

Design of Ceiling Fan Regulator Knob

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ABSTRACT

Injection moulds are divided into two types based on runner design (i.e.) Cold runner moulds and Runner less moulds (i.e.) hot runner moulds. In cold runner moulds, for multi-cavity and multi-point injection moulds, there is wreckage of material in runner area. Sometimes wreckage of material is more than component weight. For avoiding the above problem, the technique used is hot Runner moulds. Hot runner mould is the advanced manufacturing methods for multi-cavity type moulds. These types of moulds are widely used for large production rate. While producing plastic components using normal/standard multi-cavity mould, we are facing the problems like partial filling, cavities in components, less product quality, injection pressure and temperature drop age and warpage etc. Thus we are redesigning the Ceiling Fan Regulator Knob by doing some modification in and this will be beneficial for our using purpose. We are making design of the component, mould flow analysis using software Solidworks.

KEYWORDS: mould, core-cavity, warpage, etc

I. INTRODUCTION

Injection moulding is a method of forming a plastic product from thermoplastics by feeding the material through the machine component called the hopper to a heated chamber in order to melt it and force the material into the mould by the use of the screw. In this whole process, clamping force should be constant till the material is solidified and is ready to be ejected from the mould. This is the most vernacular and preferable way of producing plastic products with any complexity and size.

The runner system congruous the molten plastic material coming from the barrel and guides it into the mould cavity. Its configuration, dimensions, and connection with the moulded part influence the mould filling process and, therefore, largely the quality of the product. In other words, the runner system prescribe part quality and productivity. Runner systems in ordinary moulds have the same temperature level as the rest of the mould because they are in the same mould block. The ideal injection moulding system delivers moulded parts of uniform density and free from all runners, flash, and gate stubs. To obtain this, a hot runner system, in contrast to a cold runner system, is employed. The material in the hot runners is preserve in a molten state and is not ejected with the moulded part. Unlike an ordinary cold runner, the hot runners are heated, so the plastic melt in the hot runners never solidified.

II. OBJECTIVES

The prime objective is to design the Injection Mould tool to produce good quality Component and economically and also:-

- Design and analysis of Ceiling Fan Regulator Knob.
- To improve the aesthetic view and reduce material wastage.
- Provide strength to the Knob.
- Provide grip to the knob.
- Applying a shrinkage to the part material, geometry and moulding conditions.
- Make conceptual design of mould.

III. MODEL STUDY AND MODELLING OF COMPONENT

Model study includes identifying the problems in Component, following are the problems involved in component

- Proper ejection method required to eject the component.
- Bosses at the sides needs for proper placement of screw inserts.

Component is modeled using the software SOLIDWORK Component has a circular in structure with following dimensions:

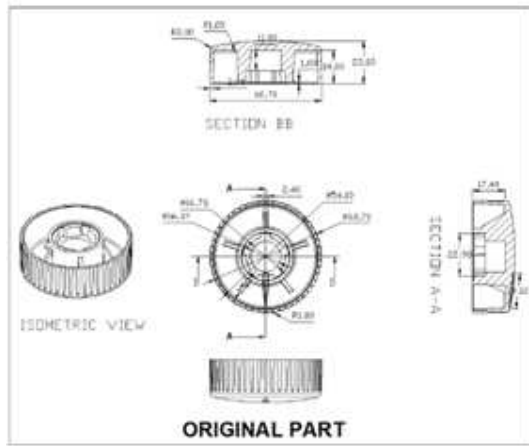


Figure No.1 Dimension of Knob.

Other details of model are given below:-

Component name: circular knob

Component material: PP (polypropylene)

Shrinkage: 1.5

Moulding type: Eight Cavity injection mould tool

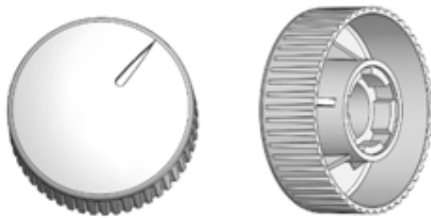


Figure No. 2 3D model of Knob.

IV. DESIGN OF MOULD

This section describes the design aspects and other considerations involved in designing the mould to produce plastic box.

Three design concepts is considered in designing of the mould including:

1. Three-plate mould (Concept 1) has two parting line with single cavity.
2. Two-plate mould (Concept 2) has one parting line with many cavities with gating and ejection system.
3. Two-plate mould (Concept 3) has one parting line with single cavity without gating system.

For designing the mould first concept had been applied. First, the mould was designed based on the flat dimension of the plastic injection machine used. Mostly, core and cavity extraction was done on the basis of the criticality of the component, after core-cavity extraction from specified modeling software, mold base also modeled on the same software, at last core cavity inserts are assembled into the mold base.

Design calculation

Numeric calculation to be carried out to predict the weight of the component, Shot Capacity, Plasticizing Capacity, Clamping Capacity, on which machine mold to be loaded, plasticizing and shot capacity of the machine, and cooling parameters like inlet and outlet temperature effect, quantity of water to be circulate. These results are tally with the simulation results during moulding.

Data from CAD model
 Material = Polypropylene
 Mass = 10 grams
 $Q_B = 546 \text{ KJ/Kg}$
 Density = 1 kg/dm^3
 Moulding Temp = $250 \text{ }^\circ\text{C}$

Calculation of Number Cavities Based on:-

1. Shot Capacity

$$N_s = \frac{0.85 \times W}{M}$$

Where,

N_s : Number of cavities based on shot capacity

M : - Mass of component.

W : - shot capacity for polymer

$$W = S_v \times \rho \times C$$

S_v : - Swept Volume

C : - Constant

ρ : - Density of material.

$$S_v = 100 \text{ cm}^2$$

$$W = 70 \times 1 \times 0.95$$

$$W = 66.5 \text{ gm.}$$

$$N_s = \frac{0.85 \times W}{M}$$

$$N_s = \frac{0.85 \times 66.5}{10}$$

$$N_s = 5.65$$

$$\approx 5$$

2. Plasticizing Capacity

$$N_p = \frac{0.85 \times P \times T_c}{3600 \times M}$$

Where,

N_p : - Number of Cavities Based on Plasticizing Capacity.

T_c = cycle time

$$T_c = \frac{M \times 3600}{P_s}$$

M = Mass = 10 gram.

P_s : - Plasticizing Capacity of Machine

$$= 6.1 \text{ kg/hr}$$

$$T_c = \frac{10 \times 3600}{6.1 \times 1000}$$

$$T_c \approx 5.9 \text{ second.}$$

Q_A - Total Heat Content of Polystyrene.

Q_B - Total Heat Content of Material.

$$P = \frac{P_s \times Q_A}{Q_B}$$

$$P = \frac{6.1 \times 279.4}{448}$$

$$P = 6.1 \text{ Kg/hr.}$$

$$N_p = \frac{0.85 \times P \times T_c}{3600 \times M}$$

$$N_p = \frac{0.85 \times 6.1 \times 5.9 \times 1000}{3600 \times 10}$$

$$N_p = 8.4 \approx 8$$

Determination of number of cavity

From the above calculation of component and its shape and size 8 cavity moulds is preferred.

V. TOOL ASSEMBLY

Tool assembly is done in modeling software, includes the positioning of extracted core and cavity inserts into the mould base, after assembly 3D models are converted into the 2D drawings for manufacturing process.

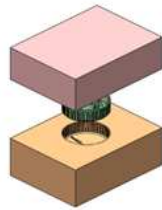


Figure No.3 Core Cavity Extraction (Exploded view)



Figure No. 4 Assembly of mould tool



Figure No.5 3D model Assembly of Mould Tool

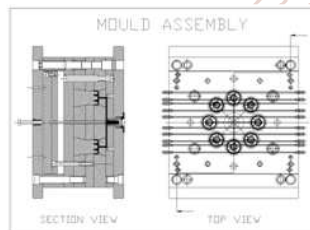


Figure No.4 Drafting of Mould Assembly.

VI. CONCLUSION

In this project, we carried out the Design of Ceiling Fan Regulator Knob. The complete injection mould tool is

designed for fabricating knob by using solidwork. All the parts of assembly get fitted exactly and has not shown any error in software.

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