

## MANUALLY OPERATED HAND MOULD DIE

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**Abstract** - Within the context of molds and dies production, frequent changes in design and increased competitiveness require an overall optimized manufacturing process. The finishing process is typically composed of an accurate milling stage to manage shape deviations, followed by polishing operations to reach required surface roughness. In this project we had design a new type of connector which connects the existing cap with new filter. Due to this project we save the time and money to a larger extend. Injection moulding machine is one of the most widely used method for conversion of plastics into various end products application to wide range of plastic material.

**Key words:** *Cavity Plate, Punch Plate, Guide pins, Injection moulding.*

### 1. INRODUCTION

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 mold, which is the inverse of the product's shape. After a product is designed, usually by an industrial designer or an engineer, molds are made by a moldmaker (or toolmaker) from metal, usually either steel or aluminium, and precision machined to form the features of the desired part. Injection molding is widely used for manufacturing a variety of parts, from the smallest component to entire body panels of cars. Injection molding is the most common method of production, with some commonly made items including bottle caps and outdoor furniture. Injection molding typically is capable of tolerances equivalent to an IT Grade of about 9–14. The most commonly used thermoplastic materials are polystyrene (low cost, lacking the strength and longevity of other materials), ABS or acrylonitrile butadiene styrene (a terpolymer or mixture of compounds used for everything from Lego parts to electronics housings), The main principle is to compress the plastic material in a heating chamber (barrel) with the help of plunger and induction coil convert plastic polymer into molten (semi-solid) state. Then the plastic polymer in predetermined quantity is forced through the nozzle into the die under pressure. After completing the process, final product is obtained from the die. We can use plastics, metals or alloys for this process. In our project we are using plastics polymers for making a connector which is going to connect the filter with the existing bottle cap. This machine is a prototype for producing small plastic

components. This injection moulding machine is very useful for the small scale industries because of its low manufacturing cost, low maintenance cost, no skilled worker is required. It can be recommended for small scale investors those who are willing to produce small plastic products.

### 2. DESIGN METHODOLOGY

This paper highlights a practical design procedure/methodology of an injection molding die, adopted by analyzing the various parameters to produce a precious industrial component namely RAM component for an electrical transformer has been choked out in detail aspect which is as follows.

#### 2.1 Design Methodology.

To startup a new mold design, the designer should know some important points to avoid some mistakes before going further. i.e., Product outlook design, material usage, correction shrinkage of the material, number of cavities and selection of mold base. In injection molding, there is an optimum gate size and it should large enough for suitable fill rate and small enough seal off and prevent back flow or over packing [15]. The mould which contains one or two basic parts. A stationary mould half on side where the plastic is injected. A moving half on the closing side or ejecting side the separation between the two mould is called parting line. Usually the melted plastic material i.e polypropelene (PP) and polyvinyl chloride(PVC) which is fed through the central channel called spru or cavity the mould will coincide with machine cylinder nozzle. In this project we are manufacturing a hand mould die for connector in which the material is directly going to flow through the runner and from the runner it will get towards the gate which is opened to cavity and hence when the material is reached to the cavity, the article is crafted. The manually operated hand mould die through which the article is crafted should have optimum design for the runner and gate, if it is not designed in a proper way then, there will be wastage of the material per shot. It will consume much more time which will adversely affect the production rate. The wall thickness between the punch and cavity should be maintained in such a way that the article which is required in a highly accurate dimension must be achieved.

## 2.2 Cad/cam for mould design

The architecture of mould design system is proposed based on practical design parameters and conceptual design stage mainly consist of concept generation and concept evolution cad/cam can help designer to speed up design for the lastic part and mould design process and reduce the long lead time.The mold has to be designed to produce good quality connector component considering the ease of manufacturability, assembly and positive ejection of the component within the minimal time and cost. The design of double cavity molding tool is carried out using software AUTO CAD.the detailed drawing of mould is prepared by AUTO CAD and it is used for manufacturing the tool and connector.the mould is manufactured as per drawing specification.the performance of tool is tried out and significantly the defects are troubleshooted.the mould flow analysis using AUTODESK MOULD FLOW software is carried out on a component to achieve a good quality mould before moulding and to check the manufacturability of a moulding part.

The steps involved in the methodology followed for the manufacturing of mould design is as followed.

- 1) Definition of the problem.
- 2) Literature review.
- 3) Conceptual design and design calculations.
- 4) Mould flow analysis.
- 5) CAD modeling of a tool.
- 6) Tool manufacturing.
- 7) Assembly and tryout of a tool.
- 8) Cost estimation of a tool.

### 2.PROBLEM DEFINITION



Fig.2.1 existing bottle cap and filter.

Fig.3.2 shows the new filter and the existing bottle cap.the diameter of this new filter is reduced to a desired extent,because of the reduction in the diameter of the filter the required volume of the water is achieved.the main problem is that,the diameter of the existing cap and the diameter of the new filter is different so they do not get connected.So we are going to design the connector which is going to connect the new filter with the existing cap.



Fig.2.2 New filter and existing bottle cap.

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### 3. CONCEPT OF PROJECT

We propose a design plan that will be used for the production of the connector which is required to fulfill the requirement of the company. We are going to design a hand mould die which is going to do the mass production of connector which is required by the company to fulfill its requirement. Fig.2.1 shows the existing bottle cap and filter which company uses for the filtration purpose. because of the diameter of the existing filter, the volume of water which get stored in the bottle is reduced. Because of this problem the company manufactured the new filter which is shown in the fig.2.2.To connect the existing bottle cap and the new filter which company had recently designed we are manufacturing a hand mould die of a connector.The plastic material of the connector which is going to be used for the mass production of the connector is polyvinyl chloride and polypropelene as well.The

material from which the mould is going to be manufactured will be of mild steel and p20 (2738) steel. In this project we are going to manufacture as follows.

- 1)Cavity Plate.
- 2)Punch Plate.
- 3)Cavity guide pin
- 4)Bush.
- 5)Cavity side backplate.
- 6)Punch side backplate.
- 7)Runner.
- 8)Gate.

#### 4. WORKING PRINCIPLE

##### 4.1. Punch Plate.

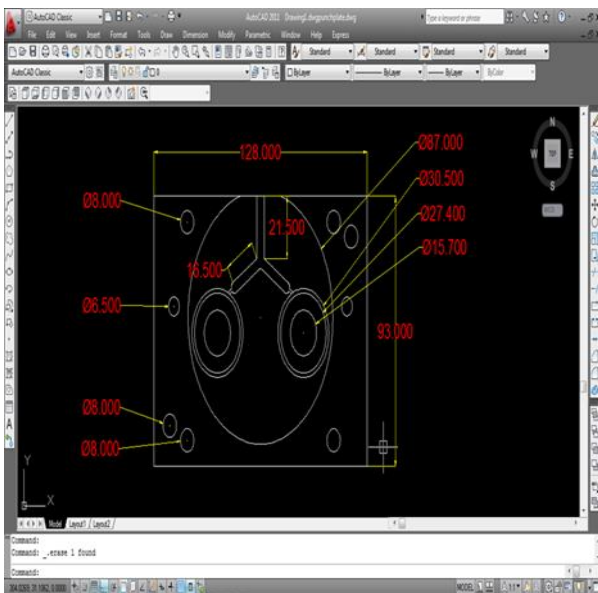


Fig 4.1 punch plate

The punch plate is one of the main component in the connector designing. It consists of the total eight holes, four of them are going to carry guide pins on which the mould is going to function, two of them are for the ejector pins which help to release the article from the mould. The remaining two of them will be for bolting which is required to joint the punch support plate. The punch plate is out centered in order to decrease the runner length, because of the reduction in runner length, the molten plastic will take much less time to enter the mould and it will also reduce the plastic consumption per each shot of the machine. Side runner is provided to it. In this plate the punch is going to be fitted externally in order to reduce the metal consumption. Also the advantage of fitting the punch externally is it can be replaced if need occurs.

##### 4.2 Punch side backplate.

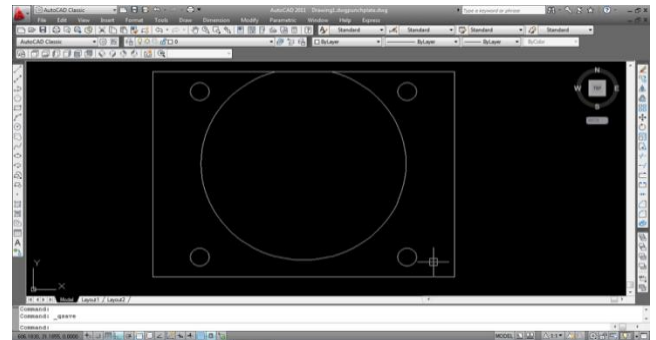


Fig4.2 Punchside back plate.

The punch side back plate is only going to support the punch plate. It is going to connect the punch plate with it by means of bolting. The head of the bolt will be on the backside of this plate. The guide pin holes will be tapered in order to make the function of the mould rub free.

##### 4.3 Cavity Plate.

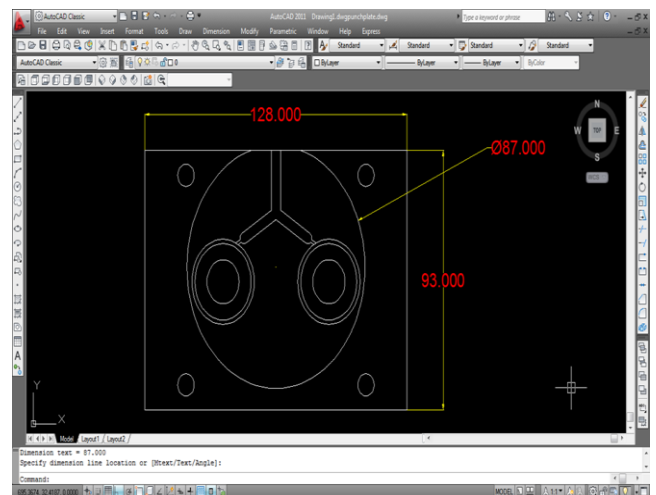


Fig4.3Cavity plate.

The cavity plate consists of a hollow part in which the article is going to produce. The cavity plate is out centered in order to match the exact dimension with the punch plate. The cavity plate will be splitted into two parts in order to release the final article produced from the mould. The guide pins will be fixed in the punch side where as in the cavity it will not be fixed due to the continuous function of the cavity side. The gate area from which the material is going to enter into the cavity is manufactured very smaller than runner in order to create the immense pressure so that the molten plastic will get injected at a very high speed which helps in resulting the greater surface finish. The cavity guide pins will be used to make the splitted cavity into a single cavity. The wall thickness of the final article will be maintained by designing the gap between cavity and punch.

#### 4.4 Cavity guide pin.

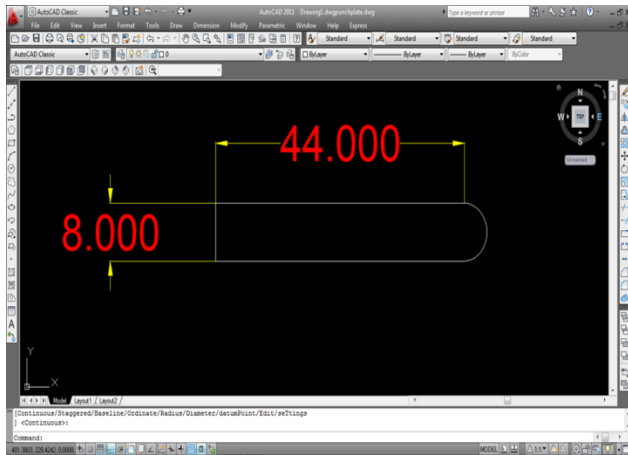


Fig 4.4 Cavity guide pin

The cavity guide pins will be used to connect the splitted cavity part into a single cavity. the diameter of the guide pins will be tapered because of the continuous function of the cavity. It will be designed in such a way that minimum friction will be there and due this the life of the hand mould die will be longer.

#### 4.5 Cavityside back plate

The cavityside back plate is designed to support the cavity plate. due to the continuous function of the cavity plate it is possible that it may lead to a wearing of it, in order to encounter this problem cavityside back plate is designed. the backside of the cavity plate is raised and the frontside of the cavityside back plate is hollowed. the raised part of the cavity closed for the injection of molten plastic. when the injection work is finished, the cavity plate and cavityside back plate is dismantled to split the cavity plate, and the final object is taken out from the mould.

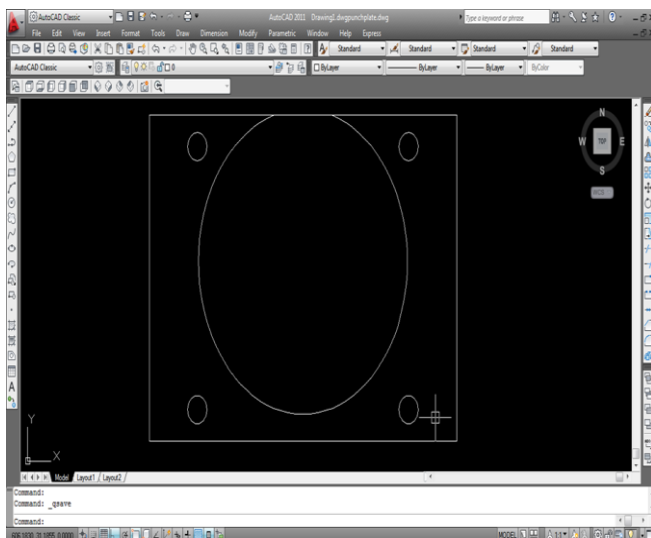


Fig.4.5 Cavityside backplate.

#### 5 Gate and runner.

The runner which is going to be used in this mould design will be side runner. there are many types of gate like direct sprue gate, side runner gate, fan gate, pinpoint gate, disk gate, ring gate, film gate, tab gate, submarine gate etc. we are going to design the side runner gate because of the company requirement.

#### 6 Shrinkage ratio.

Moulding shrinkage ratio.

Molding shrinkage will occur in the process of cooling solidification of molten resin filled at the cavity, so relatively big molding shrinkage will occur in the case of crystalline resin like PBT resin. Molding shrinkage ratio depends on mutual effect of many factors, and the major factors will be the followings.

1. Resin temperature.
2. Mold temperature.
3. Injection pressure.
4. Injection speed.
5. Injection time
6. Molded product thickness.
7. Filling material, shape of the reinforcing material, and content.

#### 7. SUMMARY

As can be seen in the working principle above. The requirement of the company is fulfilled by the designing of die.

#### 8. RESULT

The company called Premsons Plastics Private Limited has given us the project to design and manufacture the manually operated hand mould die of a connector. We had designed and will be manufacturing the mould according to the design which we had produced in this paper. With the designing of this connector mould, The company's requirement is fulfilled.

#### 9. SPECIAL FEATURES OF PROJECT

Due to manufacturing of hand mould the cost of the project has decreased to a greater extent as compared to an injection moulding. Time taken to produce a hand mould die is negligible as compared to injection moulding so the time is saved.



## 10. CONCLUSION

In this project instead of making injection mould die for a bottle cap which is already existing we are designing and manufacturing manually operated hand mould die for the production process of connector which will successfully connect the new filter with the existing bottle cap. Due to this achievement company will be able to reduce its cost and time significantly.

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## BIOGRAPHIES



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