

## Design of bottle cap mould for droplet bottle

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### Abstract

The design of bottle cap mold cludes the analysis of parts structure, the selection of injection molding machine and mold base according to relevant data, and the verification of some parameters of injection molding machine.

### Keywords

bottle cap; mould; design; parting surface.

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### 1. Principle of injection Molding

Enough plastic particles are poured into the injection molding machine drum, the plastic moves along the screw groove under the action of the screw, and the temperature is increased to a uniform density after heating and shearing of the screw thread. The viscous flow plastic fluid with uniform composition and temperature distribution is then injected into the closed mold cavity at low temperature rapidly under the screw pressure. The melt plastic is solidified and formed gradually at low temperature and the finished product is taken out at the end of the opening mold.

### 2. Selection of injection Molding Machine

If the volume of the plastic part is calculated and analyzed, the mass of the solidified material can be estimated by 20% of the volume of the plastic part. This design is determined to be 1 module 16 cavity, the required injection volume is

$$V = 1.2nV_1 = 1.2 \times 16 \times 1.38 = 26.50 \text{ cm}^3 \quad (1)$$

The density of PE is 0.92g/ cm. So, the quality of the plastic parts is

$$M_1 = \rho \times V_1 = 1.27\text{g} \quad (2)$$

The total quality is as follows

$$M = 16 \times 1.2 \times 1.27 = 24.38\text{g} \quad (3)$$

According to the process parameters, data and documents of PE material, SZ-60/450 horizontal injection machine was selected.

### 3. Design the structure of forming parts

#### 3.1 Design of gating system

The main elements of the gating system are: main channel, shunt channel, gate, cold well.

The main channel is a channel between the nozzle of the machine and the inlet of the shunt channel. The size of the channel is closely related to the flow velocity and the filling time of the plastic melt. This design is small die design, for processing convenience, bushing and positioning ring using a split, the main channel length of 40 mm, is about the thickness of the template. The bushing material is T 10 A steel, and the surface hardness is high after heat treatment.

The shunt channel is a channel between the main channel and the gate. It is usually opened on the parting surface and has the function of shunt and guide. The shunt channel should be designed to ensure that the flow direction of plastics is smoothly converted and soon filled with cavity, the temperature change in the flow is as small as possible, and the plastic melt can be evenly distributed to each cavity.

The gate is the channel between the shunt and the cavity. This mold design uses side gate, shape is rectangular.

Cooling wells are generally designed at the end of the main channel, and cold wells can also be added at the end when the length of the diversion channel is longer. This is a small die design that can use a cold well with a drawing rod at the bottom.

#### 3.2 structural design of concave and convex die

The concave mold acts on the outer contour of the molding part. Because the mold is very simple and belongs to a small mold, the concave mold uses an embedded combination. The punch is used to shape the inner contour of the plastic part. Because the mold uses a push plate demoulding and belongs to a small mold, a single cylindrical core is used.

#### 3.3 Design of steering mechanism

This design is a small template, so a single-section guide post is used. Due to the mold requirements are not high, so no more refueling slot. The guide parts should be reasonably designed around the die, and the center of the guide parts should be kept in sufficient length from the specific edges of the die to ensure that the die has sufficient strength to overcome the change in shape after pressing the guide post and the guide sleeve.

#### 3.4 Design of demoulding mechanism

The design mould is designed to guide the movement direction of the push plate by using the ordinary push rod and the guide post, and the guide sleeve will interact with the guide post. In order to reduce the loss of the guide sleeve, the quenching sleeve should be designed to be favorable to the replacement. In the mould designed this time, no reset rod is designed separately, and the push rod makes the push mechanism return to the original position. When the die is closed, the fixed die surface is in contact with the push plate, thus using the push rod to drive up and push down to make it return to its original position. In the opening of the die, the waste slag solidified in the main channel is pulled out under the action of the drawing rod. The die adopts semi-circular drawing rod.

The mold temperature is 60 °C in the process of processing. The average temperature of the mold is about 20 °C when the common water is used as the cooling medium, and the temperature of the mold can reach 30 °C when it flows out from the outlet. The diameter of the channel selected for the cooling system is 10 mm.

### References

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