Design and Analysis of Hot Runner Injection Mold For Medicine Bottle Measuring Cap

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Abstract-

This paper presents the design of Hot Runner for multi cavity mould for producing the medicine bottle measuring cap and performing the mold flow analysis. The manifold and secondary nozzle plays an very important role in keeping the plastic in melt condition. The temperature unit is accomplished to maintain the melting temperature. To have a better control over filling the impressions automatic shut off spring laded valve is used. The model for design is done in Creo 2.0 and Analysis is done using Auto Desk Mold Flow.

Keywords : Injection mould ;Hot Runner ; secondary nozzle ; manifold ; multy cavity ; shut off valve.

1. INTRODUCTION

The hot runner system establishes the linkage between the injection moulding machine and the mould cavities and act as the melt flow system. It is integrated into the mold and forms part of it. The thermo plastic melt remains inside the system for at least one injection cycle in its molten state, other than solidifying runners in conventional molds. This is commonly called sprueless molding. The hot runner unit consist of manifold block in which a series of drilling, called the flow way, connect the sprue to a number of secondary nozzles, through which the melt flows in to the impressions.

R.Spina[1] has compared different hot-runner systems, gate and product configurations, and evaluated manufacturability and process feasibility of each system through thermal stress and strain distribution, which was studied by using finite element analysis. Tzu-Chau Chen et al [2] used a true 3D numerical method to predict the temperature behaviour in the hot runner system has been developed. A hot runner system CAE model can be constructed, attribute-defined, and meshed in an efficient way in the pre-processing step. Through this numerical technique, the dynamic feature of temperature field in hot runner systems can be simulated and investigated. Paul Glendenning et al[3] The majority of valve gates are pneumatically actuated, with a smaller proportion being activated by hydraulic means in industries where cleanliness is not so critical, and large parts are moulded in hydraulically actuated moulds. In

the medical device industry, pneumatic systems are very popular because they are relatively clean, and can be simply integrated into a production system.

The main objective is to reduce the production cycle time, Raw material consumption saving, improved product quality,Better melt temperature control, Analyzing the effects of resin flow and Optimizing the design parameters.

2. COMPONENT DETAILS

Medicine Bottle Measuring Cap
Material :Poly Propylene
Colour :White
Shrinkage :1-3 %
Melt Temp. :200-300 Degree Celsius
Melt Density :0.78gm. /cm³
Solid Density :0.93 gm. /cm³

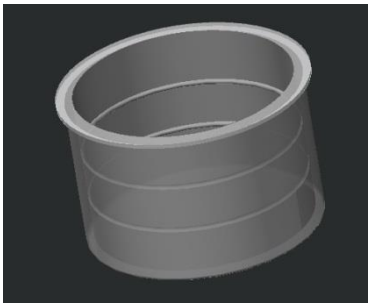

Fig 1.Medicine Bottle Measuring Cap

3. HOT RUNNER MAIN REQUIREMENTS

3.1 Manifold
3.2 Secondary sprue

3.1 Exploded view of Manifold

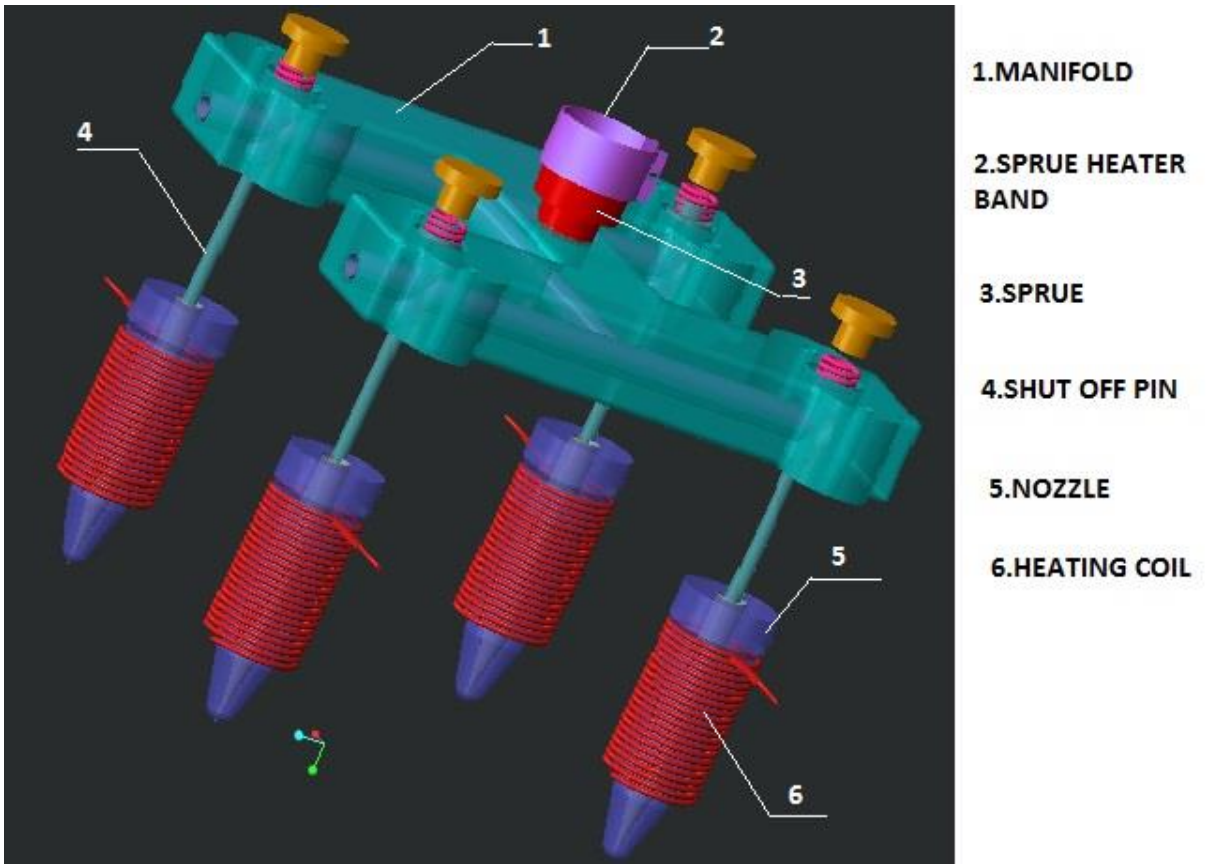

Fig2. Exploded view of Manifold

3.2 Secondary Nozzle with spring loaded shut off valve system:

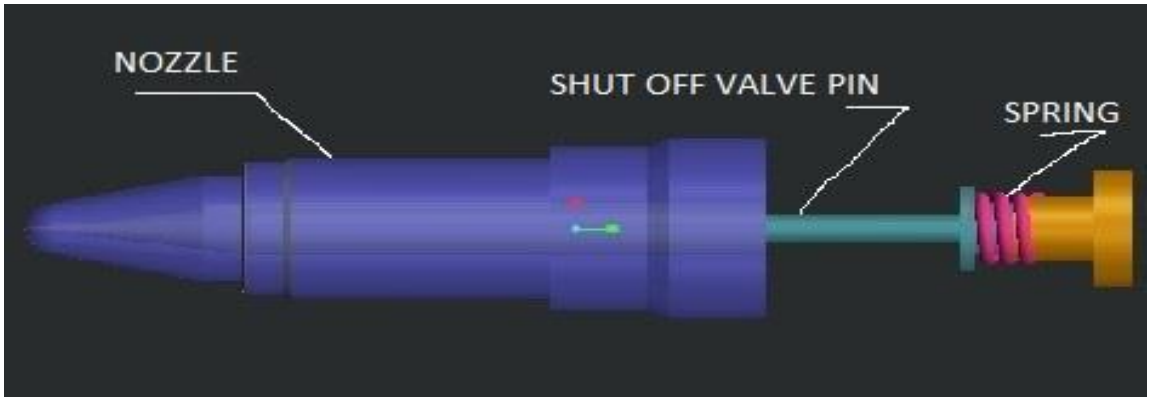

Fig 3.Secondary Nozzle with spring loaded shut off valve system:

From the above figure the shut off valve nose is held a seating by spring washer preventing the material from flowing through the nozzle into the impression. When the injection pressure builds up to the setting of the spring, the valve opens, permitting the melt to flow into the impression. The force applied to operate the valve is the material pressure. Immediately the material pressure falls below the setting of the valve spring, the valve stops the polymers to flow from the nozzle nose.

4. RESULTS AND DISCUSSION

The analysis is carried out using the software Auto Desk Mold flow. The Benefits of predictive analysis is to avoid the high costs and time delays associated with problems discovered at the start of manufacturing, it is necessary to consider the combined effects of part geometry, material selection, mold design and processing conditions on the manufacturability of a part. Using predictive analysis tools to simulate the injection molding process, organizations and industries can evaluate and optimize interactions among these variables during the design phases of a project before production begins, where the cost of change is minimal and the impact of the change is greatest. The productive analysis can simulate the filling, packing and cooling phases of thermoplastics molding processes using materials with or without fillers and fiber reinforcements, as well as predict post-molding phenomena such as part warpage, also simulate material flow and cure of reactive molding processes.

4.1 ANALYSIS FOR FREEZE TIME

The Freeze Time Variance result plots the deviation of the time it takes the polymer to freeze in any region of the part from the average time to freeze for the entire part. Areas that are plotted as positive values (red) take longer to freeze than the average time to freeze, and areas that are plotted as negative values (blue) freeze more quickly.

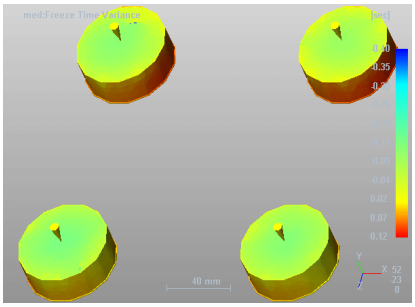

Fig 4.Freeze Time

4.2 ANALYSIS FOR AIR TRAPS

The Air Trap result shows the regions where the melt stops at a convergence of at least 2 flow fronts or at the last point of fill, where a bubble of air becomes trapped. The regions highlighted in the result are positions of possible air trap. These can be eliminated by providing air vents on cavity.

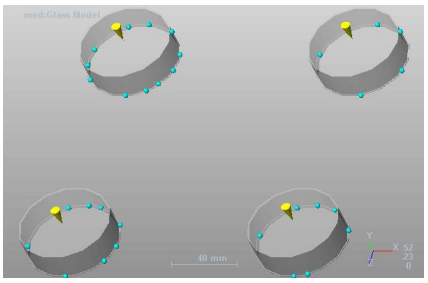

Fig 5.Air traps

4.3 TEMPERATURE AT FLOW FRONT

The flow front temperature result uses a range of colours to indicate the region of lowest temperature (colored blue) through to the region of highest temperature (colored red). The colours represent the material temperature at each point as that point was filled. The result shows the changes in the temperature of the flow front during filling.

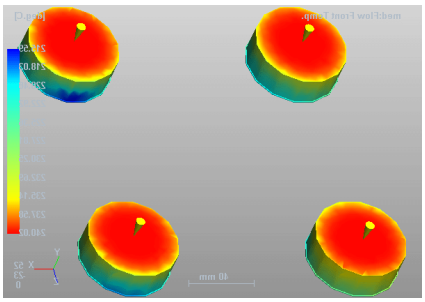

Fig.5 Temperature at flow front.

4.4 Weld Lines

The presence of weld lines may indicate a weakness or blemish. When a weld line forms, the thin frozen layers at the front of each flow path will meet, melt and then freeze again with the rest of the plastic. A weld occurs when the melt temperature is lower than 20˚C below the injection temperature. Weld lines in areas, which need strength or which need to appear smooth should be avoided. This can be done by changing the polymer injection location or altering the wall thickness to set up a different fill time.

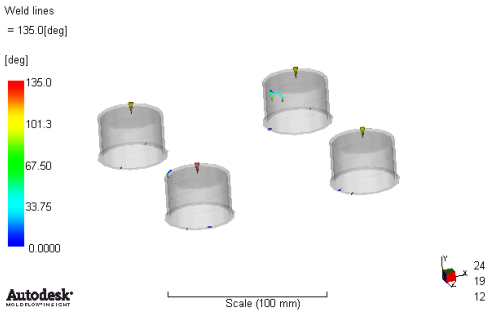

Fig 6 Weld Lines

CONCLUSION

In this paper it is concluded
1. The spring loaded shut off valve can also be used for hot runner injection mold.
2. Analysed the component for good quality.

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