 is not suitable because it has got a greater number of weld lines, shrinkage is more compare other two. In gate 2 its pressure is less compared to gate 1 but air trap and weld lines are more. When gate 1 is selected it gives more quality, less air trap and less weld lines compare to other gates. Air trap can be removed by providing small holes. Hence gate 1 is selected as optimum in this product.

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