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Die making of Submarine Part

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Abstract- Older days molding process is complicated and time consuming process. At starting drawing o drawing book, then on design software (2D) was used, then which mold patterns made. This result not get more time. So molding cost gets higher and more time consume for design process. By coming of 3D software, it can easy to draw the design and editable. This mold is done in two steps in older process. First make cylindrical part on injection mold, then groove was making on machine. Because of two steps process required more time for design and manufacturing .So two step modified in one step by using 3D software ,So less time require for design and also increasing production rate.

Keywords- Single stroke mould design, Optimization in design and manufacturing, Increase productivity, Rawmaterial

1. INTRODUCTION

In this design we manufactured the product in single shot only instead of manufacture in two different steps. In the previous design the product was manufactured in two different stages. First one manufacturing ofcylindrical mold & design of groove separately. This will leads to save in production time as well as increase productivity.

Injection Molding-Overview

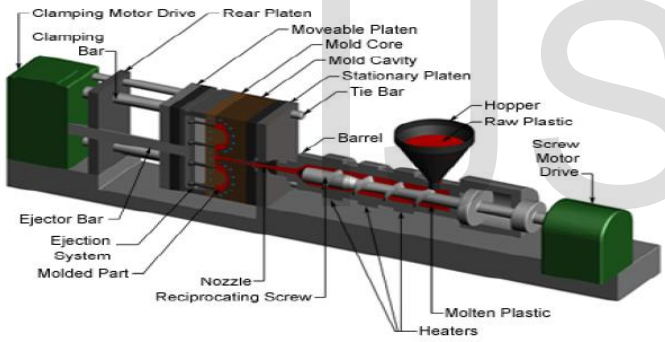

Figure 1 Injection molding-overview

Injection molding is manufacturing to producing parts from thermoplastic & thermosetting plastic materials.

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The material is heated in hoppers and then fills in mold cavity by high pressure. Then it cools & it solidifies. [3]

2. PROBLEM DEFINITION

It is mandatory to design the mould to increase the productivity with less time. This mold will suitable only for batch production as per the requirement of consumer.

3. OBJECTIVES

- To form effective, efficient mold design as well as the manufacturing process.
- Reduction in the time required for tedious design and minimizes cost of design.

4. SCOPE

- To insure effective understanding of each component of mold along with their functions.
- To study the configuration of mold.

5. METHODOLOGY

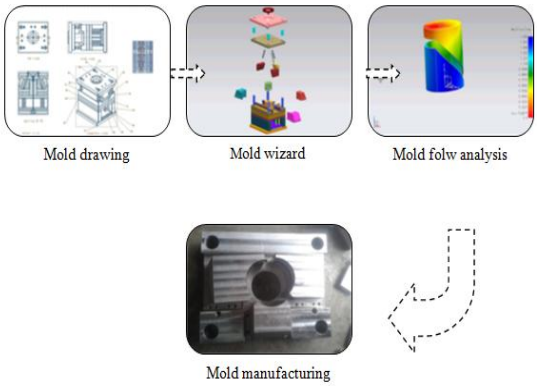

Figure 2 Methodology

6. MOLD SYSTEM

The mold system consisting of various parts it consists of same of important terms which are listed below.

- Impression

The two mould members forms and impression is provides shape to remolding.

- Cavity and Core plates

Cavity which is the female portion that forms the external molding .while the core is male part that forms internal shape of molding.

- Sprue Bush-

Sprue and bush that is sprue bush the members which delivers plastic material that from nozzle to the impression through the passage it runnes and gate system, this system are made according to size of cavity and cavity.

- Register Ring

The register ring is used for alignment of mold centrally with machine.

- Guide Pillars or Pin and Bush-

It is necessary that the cavity and core should be aligned for these guide pillars or pins and bushes are used. [3]

7. MATERIALS USED FOR MOLDING

Table 1 Materials used for molding

Mold part	Material	Property
Product	Noryl (polyphenylene oxide)	Light weight, Heat resistance
Core & cavity supporting plates	Carbon steel	Resistance to atmospheric corrosion
Slider (cavity) & core insert	Tool steel P20	Heat resistance
Bushes & pillars	High carbon alloy steel EN31	High compressive strength& abrasion resistance

8. DESIGN CALCULATIONS FOR MOLD

- **Total clamping force required**

Clamping force=

$$\frac{(\text{projected area of moulding} * \text{injection pressure})}{1000}$$

= (380*0.334)/1000

= 1.55 tons

- **Shot weight**

Shot weight = weight of component +weight of feed system

Weight of component = 93.8 gms

Weight of feed system = 6.9gms

Shot weight = 93.8+6.9

=100.7gms

- **Cavity diameter**

$D_{cavity} = D_o(1 + S_p + S_s)$

= 82.499(1+0.00924+0.002)

= 83.426mm

- **Cycle time calculation**

$t_{cycle} = t_{open} + t_{fill} + t_{cooling} + t_{ejection} + t_{close}$

t_{cycle} = 1.8+9+36+4.6+2.5

t_{cycle} = 53.9sec≈54sec

[1], [2]

9. ANALYSIS OF PART

Analysis for maximum cooling Time

The maximum cooling time required, after injection of molten noryl material is shown in this analysis. It is observed that maximum cooling time for the mould is around 47°sec.

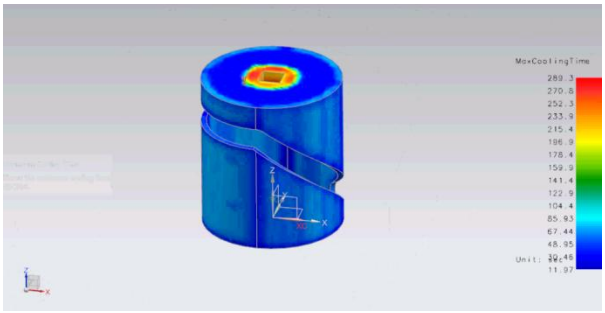

Figure 3 Analysis for maximum cooling Time

Analysis of pressure drop

We the analysis it is cleared that the pressure drop is in between 6.5 to 7bar .it is necessary to avoid the cavitations.

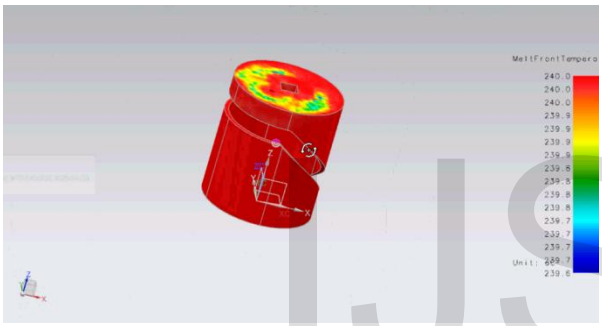

Figure 4 Analysis of pressure drop

Analysis of maximum temperature presents in mold

Temperature is the most important parameter for injection molding. It is essential that temperature of mold everywhere is same it's always up to melting temperature of mold material because, of the low temperature of mold it's possible that some part of mold solidified early than other part, and the defect will form in mould part

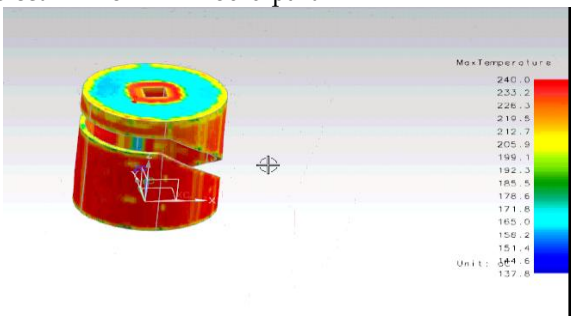

Figure 5 Analysis of maximum temperature presents in mold

10. RESULTS AND DISCUSSION

Table 2 Results & Discussion

Sr. No.	Parameter check	Mathematically	Analytical	Manufacturing time	Remark
1	Cooling Time	36 sec	45.01 sec	47 sec	Satisfy
2	Cycle Time	54sec	56 sec	68 sec	Satisfy
3	Pressure Drop	-	7.13 psi	8 psi	Safe
4	Max. Temp.	-	222°c	235°c	Safe

Cycle time

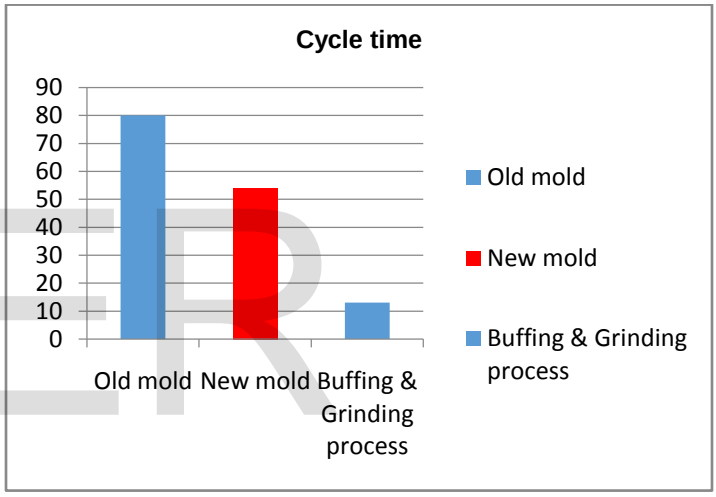

Figure 6 Cycle time

Cooling Time

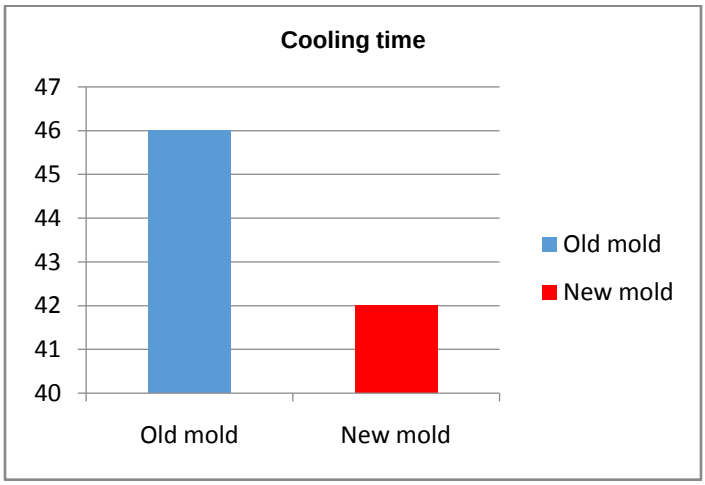

Figure 7 Cooling time

Actual product

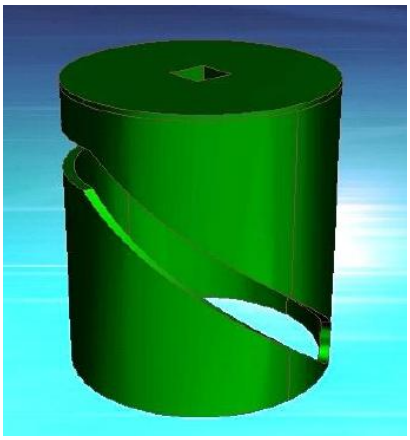

Figure 8 Actual product

11. CONCLUSION

On the basis of above result obtained-

- To form effective, efficient mold design as well as the manufacturing process.
- Reduction in the time required for tedious design and minimizes cost of design.
- Increase in quality of product.
- Production cost per unit decreased.
- Increase in profit.
- Material saving.
- Fulfill the need of company

12. REFERENCE

1. [1] Michelle M. Gauthier "Injection molding" Engineered Materials Handbook Desk Edition, 1995, pp. 299-307
2. [2] "Injection Mould Design" by R. G. W. PYE, 4th Edition.
3. [3] Narwade V.B., Kale M.L., Mate A.K., Rayate M.N. Vharkate C.B., Jagtap P.V., Rathod N.R. "Design and Analysis of Injection Mould for Submarine Engine Part (MAD-7503)" Vol-3 Issue-1 2017 IJARIIE-ISSN (O)-2395-4396
4. [4] JitendraDilipGaneshkar, Prof. R.B Patil, Swapnil S. Kulkarni, "Design of'Plastic Injection Mold' For An Automotive Component Through 'FlowAnalysis' (CAE) For Design Enhancement", International Journal of AdvancedEngineering Research and Studies, Int. J. Adv. Engg. Res. Studies/III/II/Jan.-March,2014,pp.157-159.