Design and Analysis of Plastic Injection Mold for Housing Retainer

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Abstract— Injection molding is one of the most important processes in the plastic manufacturing industry. Design for the 'plastic' component part is followed by the Design for its mold. This paper deals with the design and analysis of plastic injection mold for housing retainer. Analysis/ Simulation can be performed using Autodesk mold flow software. From the simulation and analysis, the software for flow simulation provides sufficient information regarding filling time, Injection pressure, Temp at flow front, sink mark air traps weld line. With these results, users can avoid the defect of the plastic in actual injection. The analysis will also help the mold designer to design a perfect mold with minimum modifications and which will also reduce the time and cost

Key words: Injection Pressure, Plastic Injection, Housing Retainer

I. INTRODUCTION

The main concept of plastic molding is placing a polymer in a molten state into the mold cavity so that the polymer can take the required shape with the help of varying temperature and pressure. Injection molding is perhaps the most common and important of all plastic processing processes. The process is extremely versatile, and can produce very complex shaped parts, with the use of multi-sided molds. Even parts with metal inserts can be produced. While injection molding dies are expensive to produce, each die can be used to make tens of thousands of components at very rapid rate, so that per-part cost is very low.

A. Component Detail:

Name of Component: Housing Retainer
Molding type- Multi cavity injection mold
Material- Delrin 500P

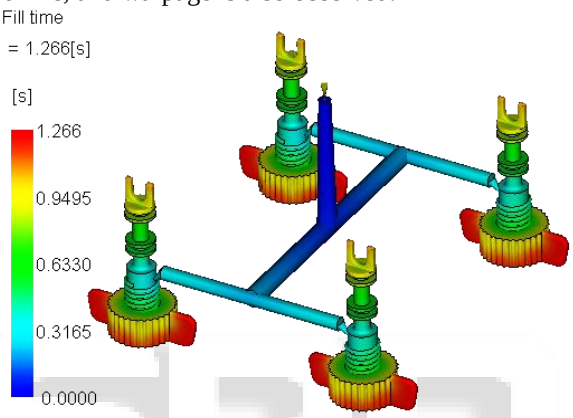
The part is fixed at the bottom of the housing containing lubricating oil. Typically, the retainer has external treads that engages with the tapping in the Aluminum housing. The part is required to withstand the torque applied during fitment with the housing. Weld line, Warpage also needs to be controlled. The housing retainer is as shown in fig 1

Fig. 1: Housing Retainer

II. MOLD FLOW ANALYSIS RESULT:

A. 1st Iteration

Feeding system is designed with submarine gate having Cold Runner Melt Flow Channel diameter of 5 mm, Gate diameter 1x3mm.The simulation result of 1st iteration is as shown in fig 2. The fill time is the time required to fill up the cavity and it is 1.226sec.with pressure of 18.41MPa and temp. of 266.6 C. sink mark, Air traps, weld line, and warpage is also observed.



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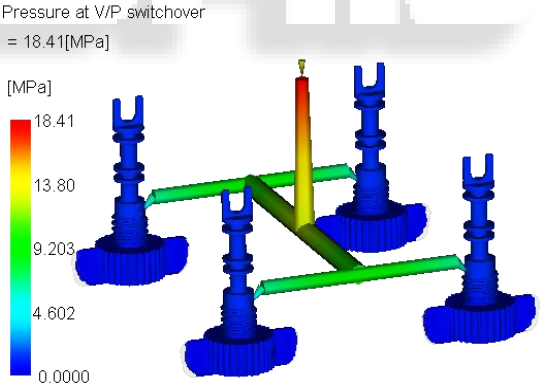

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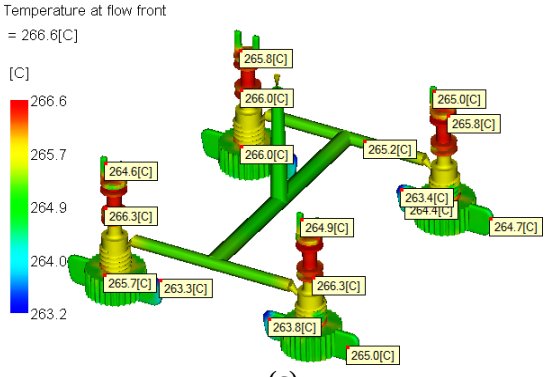

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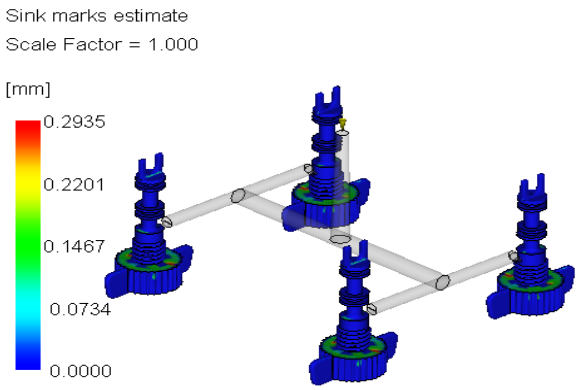

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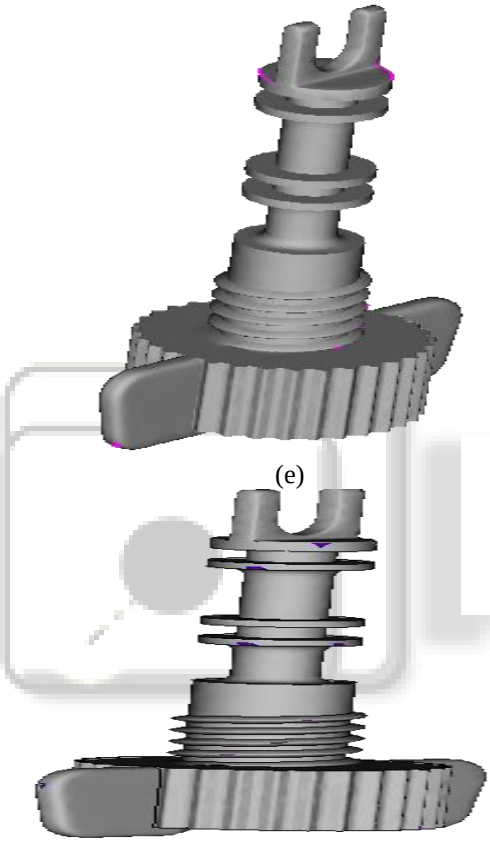

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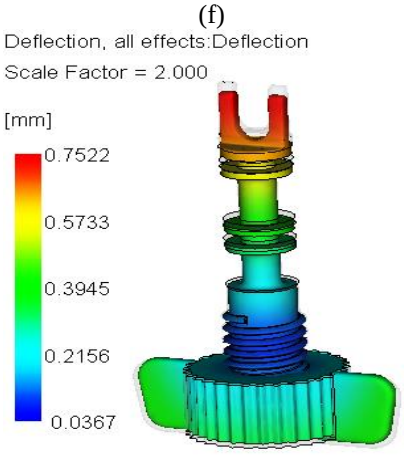

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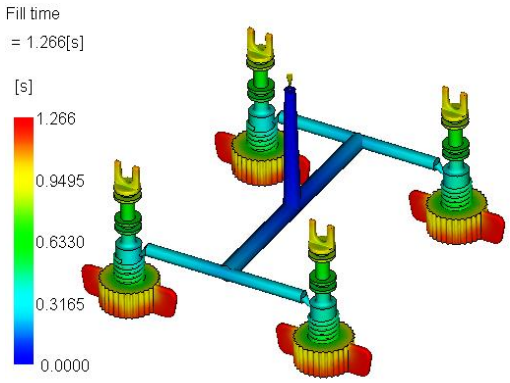
Fig. 2: Simulation Result A) Fill Time B) Injection Pressure C) Temp. At Flow Front D) Sink Mark E) Weld Line F) Air Traps G) Warpage

B. 2nd Iteration

Results obtained from first iteration can be further optimized by changing only the gate size. Feeding system is designed with submarine gate having Cold Runner Melt Flow Channel diameter of 5 mm, Gate diameter 1x3.5mm.The simulation result of 2nd iteration is as shown in fig 3 This result are better than one but there is a scope for further optimizing the gate sizes for less defect in the component



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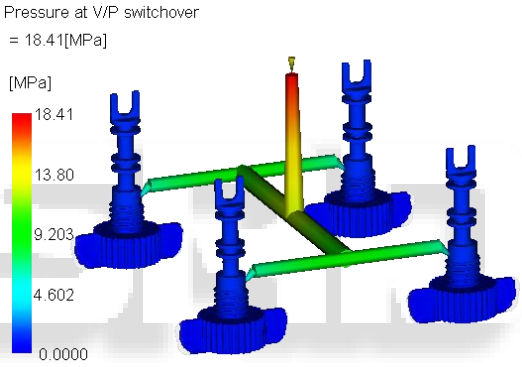

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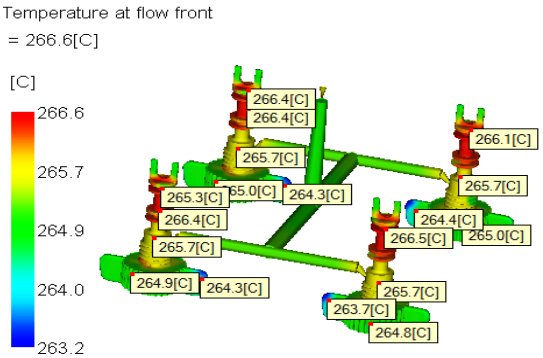

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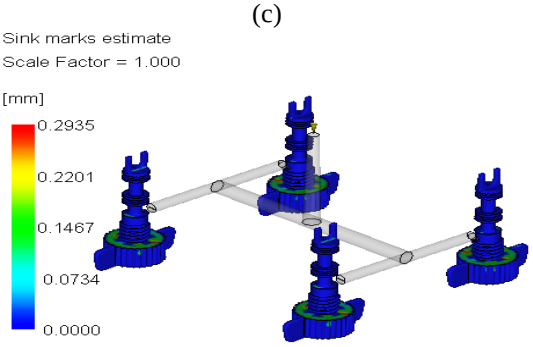

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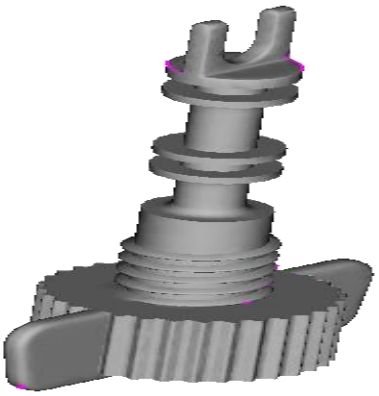

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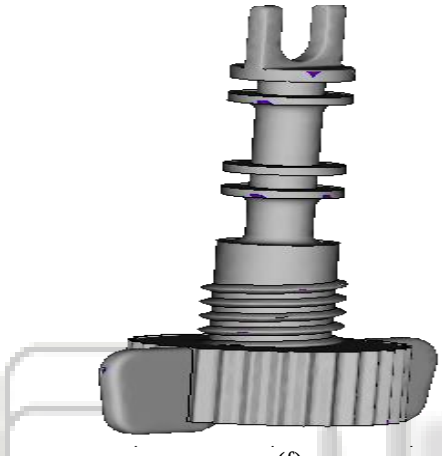

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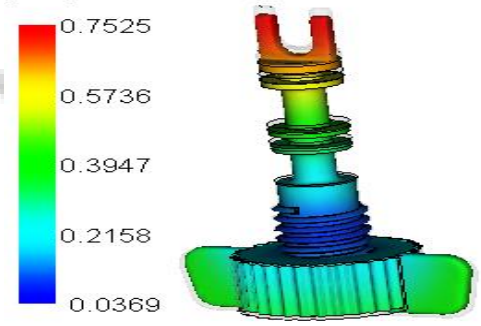

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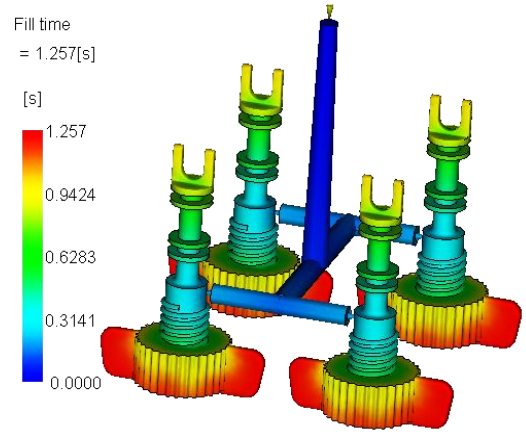
Fig. 3: Simulation Result A) Fill Time B) Injection Pressure C) Temp. At Flow Front D) Sink Mark E) Weld Line F) Air Traps G) Warpage

C. 3rd Iteration

Since the results obtained in first and second iteration are not satisfactory, feeding system is redesigned. Feeding system is designed with pin point gate having Cold Runner Melt Flow Channel diameter of 5 mm, Gate diameter 1.2x1.5mm.The simulation result of 3rd iteration is as shown in fig 3 The fill time is 1.257sec.with pressure of 14.77MPa sink mark weld line ,air traps and warpage is also is minimum.



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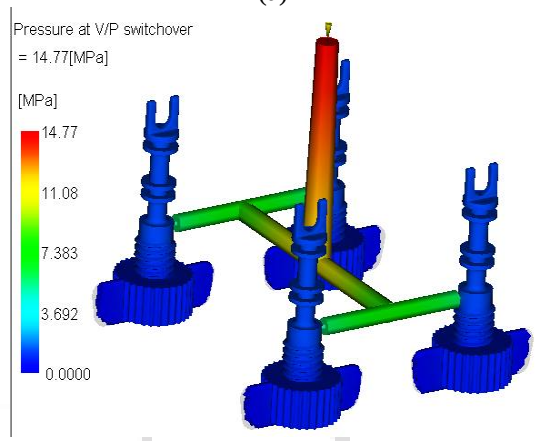

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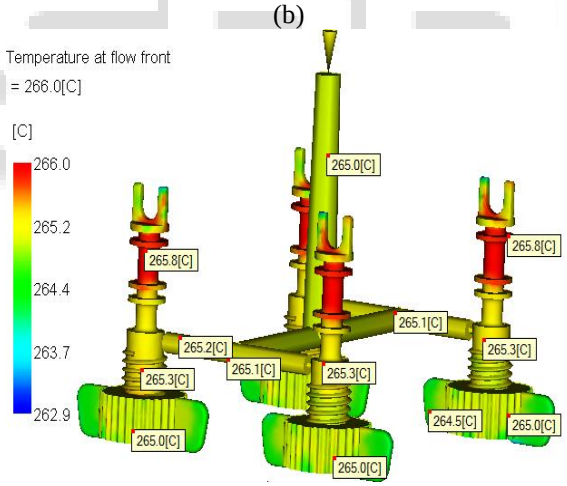

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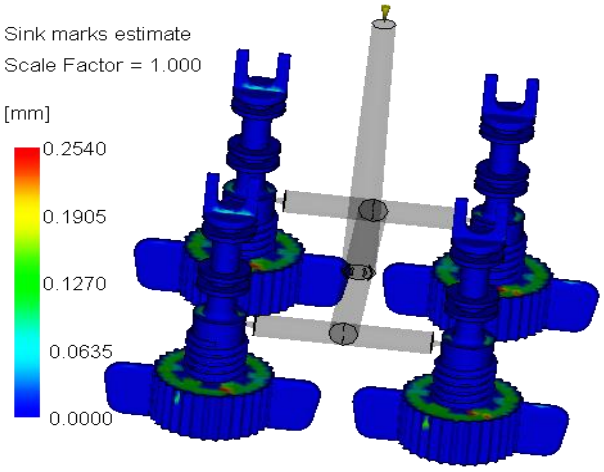

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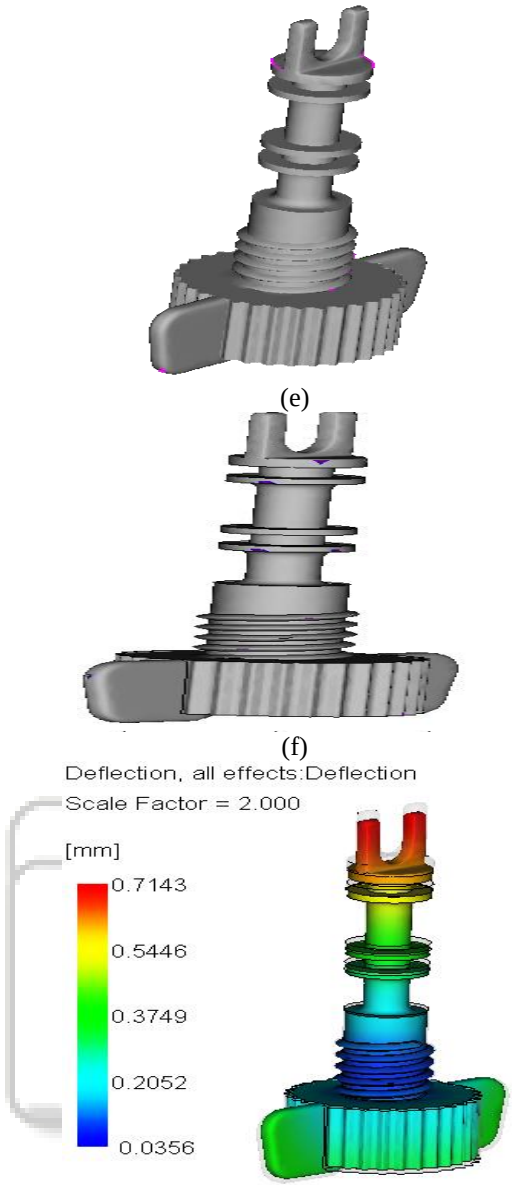

Fig. 4: Simulation Result A) Fill Time B) Injection Pressure C) Temp. At Flow Front D) Sink Mark E) Weld Line F) Air Traps G) Warpag

III. Conclusion

Mold flow analysis was carried out on the component and feed system of injection molding tool. This gave satisfactory results and the same was confirmed from analysis such as injection pressure, fill time, flow front temperature, quality of fill, weld line, air traps etc. The results indicated that the injection molded components could be manufactured with minimum molding defects. It is observed that out of three iteration, runner model with pin point gate system provide good result as compared to submarine gate. Minimum defects are observed in this iteration also minimum sink mark and warpage observed in iteration three. So iteration 3rd is the best iteration. The result comparison of three iteration is as shown in table 1

	Iteration 1st	Iteration 2nd	Iteration 3rd
Type of gate	Submarine gate.Dim:1 x3 mm	Submarine gate.Dim:1x 3.5 mm	Pin point gateDim:1.2x1.5 mm
Fill time	1.226	1.226	1.257
Injection Pressure	18.41MPa	18.41MPa	14.77MPa
Temperature At Flow Front	266.6	266.6	265
Sink Marks	0.2935	0.2935	0.2540
Air Traps	Acceptable	Acceptable	Acceptable
Weld Lines	Acceptable	Acceptable	Acceptable
Warpage	0.7522	0.7525	0.7143

Table 1: Result Comparisons

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