Scientific Journal of Impact Factor (SJIF): 5.71
e-ISSN (O): 2348-4470
p-ISSN (P): 2348-6406
International Journal of Advance Engineering and Research Development
Volume 5, Issue 04, April -2018

DESIGN AND DEVELOPMENT OF MOULD FOR BATTERY HANDLE STIFFNER

Prasad S. Kharote[1],Shubham S. Kothawade[2], Sanket S. Kotkar[3]
Manoj A. Randhir[4] Prof. Amit J. Somwanshi[5]

[1234]B.E Mechanical Engineering, Matoshri College of Engineering and Research Centre, Nashik
[5]Assistant Professor, Mechanical Engineering Department, Matoshri College of Engineering and Research Centre, Nashik

Abstract —*This has been opportunity to study, design and manufacture of moulding insert for battery handle stiffner. The optimal mould design along with production required component with necessary specification free from any defect with required strength and safety.Proper material selection and proper combination of alloys is selected for manufacturing of mould. Cost estimation procedure is carried out to predict the cost of a tool to be manufactured before it is actually manufactured. Fabrication is carried out starting from the process planning and assembly procedures. The report is made complete by process planning, and assembly procedure and Component try-outs. Added to this the Component is checked for dimensional accuracy and a note on cost estimation of the tool is included.*

Keywords*-battery handle stiffner, Unigraphics ,3D model,*

I. INTRODUCTION

Injection molding is a manufacturing technique for making parts from both thermoplastic and thermosetting plastic materials in production. Molten plastic is injected at high pressure into a mould, which is the inverse of the product's shape. Injection molding is widely used for manufacturing a variety of parts, from the smallest component to entire body panels of cars. The most commonly used thermoplastic materials are polypropylene (low cost, lacking the strength and longevity of other materials), ABS, polyamide etc. The ultimate aim of a machine is to produce no scrap material and increased product quality with reduced labour skill requirements low energy consumption, and minimal maintenance. Nowadays plastic consumption is more than metallic products due to its ease of production and high performance. Worldwide plastic consumption is at least 125,000 million pounds (by weight). About 30% of all the plastic parts are manufactured by the injection moulding process. This is one of the process that are greatly preferred in manufacturing industry because it can produce complex-shape plastic products and having good dimensional accuracy with short cycle times typical examples are automobile industry, aerospace, casings.

STIFFNER

- Stiffner is one of the main component in battery handle of invertor.
- The function of stiffner is to prevent slippage of cable from handle of invertor battery.

II. PROBLEM STATEMENT

- Previously, we were used plastic handles for battery handling but there was chance of accidents due to slippery nature of plastic handles.
- Due to weight of inverter battery during lift, rope gets slipped through handle so to avoid this problem we are designing and manufacturing a mould for proposed stiffner.

III. OBJECTIVES

The main objective is to develop a component which fulfills given quality and strength requirements according to safety point of view. Developing a design protocol for the tool to manufacture the component “Stiffner”, with the following design objectives

1. Developing an optimum solution.
2. Safety of user.
3. Life of battery increases.

IV. SCOPE OF THE WORK

The problem identified was approached scientifically by the following means:
The scope of the study for this project consists:

- Study of component.
- Conceptual design and calculation.
- Analysis for the component.
- Preparation of assembly and mould base drawings.
- Preparation of detailed drawing of core and cavity with all other mould elements.
- Tool manufacturing, assembly and inspection.
- Try-out and rectifying the defects if found.

V. METHODOLOGY

Methodology is a systematic approach for the realization of total task. It consists of the following detail:

- Study of the component: The study of the component is the most important and the first step for the designer. The component drawings are carefully scrutinized to extract the maximum possible amount of Information. The important information available is the critical dimensions, line of draw, parting line, suitable ejection system, and required side core.
- Solid model of the component: Solid modelling of component is done using "NX" considering all the critical dimensions.
- Step by step design Calculations: It is carried out to determine the various design parameters that determine the final mould clamp force required during injection, number of cavities, wall thickness of inserts, guide pillar design, design of feeding system, cooling calculations.
- Core and Cavity extraction: Extraction is done by providing proper shrinkage, tolerance is provided to the dimensions to which a cavity and core should be manufactured in order to produce a part of desired shape and size. The usual way to decide on the amount of shrinkage is to consult data supplied by the material manufacturer. While designing shrinkage is provided depending on the type of plastic material to be chosen for injection moulding. A thicker piece will have a higher shrinkage value compared to thinner section.
- Solid modelling of the tool: 3-D modelling of the entire mould is done using "NX". The required dimensions are determined by calculation, which is used during modelling of the tool.
- Mould flow analysis: Moldflow analysis is carried before tool manufacturing to determine input parameters to the injection moulding machine etc.
- Moldflow advisor analysis is carried before tool manufacturing to select best gate location and confidence of fill.
- Tool try-out and troubleshooting: After the tool is manufactured and assembled, the tool is tried to see that component produced is true to the geometry and dimensions specified by the customer. Try-out is a procedure where the tool is subjected to actual working condition and the performance of the tool is noted. After the tool has been tried out, the component is thoroughly inspected for various defects. If any defects are found, it is suitably reworked.

VI. PROPOSED DESIGN CALCULATION

Part Details

Name of the component: stiffner Material: PPM310 (Polypropylene)
Shrinkage: 1-2 %
Weight of the component: 4 g
Number of cavities: 4
Projected area of component: 37.48 cm2
The essential considerations are:

- Shot capacity
- Clamping force
- Injection pressure

1. Shot Capacity (SC)

The capability of machine is normally expressed in cubic centimeters of swept volume the injection cylinder. The shot is, therefore, the mass of this volume of plastic melt at the plasticizing temperature and pressure.

Thus

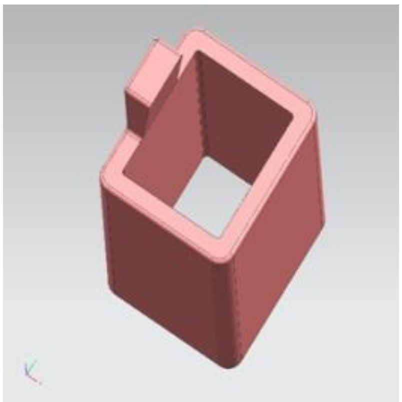

Fig.1Stiffner 3D model

Shot capacity (kg) = Swept volume x Density of material x Const.

Where, Constant = correction factor for percent volume expansion of the plastic at the moulding temperature for PP = 0.93 (Crystalline materials).
Density of material = 0.9 g/cm3
Shot capacity (g) = 23.894 x 0.9 x 0.93= 20g
Shot capacity of the machine with PP is 20g. Since the shot weight of the component is 4 g, the design is safe and production of the component can be carried out without any restrictions.

2. Injection pr. (kg/sq. cm.)

$$= \begin{bmatrix} \text{Injection hydraulic} \\ \text{Line gauge pressure} \\ \text{(kg./sq. Cm.)} \end{bmatrix} X \frac{d_i^2}{d_p^2}$$

= 133.4 X 20

= **2.663 tons/sq.cm**

d_i= Diameter of injection cylinder (cm)

d_p =Diameter of heating cylinder ram (cm)

$\frac{d_i^2}{d_p^2}$= 20 *on many plunger injection presses*

3. Clamping force

The clamping force required to keep the Mold closed during injection must exceed the force given by the product of the opening pressure in the cavity and the total projected area of all impressions and runners. Lower clamping values can be used with screw presses owing to the lower injection pressures possible with these machines.

Clamping force (Tons) = [Projected area of mould/s (sq.cm)] x [½ of injection pressure (Tons/sq.cm)]

= 37.48 X 0.5 X 2.668

= 60 (tons)

4. Gate:

Gate is a small area between the runner and the part cavity. The type, size and location of a Gate in an injection mold are critical to efficiently producing quality parts.

h = n x t

h = 0.63 mm

Where,

h = depth of gate (mm)

t = wall section thickness (mm) = 0.9

n = material constant (polypropylene) = 0.7 from Material properties.

5. The width of the gate controls flow rate

$$W = \frac{n\sqrt{A}}{30}$$

$W = 0.7 \text{ x } \sqrt{460} \text{ x } \frac{1}{30}$

W = 0.5 mm

Where,

W = gate width (mm)

A = surface area of Cavity (mm^2) = 23 X 20 = 460

n = material constant = 0.7

VII. CONCLUSION

- Injection moulding is extensively used to produce intricate parts for engineering and commercial applications from polymer granules.
- For this Material identification is required which is environment friendly, recyclable. So processing is to done in this field. So study on other process parameter is required for increment of production of quality based plastic products which should be defect free.
- Total weight of single component is 4 gm.
- Shot capacity of the machine with is 20 gm, the design is safe and production of the Component can be carried out without any restrictions.
- Cooling cycle time is 11 sec.
- After taking the testing of rope handle, we conclude that the battery up to **180 kg** weight can be lifted by using our design .so, obviously the safety of user increase which is the main purpose of our project

Fig 2 Final Assembly and Component

VIII. REFERENCES

1. GurjeetSingha*, Ajay Vermaa "A Brief Review on injection moulding manufacturing process"Materials Today: Proceedings 4 (2017) 1423–1433
2. Hong-Seok Parka, Xuan-Phuong Dangb "Development of a smart plastic injection mold with conformalcooling channels" Procedia Manufacturing 10 (2017) 48 – 59
3. Mehdi Moayyediana,*KazemAbharya, Romeo Mariana "New Design Feature of Mold in Injection Molding For Scrap Reduction" Procedia Manufacturing 2 (2015) 241 – 245
4. M. Kafara a*, M. Süchting b, J. Kemnitzer c, H.-H. Westermann c, R. Steinhilper "Comparative Life Cycle Assessment of Conventional and Additive Manufacturing in Mold Core Making for CFRP Production" Procedia Manufacturing 8 (2017) 223 – 230
5. Hong-Seok Parka, Xuan-Phuong Dangb "Development of a smart plastic injection mold with conformalcooling channels" Procedia Manufacturing 10 (2017) 48 – 59

