

## Modeling of Rubber Bush Mould by using DME Standard

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### Abstract

With increasingly short life span of consumer electronic products such as mobile phones, computers, and bags; they are becoming more fashionable and requires continuous improvement. Injection molding remains the most popular method for producing the associated plastic parts in minimum time. In injection process, a molten polymer is injected into a cavity inside a mold with the help of injection machine which is cooled and the part gets ejected. There are several phases in an injection molding process that involves filling, cooling and ejection. The cost-efficiency of the process is dependent on the time spent in the molding cycle. There are various stages out of which die design is the most time consuming stage; here modified die with the help of existing data can reduce various defects such as shrinkage, sink marks, etc.

**Keywords:** injection molding, die design, warpage, sink marks

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### INTRODUCTION

There are various techniques used for generating plastic parts. Injection moulding is a manufacturing technique which is used to generate both thermoplastic and thermosetting plastic material parts in production. In this process molten plastic is injected at high pressure into a cavity, which is the inverse of the product's shape. An industrial designer designs this cavity according to product design.

The next stage is making of mould; these moulds are made by a mould maker (or toolmaker) from various metals, usually either steel or aluminum, and precision machined to form the features of the desired part. We can manufacture a variety of parts with the help of injection moulding, from the smallest component to entire body panels of cars. Injection moulding is the most common method of production, with some commonly made items including mobile body, bag handle, tiffin box, etc. [1-5].

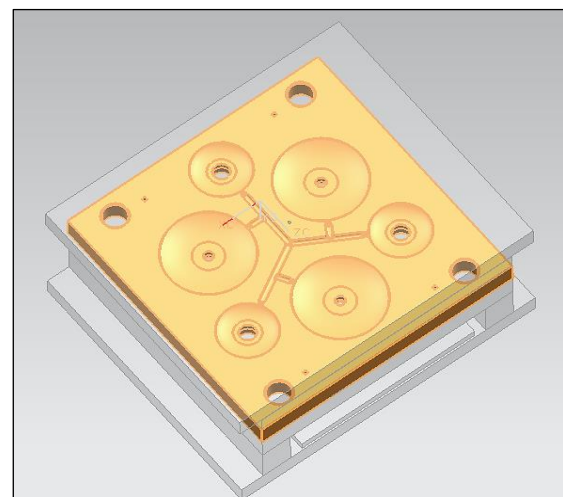
### DIE DESIGN

Mould is a hollow form or cavity into which molten plastic is forced to give the shape of the required component. The term generally

refers to the whole assembly which is also called as a tool or die.

### Existing Design

According to industrial design, a transparent view of the existing design is as shown in Figure 1.



**Fig. 1:** Transparent View of Die [1].

### Parts and Assembly Design of Mould

- The size and measurement of the standard components are directly related to the platen size, the shot capacity, locking force and other parameters of the moulding machine.

- A mould system is defined as an assembly of mould parts, the parts, the plates of which conform to accepted structural shape and size.
- Here, two-plate mould is adopted as the standard mould system because it is the most widely used design in industrial practice. Standard mould base includes all elements of a plastic mould, except the core and cavity inserts.
- Different internal national agencies manufacture standard mould system. Out of them, the following two are quite common.
  1. DME standard, and
  2. HASCO standard

**1. DME Standard**

Standards have N-type ranges of mould systems which include bore plates plus guide pillars, guide bushes, dowels and cap screws. Assembled mould unit consisting of bored plates, push back pin, sprue bush, locating ring, etc.

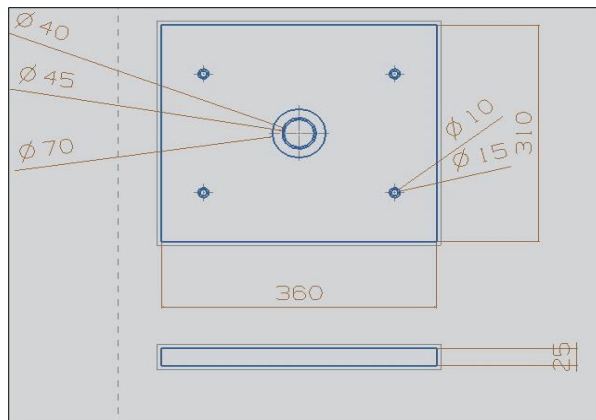


Fig. 2: (a) 2D Drawing of Top Plate.

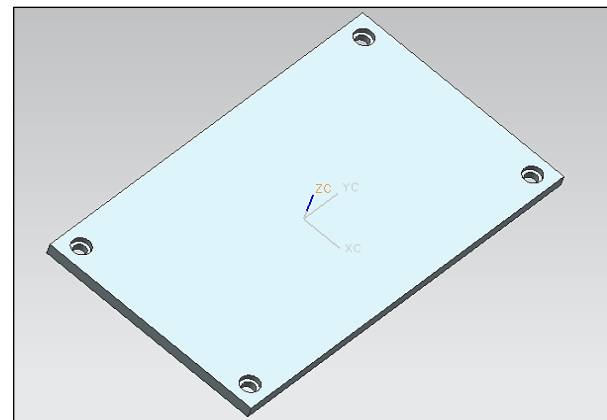


Fig. 2: (b) 3D Model of Top Plate.

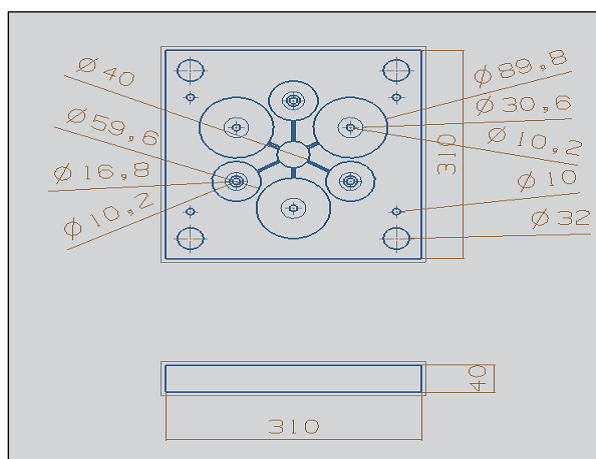


Fig. 3: (a) 2D Drawing of Cavity Plate.

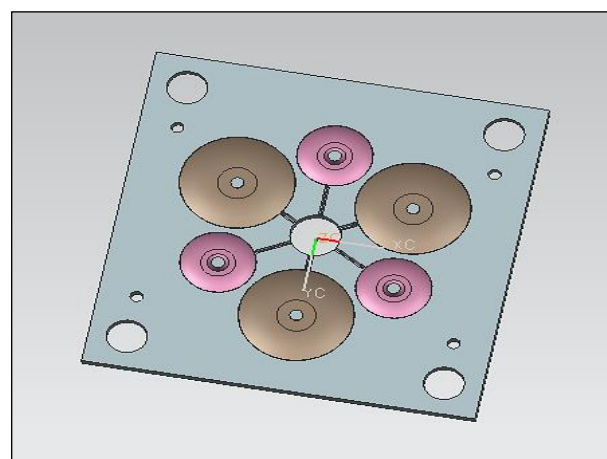


Fig. 3: (b) 3D Model of Cavity Plate.

**2. HASCO Standard**

In this standard, K standard elements are used to designate their standard system. Here mould plates are supplied, bored and ground to accommodate guide pillars, guide bushes, etc. Here, we preferred the DME standard for mould design.

**Different Parts Used in the Design**

With the 3-D and 2-D detailed drawing, the different parts used for making the assembly are listed below:

**Top Plate**

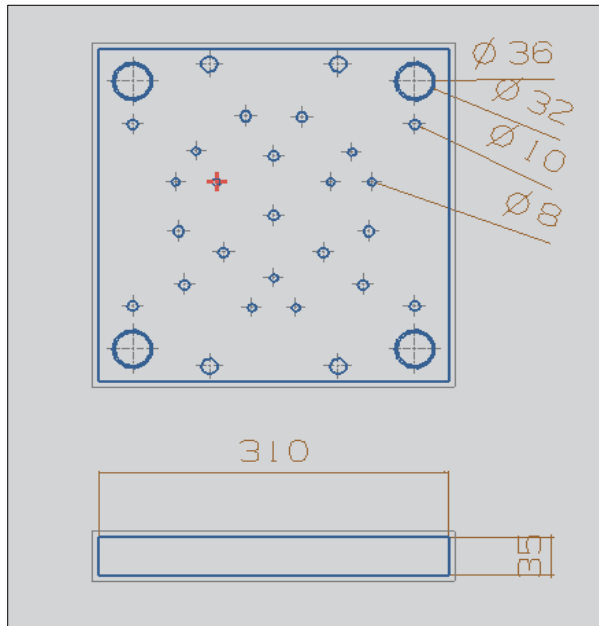
It holds the fixed side of the mould to be attached with the fixed platen of the injection moulding machine. On this plate, locating ring, eye bolt and sprue bush are attached (Figures 2a and b).

**Cavity Plate**

It is used to hold cavity side of the product, leader pin, guide pillar, support pin, puller bolts and finger cam with the slider attached (Figures 3a and b).

**Core Plate**

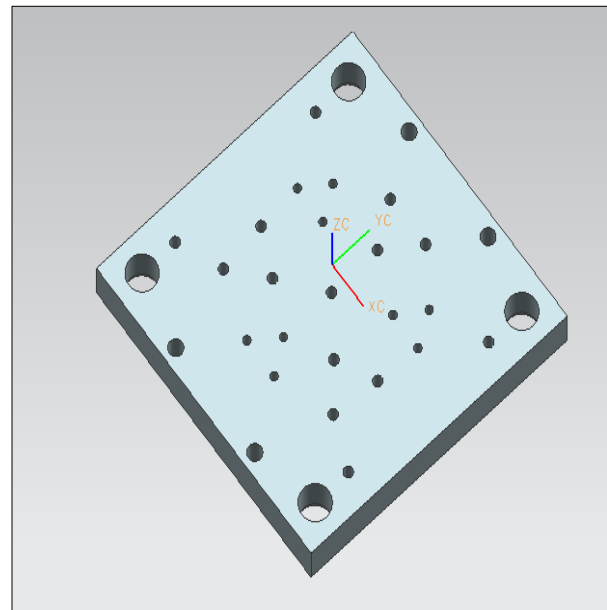
It is used to attach the core side of product, return pin, leader bush and split, if needed (Figures 4a and b).



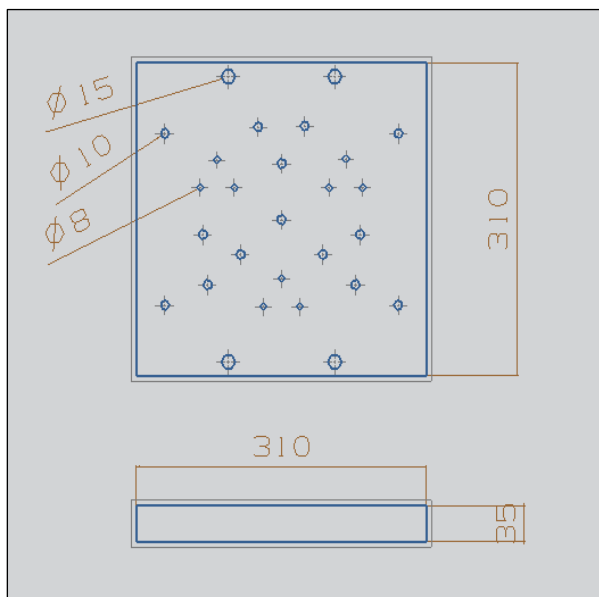
**Fig. 4: (a) 2D Drawing of Core Plate.**

**Core Back Plate**

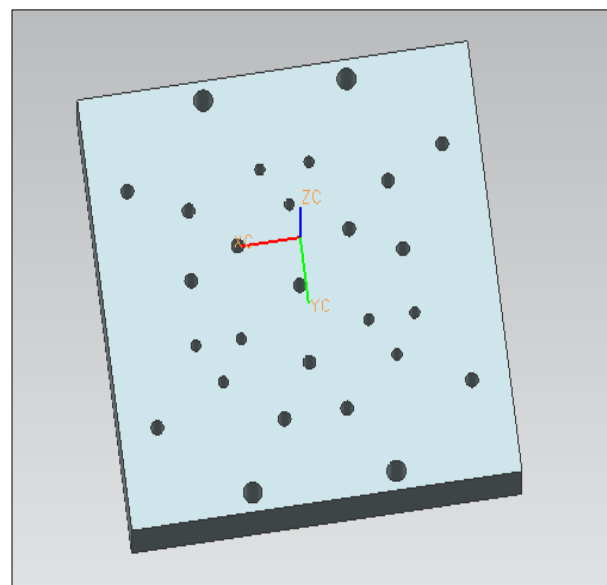
It is used to support cavity plate and to attach the hole for return pins and cooling channels (Figures 5a and b).



**Fig. 4: (b) 3D Model of Core Plate.**



**Fig. 5: (a) 2D Drawing of Core Back Plate**



**Fig. 5: (b) 3D Model of Core Back Plate.**

**Spacer Block**

It is mounted between the bottom mountings plate and the movable core back plate to give space for ejection system. The required length of spacer block depends on ejection stroke required to eject the component (Figures 6a and b).

**Ejector Plate**

It is used to hold the ejector pin, sprue puller, push back pin, and place for ejector pin and support pillar (Figures 7a and b).

**Ejector Back Plate**

It pushes the ejector pins and return pins fixed in the plate (Figures 8a and b).

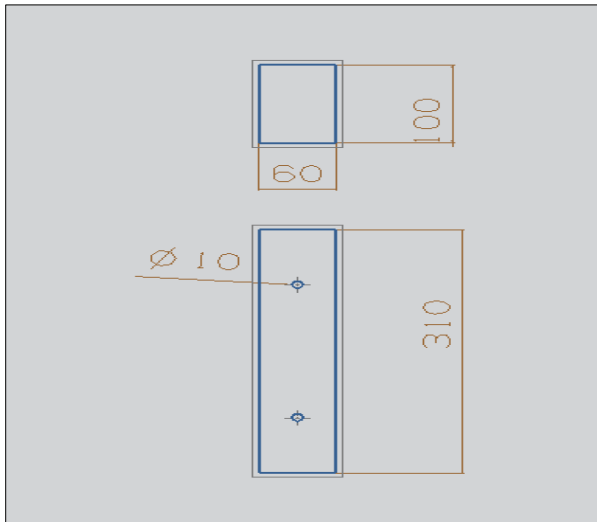


Fig. 6: (a) 2D Drawing of Spacer Block.

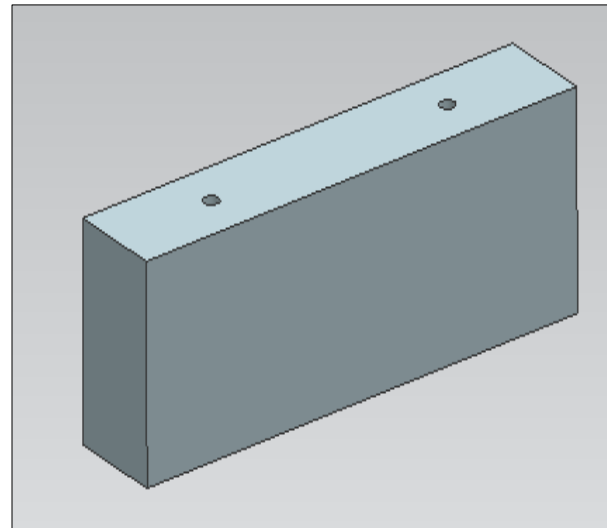


Fig. 6: (b) 3D Model of Spacer Block.

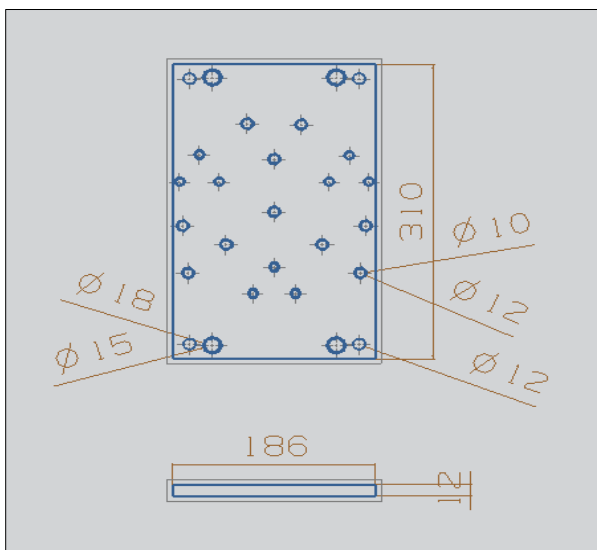


Fig. 7: (a) 2D Drawing of Ejector Plate.

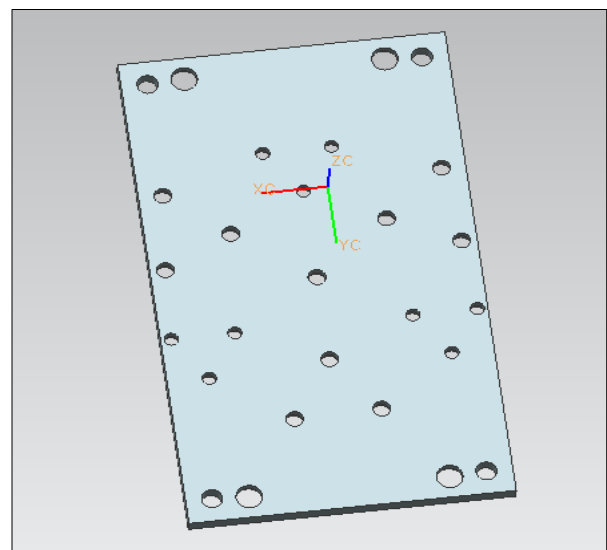


Fig. 7: (b) 3D model of Ejector Plate

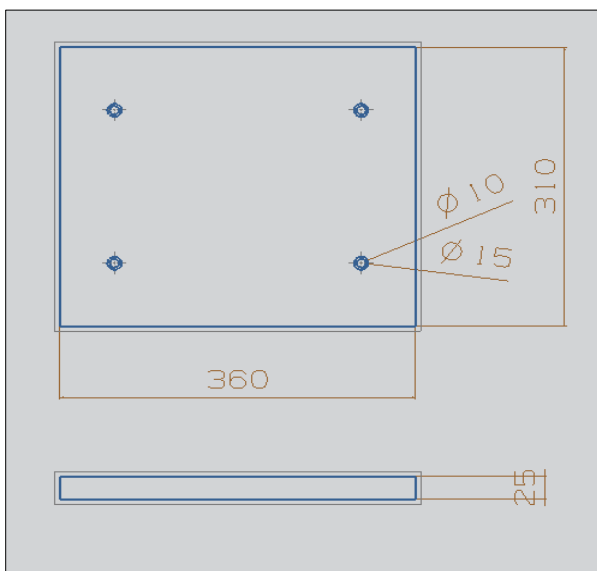


Fig. 8: (a) 2D Drawing of Ejector Back Plate.

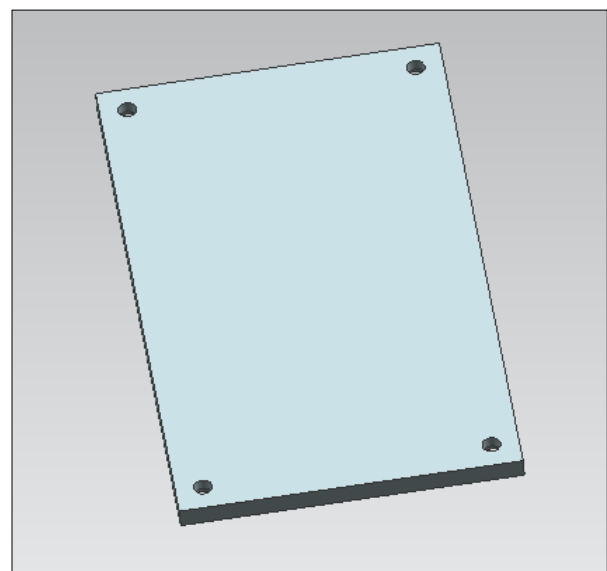


Fig. 8: (b) 3D Model of Ejector Back Plate.

### Ejector Pin

It is used to eject the part from the cavity plate (Figures 9a and b).

### Guide Bush

A guide is used in a mould to provide a suitable wear resistance surface for a movable guide pillar. The internal diameter of the hole of guide bush is designed as a slide fit on the

adjacent pillar whereas external diameter is press fit into the mould plate. A radius is made at front end of the bore to provide a lead in for the guide pillar (Figures 10a and b).

### Sprue Puller

It is provided to pull the material from the sprue bushing (Figures 11a and b).

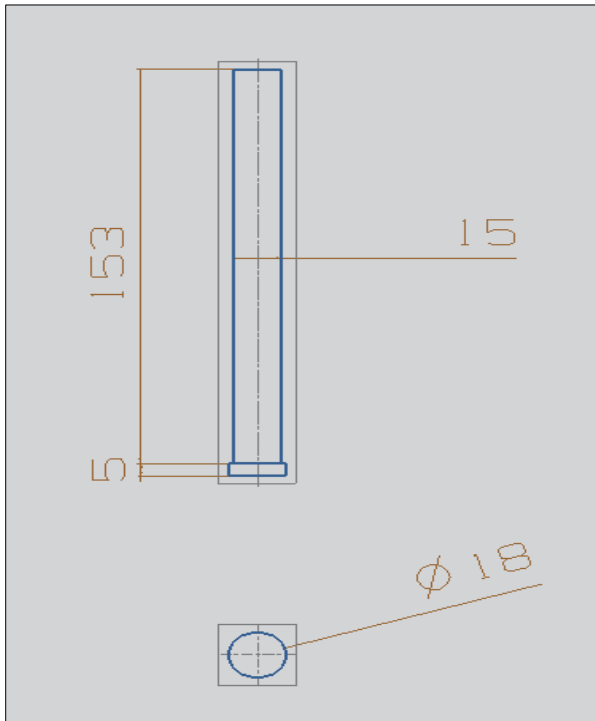


Fig. 9: (a) 2D Drawing of Ejector Pin.

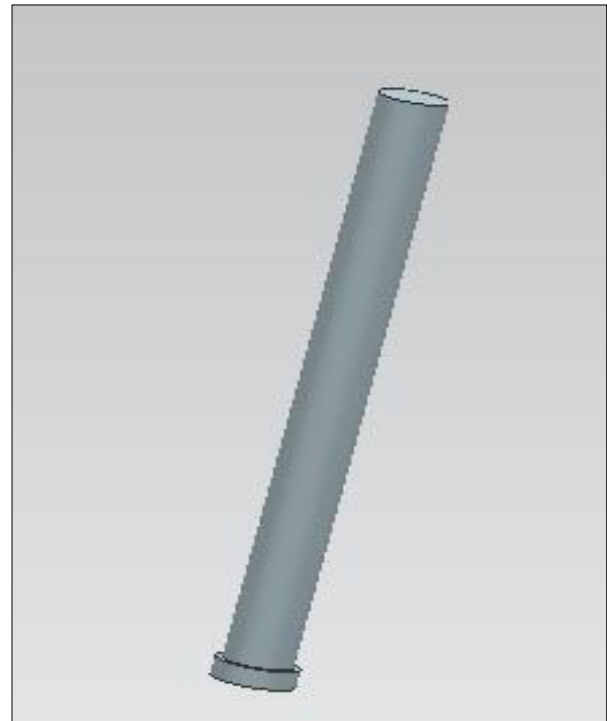


Fig. 9: (b) 3D Model of Ejector Pin.

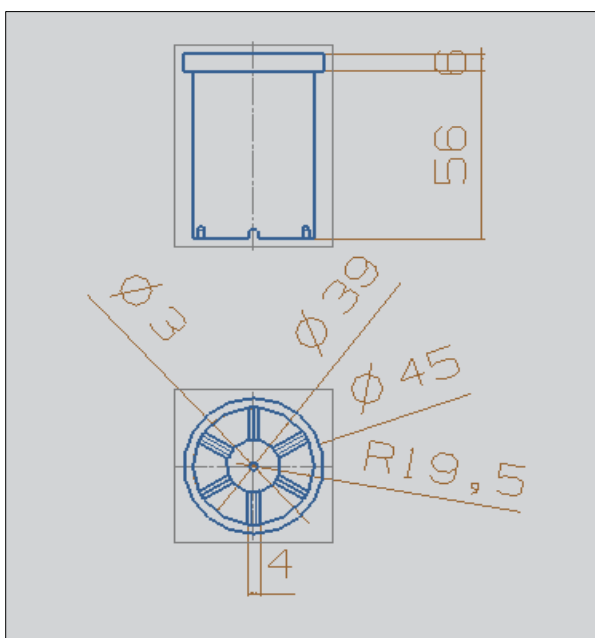


Fig. 10: (a) 2D Drawing of Guide Bush

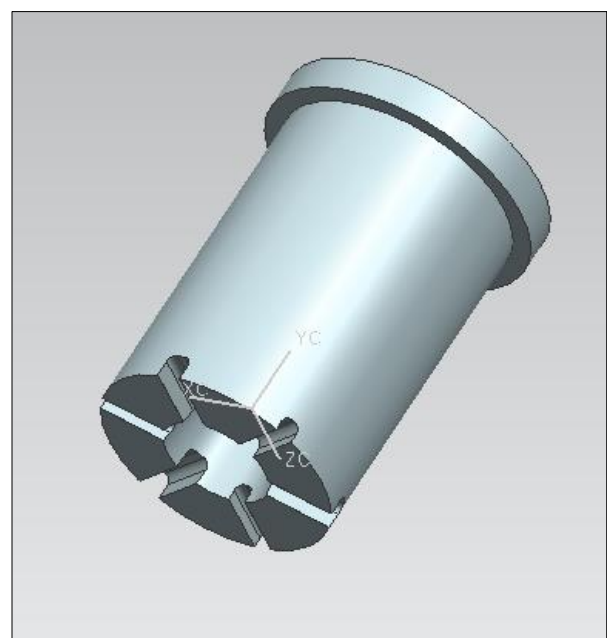


Fig. 10: (b) 3D Model of Guide Bush

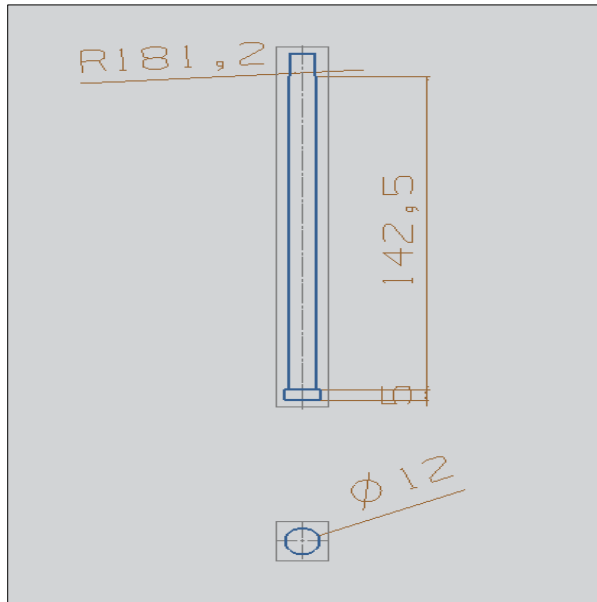


Fig. 11: (a) 2D Drawing of Sprue Puller.



Fig. 11: (b) 3D Model of Sprue Puller.

**Bottom Plate**

It holds the movable side of the mold like spacer block, support plate, cavity plate, and ejector mechanism to the movable platen of the injection machine (Figures 12a and b).

**Assembly Design**

**Setup**

In this setup, we changed the runner system as well as gating system as shown in Figure 13. The runner system was designed as the whole

cavity at same distance from the sprue so that during cavity fill all of the parts were filled simultaneously. Second thing that we changed was the gating system. Here we used modified trapezoidal gate instead of half round gating system; the reason to choose this gate system was that whenever we used trapezoidal section it creates pressure during fill unlike half round gating system. The whole setup in 3D as well as transparent view is as shown in Figure 13.

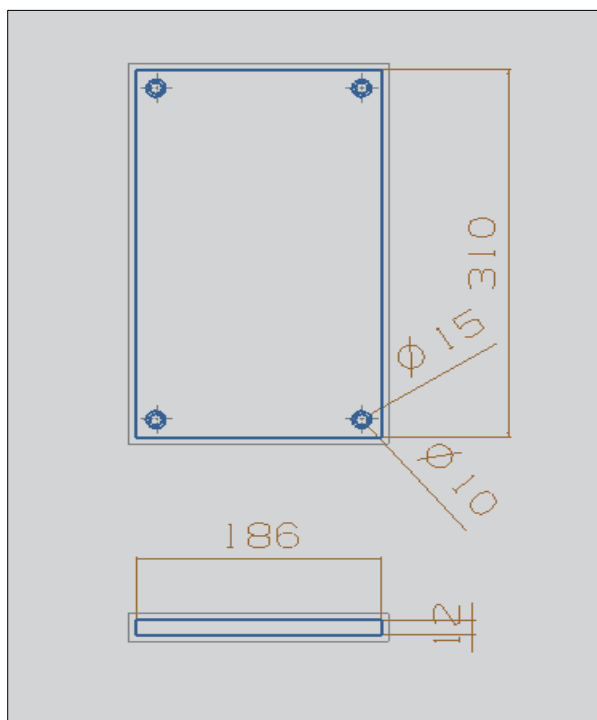


Fig. 12: (a) 2D Drawing of Bottom Plate.

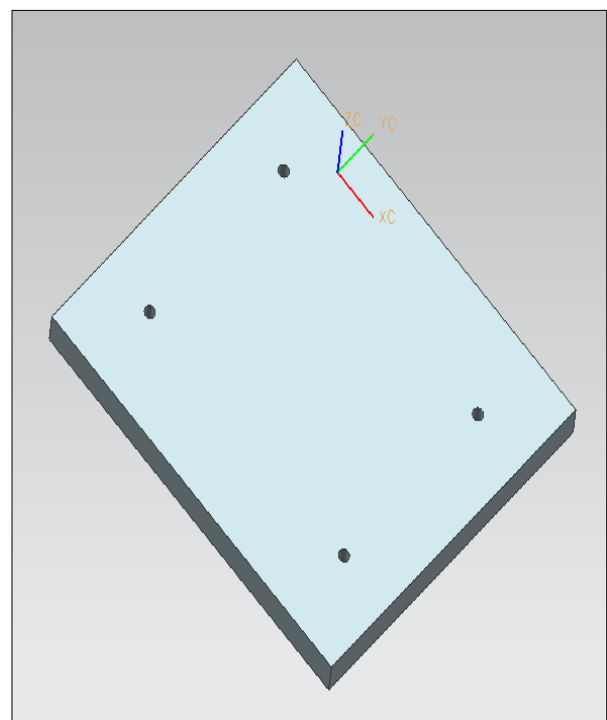
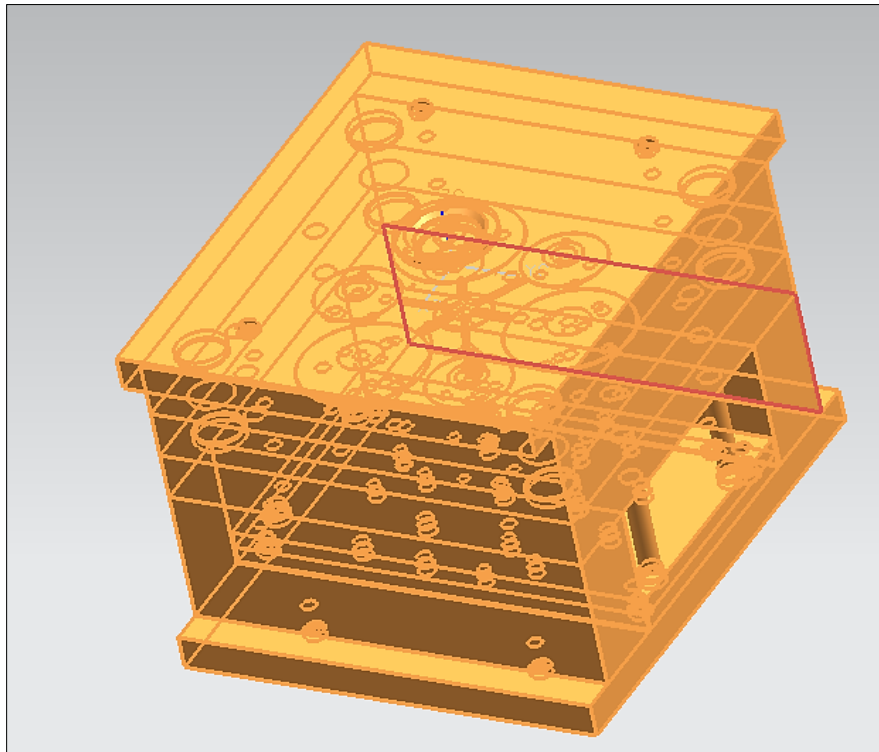


Fig. 12: (b) 3D Model of Bottom Plate.



**Fig. 13:** 3D Setup of Assembly Design.

## CONCLUSION

As existing design is totally experience based and there is no any standard applied, design is not viable or trustable. The new design is totally based upon DME standard that can help to reduce defects such as warpage, sink marks, etc.

## FUTURE SCOPE

The design can be analyzed with mold flow, verified with experimental result, and compared with existing data.

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