

# Design and Fabrication of Stool Leg Bush Die for Injection Moulding Machine

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**Abstract:** Injection moulding is considered to be one of the most prominent process for mass production of plastic products the object moulded can be depend on the selection of proper mould and behavior of the polymeric material in injection moulding process. The injection moulding machine melts and plasticize the moulding material inside the heating cylinders and inject this into the mould to create the product. In this project, the stool leg bush die is designed and modeled for the required dimensions by using PRO-E software. By using CNC milling simulator, the die simulation work is done using NC program .The die is manufactured by CNC milling machine. The stool leg bush is made by using injection moulding machine.

**Keywords:** Injection Moulding, Polimeric Material, Pro-E, Stool Leg Bush

## 1. Introduction

Injection is the most important plastics manufacturing process. Injection moulding can be used to form a wide variety of products. It produces such small products as bottle tops, children's toys and containers. In producing product by injection moulding process, the quality of the product is very important. The product should be good in physical and mechanical properties in order to have a good performance for consumer. 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), polyamide (chemically resistant, heat resistant, tough and flexible – used for combs), polypropylene (tough and flexible – used for containers), polyethylene, and polyvinylchloride or PVC (more common in extrusions as used for pipes, window frames, or as the insulation on wiring where it is rendered flexible by the inclusion of a high proportion of plasticizer .

## 2. Injection molding Machines

For thermoplastics, the injection moulding machine converts granular or pelleted raw plastic into final molded parts via a melt, inject, pack, and cool cycle.

Injection molding machine are broadly classified into 2 types

- 1) Plunger type injection molding machine
- 2) Screw type injection molding machine

## 3. Design of Stool Leg Bush Die

In our project creo 4.0 is used .Injection mold tool also known as die or mold. The dies are two types, fist one is single cavity die and second one is multi cavity die. For increasing the production rate with minimizing the cost purpose, implemented multi cavity injection mold. Tool designed depends on finalized part design dimensions.

## 4. Manufacturing of Die

Some of sequential steps having to manufacturing the multi cavity die; the navigating steps are Raw material selection, Pre machining, CNC Milling, Heat Treatment, Surface Grinding, CNC Milling, Sparking, Wire EDM Process, Polishing, and Assembly.

Selected Mild steel (MS) raw material based on the DME and HASCO designed standards to design and manufacturing the tool. In below table contains raw material sizes of components of injection tool.

## 5. CNC Milling Simulation Software

Based on factories' manufacturing and colleges' teaching experience, Nanjing Swan Software Technology Co., Ltd developed the following software: FANUC, SIMUMERIK, MITSUBISHI, GSK, HNK, KND, and DASE

## 6. CNC Programming for Milling

### Programme for Part 1

```
G40G49G80
G21
G91G28Z0
M06T01
G90G54
G00X0.Y0.Z100
M08
M3S8000
G40G49G80
G21
G91G28Z0
M06T01
G90G54
G00X0.Y0.Z100
M08
M3S8000
X-25Y-25Z9
G01Z-2F100
X50
Y50
X-25
```

Y-25  
Z10  
G01Z-2F100  
X45  
Y45  
X-20  
Y-20  
Z10  
G01Z-2F100  
X40  
Y40  
X-15  
Y-15  
Z10  
G01Z-2F100  
X35  
Y35  
X-10  
Y-10  
Z10  
G01Z-2F100  
X30  
Y30  
X-5  
Y-5  
Z10  
G01Z-2F100  
X25  
Y25  
X0  
Y0  
Z15  
M15  
M30  
**PROGRAMME FOR DIE 2:**  
G40G49G80  
G21  
G91G28Z0  
M06T01  
G90G54G00X0.Y0.Z100  
M08  
M3S8000  
X-50Y-50Z9  
G01Z-2F100  
X100  
Y100  
X-50  
Y-50  
Z10  
G01Z-2F100  
X95  
Y95  
X-47.5  
Y-47.5  
Z10  
G01Z-2F100  
X90  
Y90  
X-45  
Y-45  
Z10  
G01Z-2F100

X85  
Y85  
X-37.5  
Y-37.5  
Z10  
G01Z-2F100  
Z15  
M15  
M30

The programme is to be continued up 20 mm.

**PROGRAMME FOR PART 3:**

G40G49G80  
G21  
G91G28Z0  
M06T01  
G90G54  
M08  
M3S800  
X-13Y-13Z10  
G01Z-2F100  
X13  
Y13  
X-13  
Y-13  
Z10  
X-18Y-18  
G01Z-2F100  
X18  
Y18  
X-18  
Y-18  
Z10  
X-23  
Y-23  
G01Z-2F100  
X23  
Y23  
X-23  
Y-23  
  
Z10  
X-28Y-28  
G01Z-2F100  
X28  
Y28  
X-28  
Y-28  
Z10  
X-33Y-33  
G01Z-2F100  
X33  
Y33  
X-33  
Y-33  
Z10  
X-38Y-38  
G01Z-2F100  
X3  
Y38  
X-38  
Y-38

Z10  
 X-43Y-38.5  
 G01Z-2F100  
 X43  
 Y38.5  
 X-43  
 Y-38.5  
 Z10  
 X-45Y-38.5  
 G01Z-2F100  
 X45  
 Y38.5  
 X-45  
 Y-38.5  
 Z10  
 M15  
 M30  
 The programme is continued up to 15mm

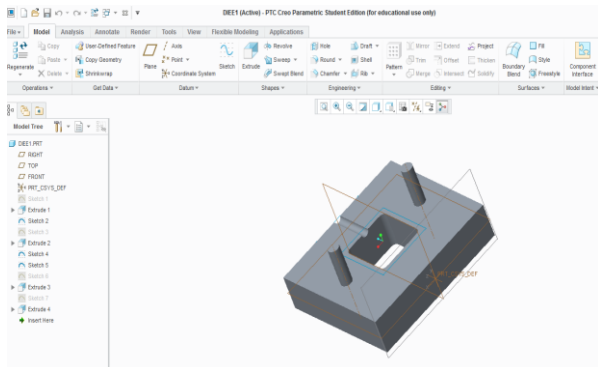
### 7. Part Manufacturing

The process cycle for injection moulding is very short, typically between 2 minutes.

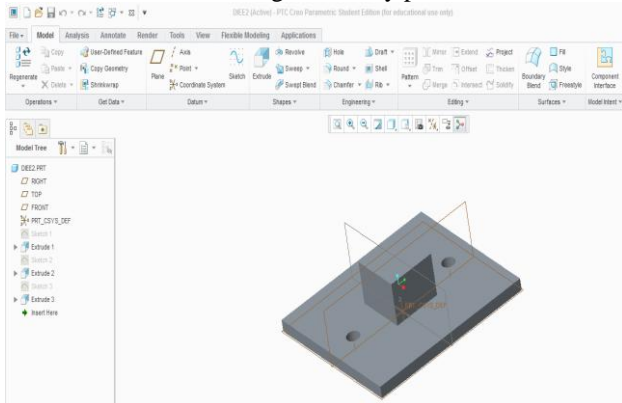
Consists of the following stages:

- 1) Clamping
- 2) Injection
- 3) Cooling
- 4) Ejection

### 7.1 Figures and Tables



3.1. Design of cavity plate



3.2.design of core plate



5.1.FANUC 0-MD(milling machine)



5.2. FANUC 0-MD(milling machine)



7.1.PP Material Pellets



7.2.Clamping





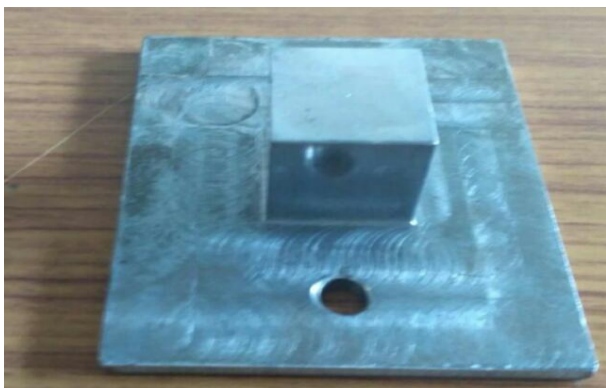
7.3.Injection



7.4.Die part-1



7.5.Die part-2



7.6.Die part-3

|                 |    |    |    |
|-----------------|----|----|----|
| Core Plate      | 5  | 77 | 88 |
| Cavity plate(2) | 20 | 77 | 88 |

## 8. Result and Conclusion

The stool leg bush die modeled in pro-e and simulated by using swan NC milling software. It is manufactured by using CNC milling machine. The required die is produced for injection moulding machine.



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### Die Dimensions

| Material Purpose | Height (mm) | Width (mm) | Length (mm) |
|------------------|-------------|------------|-------------|
|------------------|-------------|------------|-------------|