

# **ME-566- Design for Manufacturability**

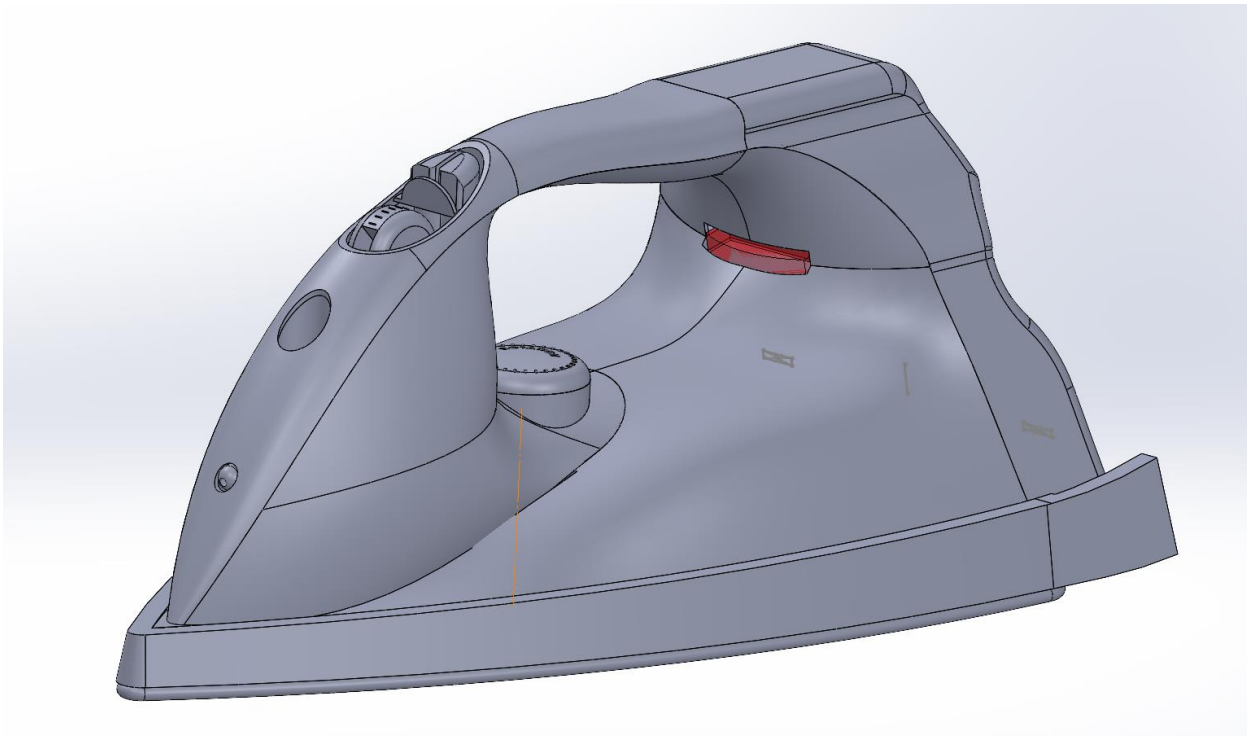
## **Group 5**

Nidhish Patel – 100% Contribution

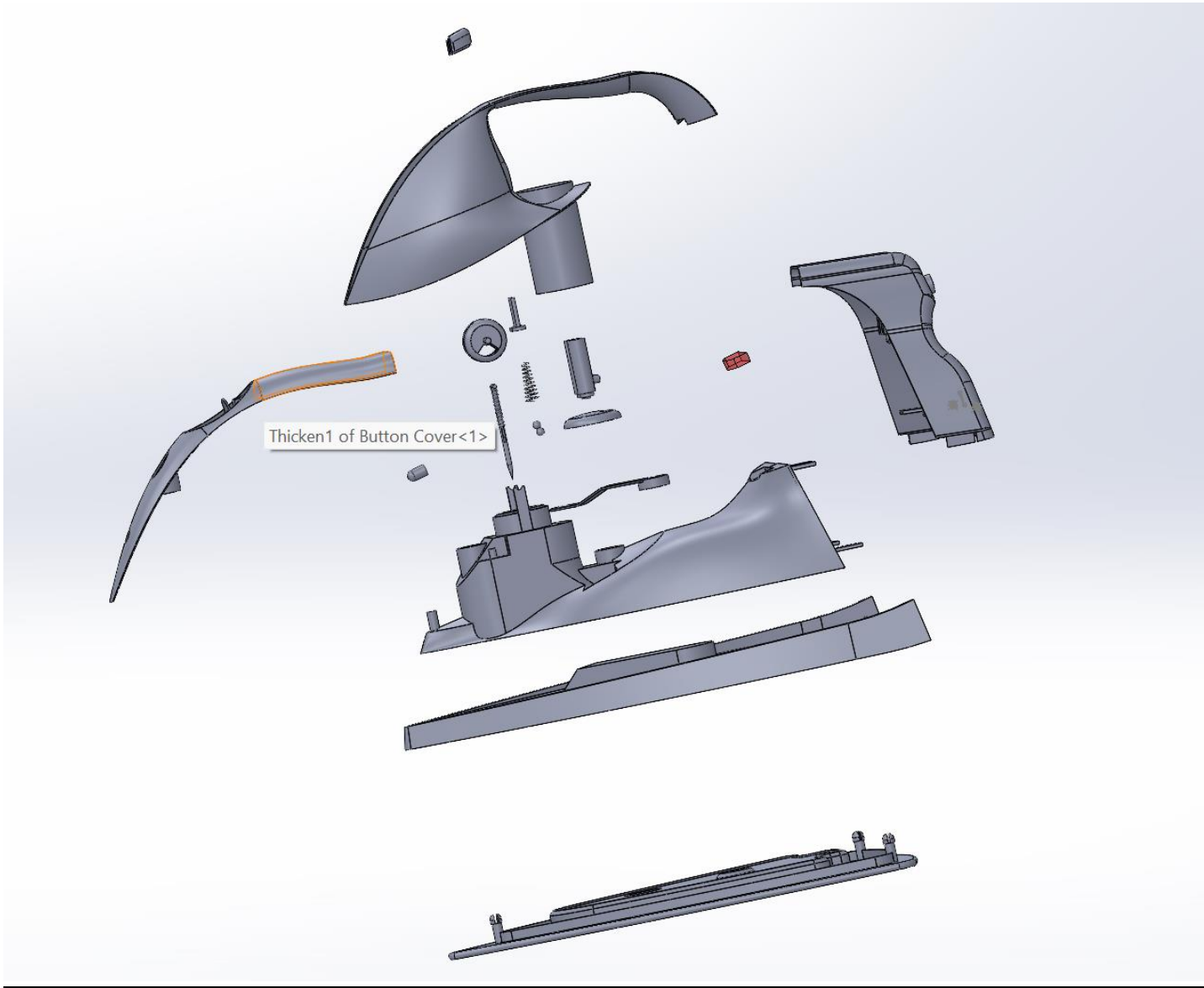
Kalpak Hedawoo - 100 % Contribution

Sneh Gabani – 30% Contribution

## **Final Assembled Model**



Exploded View of Assembly

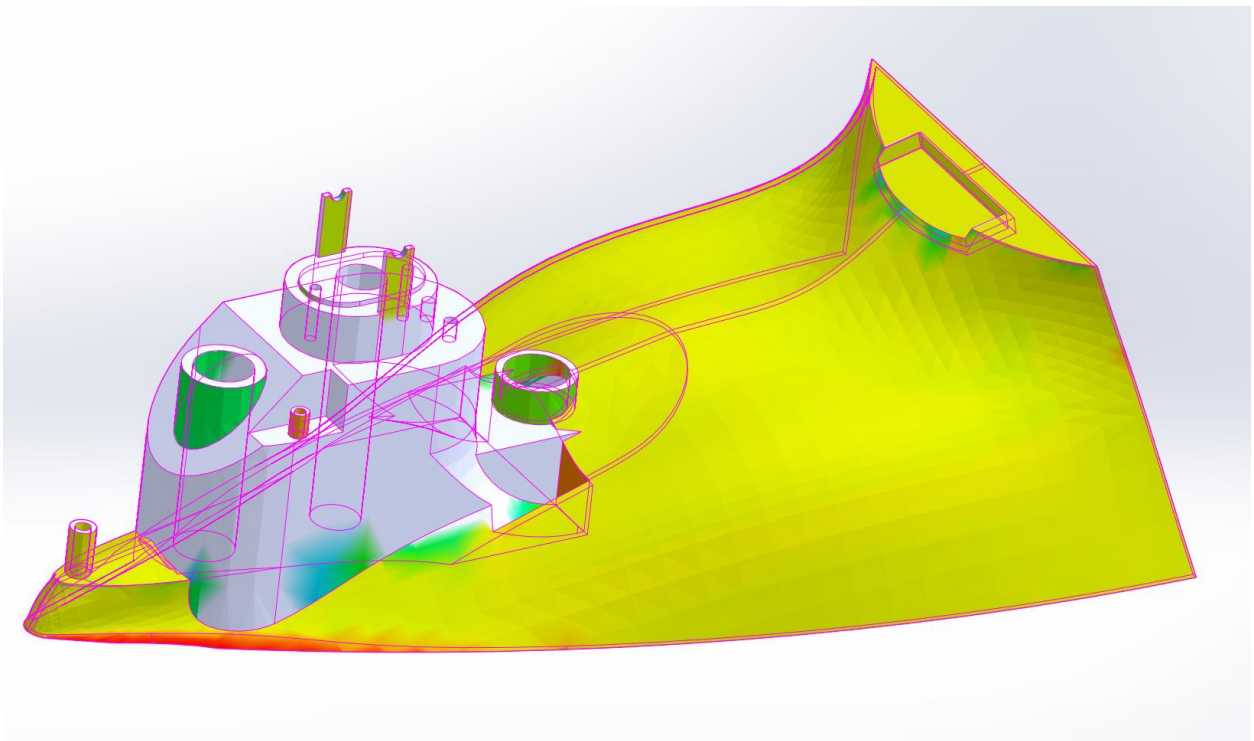
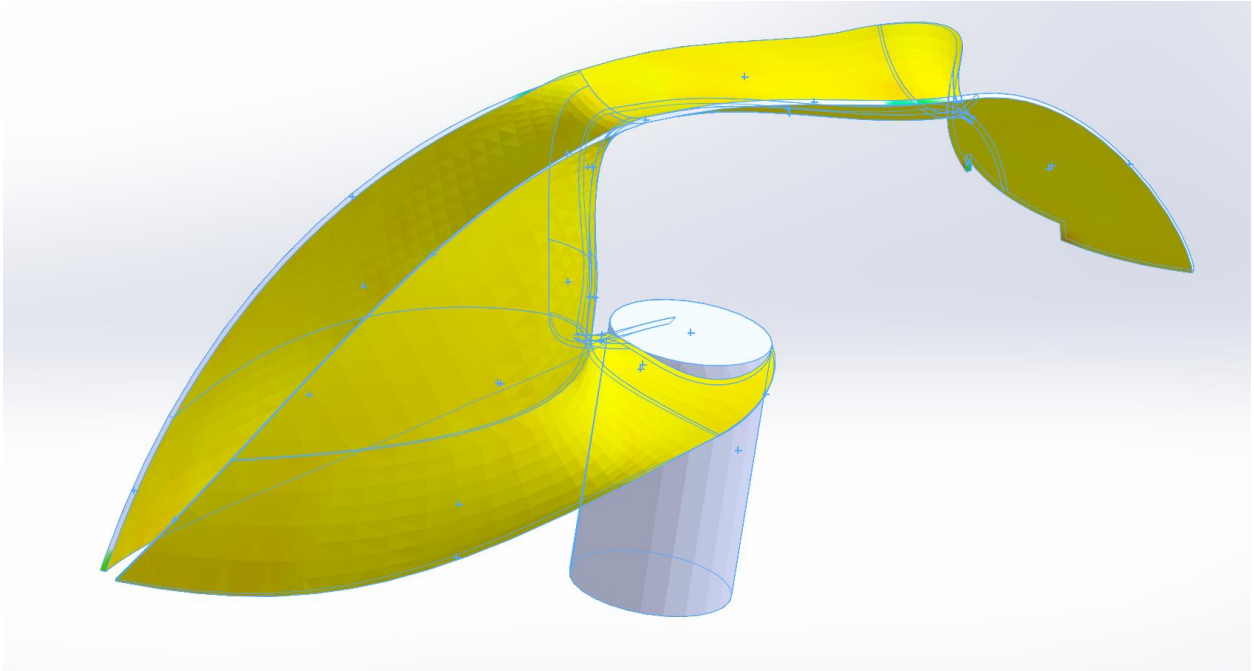


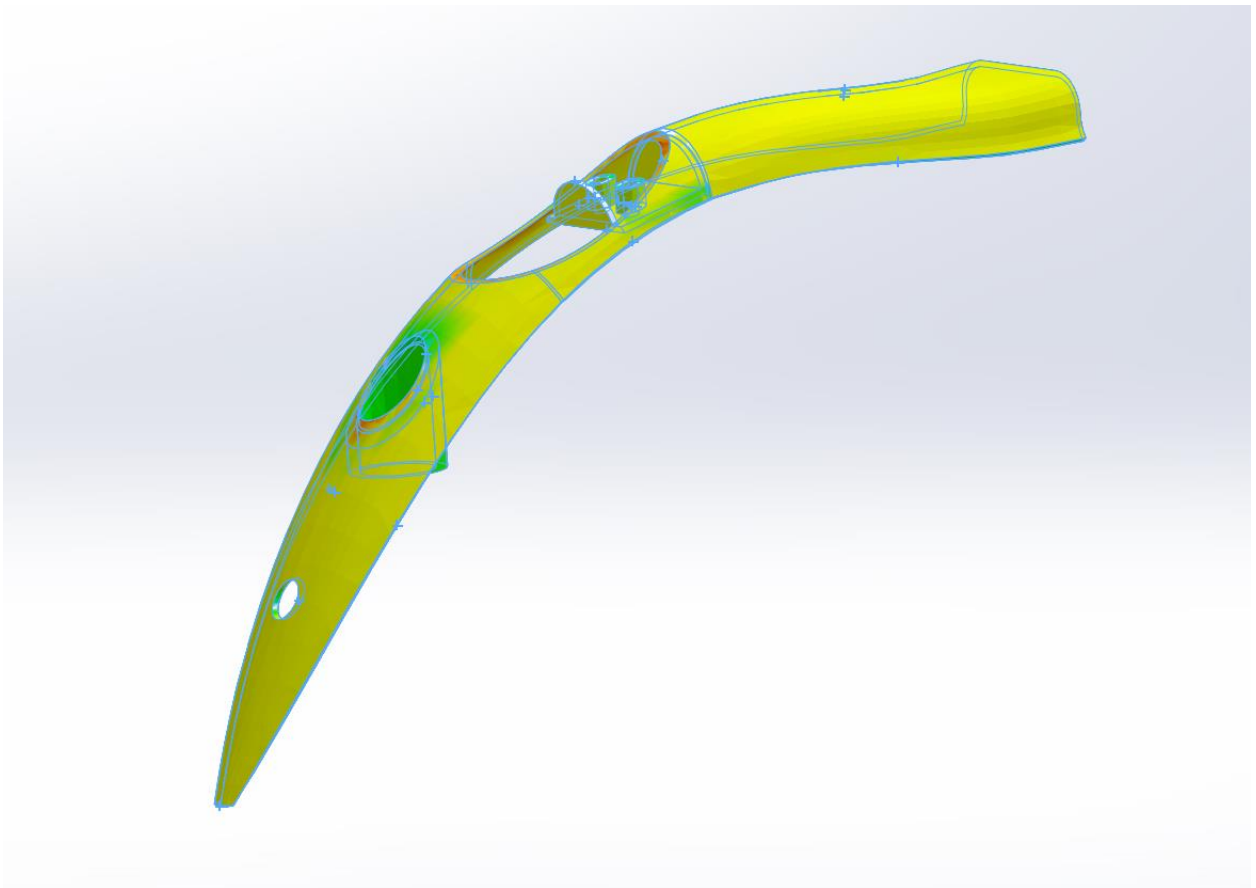
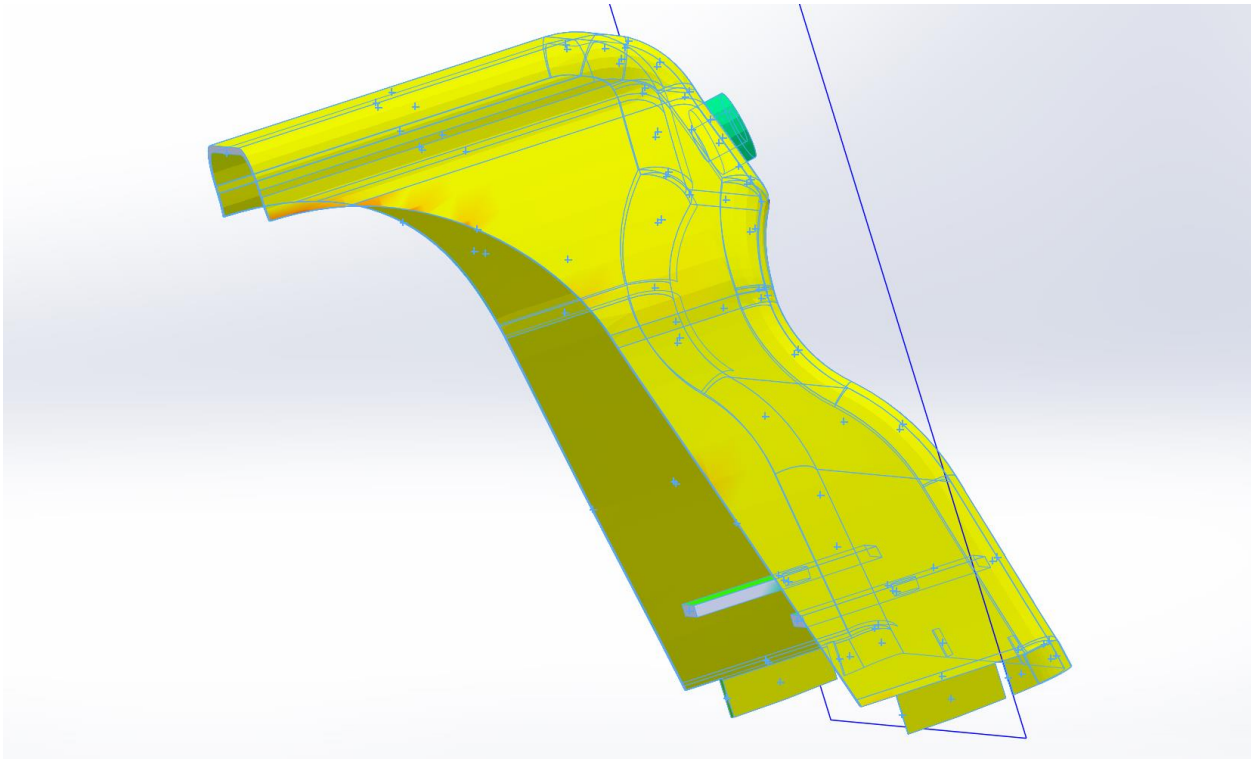
## Design for Manufacturing

Considering uniform wall thickness

No sharp corner on the exterior Surface

Most of the fixture are snap fit reducing the assembly time





# FMEA

## Design Failure Mode and Effect Analysis

ME56

6

Group

Number:

5

Electric

Product Name:

Steam

Iron

	Function	Potential Failure Mode	Effects of Failure	SE V	Potential Causes	OC C	Recommended Corrective Action(s) & Action Taken	Revised			
								SE V	OC C	DE T	RP N
	Base Metal	No access of steam as well as. Cause burns due to overheating than desired temperature.	Can cause 3rd degree burns of the customer as well as the fabric	10	No sensor to cutoff power after the desired temperature	9	Using a steam release valve to maintain the temperature as well as a cutoff power sensor after the desired temperature is achieved	5	6	6	180
	Connecting Wire	Due to lack of measures taken to store the wire can cause broken or malfunctioning	Improper storage of wire can snap the wire from inside	9	Lack of measures taken to store	8	Using braided wire which is easily contrapuntal and durable	4	4	2	32
	Rotating Button	Cannot control the amount of steam pressure for different fabrics	No such system or vale available to control it	3	No such system or valve present	4	By using different material which are good heat conductors	2	2	1	4
	Back Cover	A convenient space to store wire inside in steam iron	No Space in the product so that wire can contractable	7	Unavailability of space	3	Introducing extension cord retractable wire system	2	1	1	2

# Design for Assembly

## DESIGN FOR MANUAL ASSEMBLY WORKSHEET

1	2	3	4	5	6	7	8	9	10	Name of Assembly	
Part ID No.	Number of Identical Operations	a + β	Manual Handling Code	Manual Handling Time	Manual Insertion Code	Manual Insertion Time	Total Assembly Time (2) * [(5) + (7)]	Total Assembly Cost \$30/h * (8)	Theoretical Minimum Number of Parts		
1	1	90	0	1.13	31	5.3	6.43	0.053583	1	Base Metal	
2	1	360	18	3	59	12	15	0.125	1	Base Body	
3D	1	360	15	2.25	38	6	8.25	0.06875	1	Body Filler, Body Holder and Support [Combined]	
5D	1	360	88	6.38	59	12	18.38	0.153167	1	Button Cover (Redesigned)	
6D	1	360	16	2.57	49	10.5	13.07	0.108917	1	Back Cover (Redesigned)	
7D	1	360	14	2.55	43	7.5	10.05	0.08375	1	Heat Controller (Redesigned)	
9D	1	180	3	1.69	8	6.5	8.19	0.06825	1	Right Button, Left Button and Valve 1(*2) [Combined]	
10D	1	180	3	1.69	8	6.5	8.19	0.06825	1		
17	2	360	19	3.38	7	6.5	19.76	0.164667	1	Base Rubber	
21	2	180	4	2.18	0	1.5	7.36	0.061333	1	Triangle Spring	
26	1	360	18	3	19	10	13	0.108333	1	Nozzle	
27	1	450	28	3.18	6	5.5	8.68	0.072333	1	Type Button	
28	1	180	1	1.43	6	5.5	6.93	0.05775	1	Connector 2	
29	1	360	88	6.35	34	6	12.35	0.102917	1	Spring 3	
31	1	360	88	6.35	34	6	12.35	0.102917	1	Cable Holder	
32D	1	90	9	2.98	29	11.5	14.48	0.120667	1	Warning Lamp (Redesigned)	
37	1	360	19	3.38	13	3.5	6.88	0.057333	1	Needle	
							189.35	1.577917	17		
							TM	CM	NM	Design Efficiency = (3 * NM) / TM =	26.93%

## Unit Manufacturing Cost

Unit Manufacturing Cost (\$)	12234.82
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Properties	Values	Material Cost (\$)	
Material (ABS) (\$/Kg)	1.65		
Injection Pressure (Bars)	1000.00	0.000363	
Maximum Cavity Pressure	50000000.00		
Number of Cavity N/(m)^2	6.00		
Runner 15%	1.15		
Projected Area (cm)^2	2.68		
Mass (gm)	0.22		
Max. wall thickness (mm)	3.75		
Volume (cm)^3	0.22		
	cm^2		
Total Projected Shot Area	18.50		
	N	kN	
Maximum Separating Force (F)	92477.25	92.48	
Then the appropriate machine would be the one with a maximum clamp force of 800 kN from Table 1.			
	cm^3		
Required Shot Size	1.49		
Which is easily within the maximum machine shot size of 34 cm^3			
Available machine clamp stroke is 20 cm – sufficient to mold a hollow part up to a depth of 9 cm >> 10 mm.			
300 kN Injection molding machine is suitable for this job			

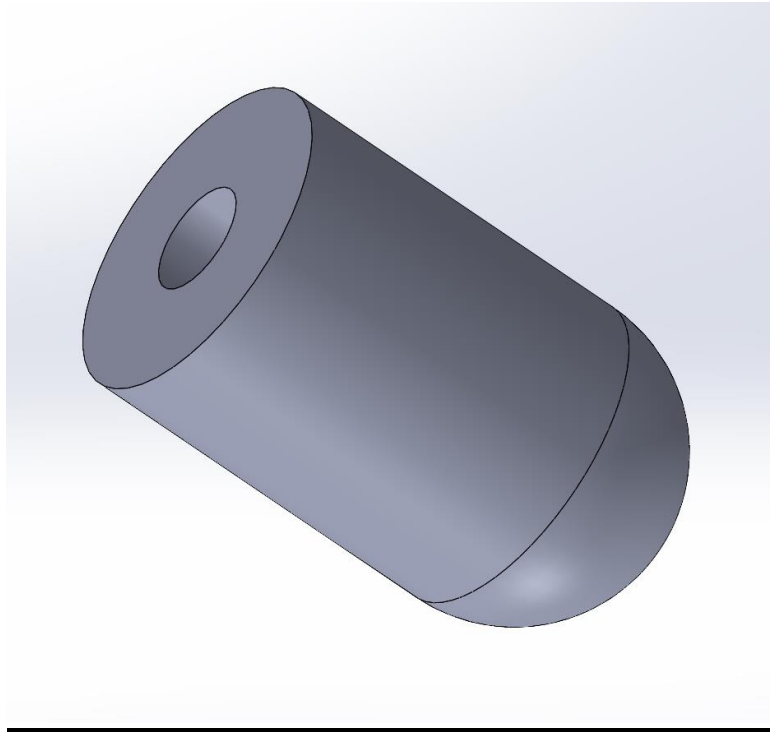
Processing Cost	
Injection Time (Fill Time) (sec)	0.05
Cooling Time (sec)	10.64
Mold Resetting Time (sec)	5.11
Total Cycle Time Per Part (sec)	15.80
<b>Total Processing Cost (\$)</b>	<b><u>0.13</u></b>
$\pi$	3.14
ABS Injection Temperature	260.00
Recommended Mold Temperature	54.00
Recommended Part Ejection Temperature	82.00
Dry Cycle Time (Sec)	1.70
D (mm)	14.00
$\alpha$	0.13
Log	Number
	9.36
	Sec
Injection Time (Fill Time)	0.05
	Sec
Cooling Time	10.64
	Sec
Mold Resetting Time	5.11



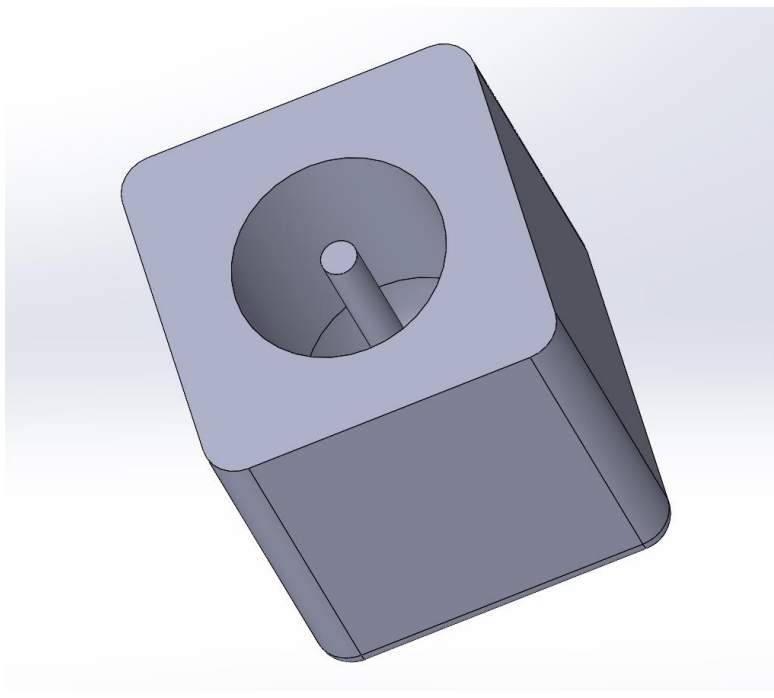
Tooling	
Mold Base Costs (\$)	1931.90
Mold Making Cost (hr)	71.87
Ejector Pin Manufacturing Cost (hr)	4.09
Cavity and Core Manufacturing Cost (hr)	5.28
Opaque Standard (15%) (hr)	12.19
Unscrewing devices (hr)	250.00
Total Hours for Mold Manufacturing (hr)	343.43
Tooling Cost (\$)	12234.69
Assuming an average rate of \$30 per hour for mold manufacturing, the estimated cost for one cavity and core	
Area of mold base cavity plate (cm <sup>2</sup> )	808.50
Dd (cm)	1.50
Combined thickness of cavity and core plates in mold base (cm)	10.50
A 3x2 array of cavities are used	
Mold Base Costs	1931.90
Mold Making Cost	71.87
Ejector Pin Manufacturing Cost	4.09
Cavity and Core Manufacturing Cost	5.28
Additional Mold Cost for Appearance Levels	12.19

## Part Considered for Unit Manufacturing Cost

### NOZZLE



Part



Mold