# Modification of Trimtool Design

**Akshay Vahile[1] Abhinav Patil[2] Anand Narasale[3] Vivek Mugal[4] Prof. Rutukesh Bhosale[5]**
[1,2,3,4]BE Student [5]Assistant Professor
[1,2,3,4,5]Department of Mechanical Engineering
[1,2,3,4,5]DIT, Pimpri, Pune, India

*Abstract*— In casting process, as our component came out from mould it is still needed to finish to form as a final product. Casting still has unwanted projection like sprue, riser, runner, etc. In order to remove the above mentioned projection in just a single pass of cutting operation the die named as 'Trimming Die' is used. Die consist of two half namely upper half and lower half. Upper half is held into ram which is known as top plate and lower half is fixed on a table which is known as bottom plate. While component is getting trimmed there are issue related cutting. One of them is undercutting. We modify design which removes the problem related to shearing cause undercutting in the product. We successfully solve problem of undercutting and completely eliminate it.

***Key words:*** Casting, Projection, Trimming Die, Upper half, Lower half, Undercutting

***Objective:*** To minimize the rejection of components after trimming operation

## I. INTRODUCTION

As casted component came out from mould it having projections like sprue, runner, riser, etc. these are unwanted projection. In order to remove these projections we have 'Trimtool die'. The die removes all projection in just a single pass and increases productivity of plant.

Fig. 1: Casted Component

Fig.1 shows the casted component produced by casting process.

Fig. 2: Trimmed Component

Fig-2 shows the trimmed component free from unwanted projection like sprue, runner, etc. From above picture the purpose of our project gets clarified.

## II. LITERATURE REVIEW

In book name 'DIE DESIGN FUNDAMENTALS' [3] by J. R. Paquin present the information about fundamentals of die design in the form of underlying principle. Each principle is clearly explained with text and picture form. Mathematics is necessary for mechanical design. It gives information and relationship between all the parts of any mechanical assembly, determine size, shape, material of each component as also give tolerance values for different parts.

Another book name 'Handbook of Die Design' [2] by Ivana Suchy covers the manufacturing aspect such as die openings, their shape and locations, surface finish, flatness, straightness, and burr tolerance.

'Removing apparatus for moulded product and method for cutting off gate of moulded product' [1] gives information about removing apparatus from moulded product.

## III. PROBLEM STATEMENT

Due to increase in gate thickness of the casting the existing trimtool assembly was not able to properly shear off the unwanted projection, this was causing an issue of undercutting in the casted product leading to rejection.

## IV. TRIMTOOL DESIGN

Trimtool can be defined as that component which is machined to receive blank having punch and its opposite member or it can be considered as entire press tool. As we proceed you are going to learn various die components and get some idea how they assembled and work together. We have modified three parts in the trimtool assembly namely locator, die plate & pressure pad and added an extra locator ring.

 

*A. Punch Press3*

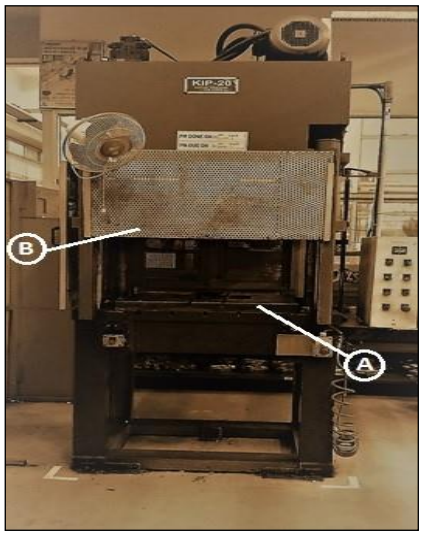


Fig. 3: Trimtool Press

The photograph shows typical punch press which operates trimtool die. A is a thick steel plate fastened to the press frame the complete die is clamped securely on this bolster plate the upper portion of die is ram B which is reciprocated up and down by crank.

*B. Part Photograph*

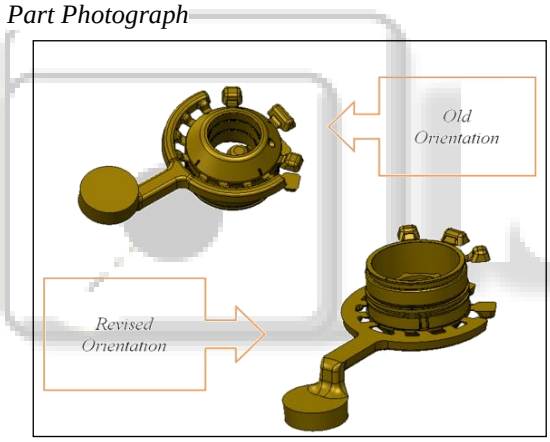


Fig. 4: Casting for which trimtool designed

In fig. 4 we can see the part of casting for which whole trimtool is designed. We worked with two orientations in order to eliminate problem of undercutting. In old orientation we have problem of undercutting but in new orientation we try to solve the problem of undercutting.

*C. Trimtool Assembly*

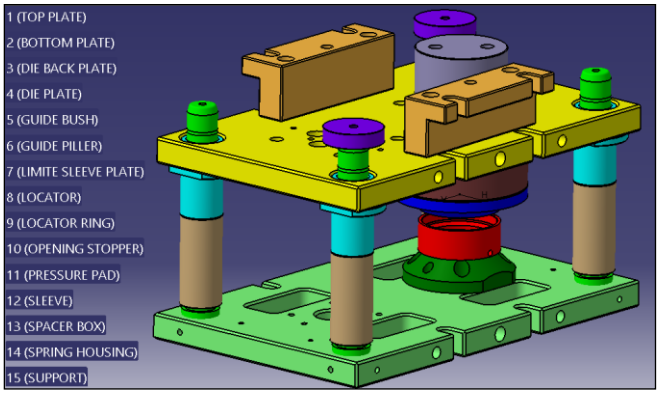


Fig. 5: Trimtool Assembly

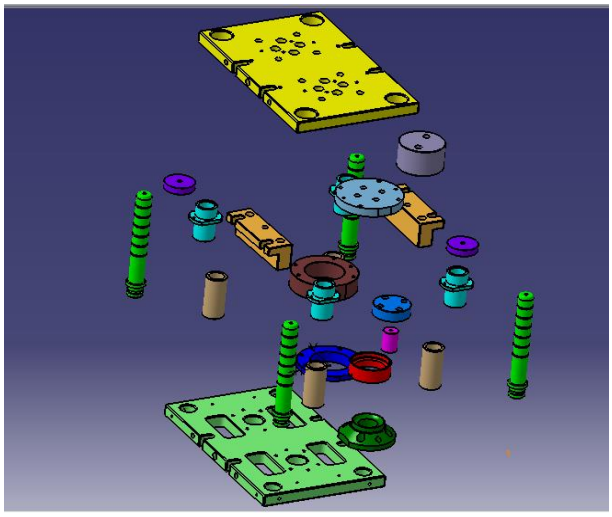

Fig. 6: Split view of trimtool components

There are different components in trimtool die assembly which are worked together to complete the trimming of unwanted projections from casting. In order to totally understand trimtool you need to have a little bit knowledge of engineering drawing. In upcoming page we show the parts with bill of material in order to get clear the picture of tool and how are they going to work together.

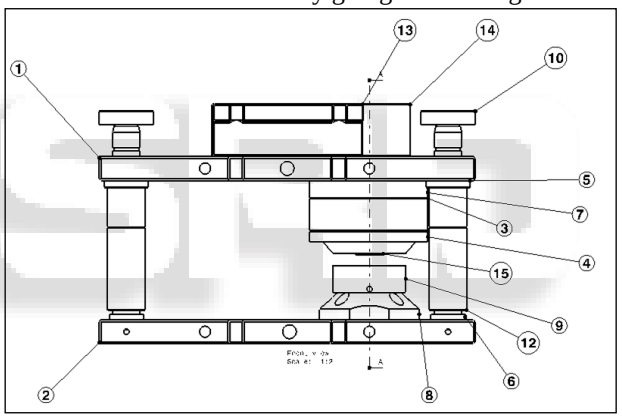


Fig. 7: Trimtool Assembly drawing

| PATR NO. | DESCRIPTION | QUANTITY | MATERIAL | HEAT TREATMENT | REMARK |
|---|---|---|---|---|---|
| 1 | TOP PLATE | 1 | EN8 | - | - |
| 2 | BOTTOM PLATE | 1 | EN8 | - | - |
| 3 | DIE BACK PLATE | 1 | EN8 | - | - |
| 4 | DIE PLATE | 1 | HCHCr | 58-60 HRC | HARD & TEMP |
| 5 | GUIDE BUSH | 4 | EN353 | 58-60 HRC | 1.2MM CASE DEEP |
| 6 | GUIDE PILLER | 4 | EN353 | 58-60 HRC | 1.2MM CASE DEEP |
| 7 | LIMIT SLEEVE PLATE | 1 | OHNS | 46-48 HRC | HARD & TEMP |
| 8 | LOCATOR | 1 | OHNS | 48-50 HRC | HARD & TEMP |
| 9 | LOCATOR RING | 1 | OHNS | 48-50 HRC | HARD & TEMP |
| 10 | OPENING STOPPER | 2 | MS | - | - |
| 11 | PRESSURE PAD | 1 | OHNS | 48-50 HRC | HARD & TEMP |
| 12 | SLEEVE | 4 | OHNS | 48-50 HRC | HARD & TEMP |
| 13 | SPACER BLOCK | 2 | MS | - | - |
| 14 | SPRING HOUSING | 1 | EN8 | 58-60 HRC | - |
| 15 | SUPPORT | 1 | HCHCr | 46-48 HRC | HARD & TEMP |

Fig. 8: Bill of Material for Trimtool

*D. Modified Trimtool Parts*

*1) Pressure Pad*

It is a component used to seat the casting on the locator with a certain amount of force to ensure that the casting does not move around while trimming. Due to change in orientation of the casting the pocket in pressure pad was rendered useless so we reduced height of the pressure pad from 43.05mm to 30.46mm which now performs the same function.

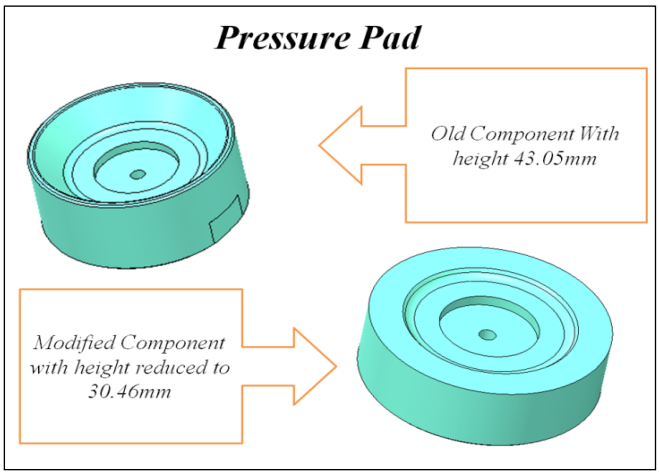


Fig. 9: Pressure Pad

*2) Die Plate*

Die plate is the component used to trim off the unwanted projections (like-runner, riser & sprue) from the casting. To increase clearance for trimming operation we increased the internal diameter of the die from 100.50mm to 110.50mm.

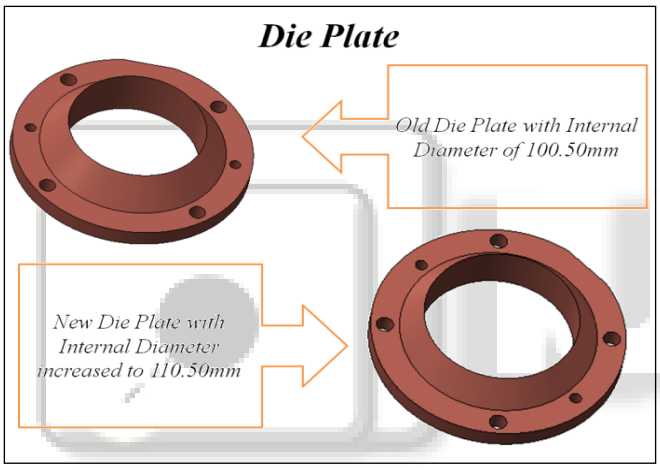


Fig. 10: Die Plate

*E. Locator*

It is used to locate the casting properly for trimming operation. Due to change in orientation now the tapered portion of casting is facing downward now existing locator cannot support this so we chopped off upper ring portion of locator. Now the height of locator is reduced from 75.49mm to 53.99mm.

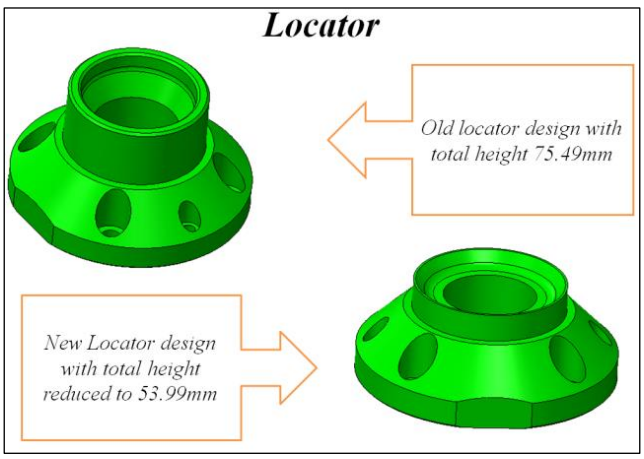


Fig. 11: Locator

*F. Locator Ring*

A new part called locator ring is added to support the casting which is shown in fig. below. It is fitted above locator ring as we can see in drawing of trimtool assembly (fig.7). As we can see locator ring has tapered portion at inner side of ring on which our casting tapered portion is being rested. Width at top gives support at time of shearing and prevents the projection to get bend and hence prevent undercutting.

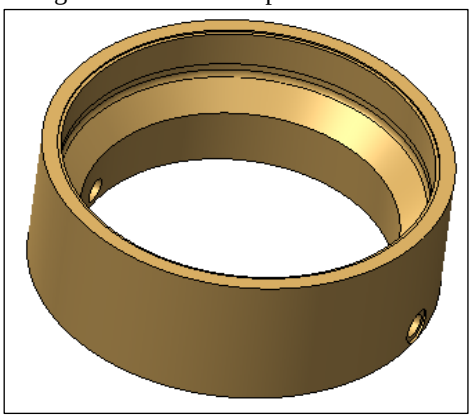

Fig. 12: Locator Ring

## V. SHEARING THEORY

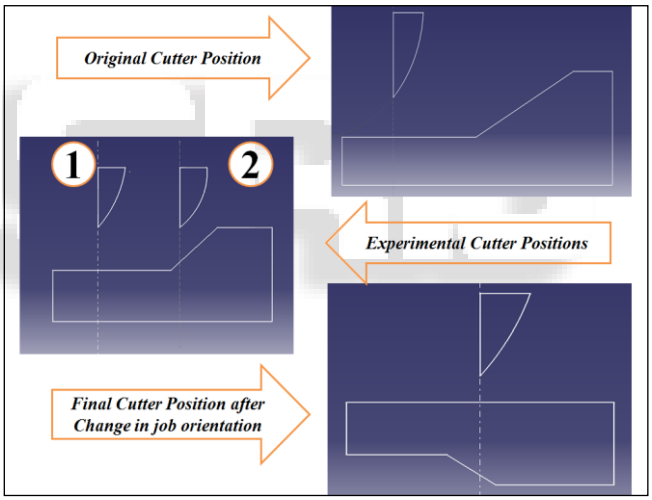


Fig. 13: Different shear positions

First orientation in fig. 13 shows previous cutter arrangement which was supposed to modify because of increased gate thickness. Initially there was clearance of 1.5mm in between cutting edge and casting.

Experimental cutter position 1 had 1.5mm but in 2 we increase it to 3.5mm. But still there was undercutting issue.

In final cutter position after change in orientation with 3.5mm clearance we successfully get shearing operation. Due to increase in clearance the machining time for turning operation increased from 150sec to 165sec. At the end increase in cycle time was not an issue because reduced rejections led to overall saving in time.

## VI. RESULT AND DISCUSSION

Before,
Single casting = 150 Sec
Monthly production =8000

With rejection quantity =8000+3040 (38% Rejection Considered)
Total cycle production quantity = 11040 Nos
Total cycle time for monthly production = 1656000 Sec
Effective time per piece = 207 Sec
Total hour = 460 Hr.
After,
Single casting = 165 Sec
Monthly production =8000
With rejection quantity = 8000 +0 (0 % Rejection Considered)
Total cycle production quantity = 8000 Nos
Total cycle time for monthly production = 1320000 Sec
Effective time per piece = 165 Sec
Total hour = 366 hr 39 min 36 sec
Total saved time month = 33600 SEC = 93 Hr20 Min

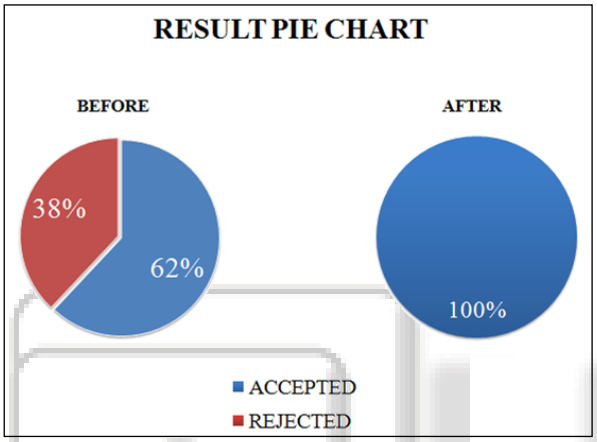


Chart 1: Comparisons Pie Chart

## VII. Conclusions

Thus we concluded that due to change in orientation we saved 93Hr 20min per month by change in design of only three parts and addition of one new part. We completely eliminated the undercutting problem caused due to improper shearing action. In future there will be no rejection caused by undercutting.

## Acknowledgement

We are thankful to Mr. Sharad Wagh for his valuable guidance in our project work.

## References

[1] 'Removing apparatus for moulded product and method for cutting off gate of moulded product' at 2001 by Isao Adachi, Nagoya-shi (JP).
[2] Die Design Handbook by Ivana Suchy 2nd edition, TATA McGraw Hill.
[3] Die Design Fundamental by J. R. PAQUIN.

 