

Design & Manufacturing Of Fixture For The Casting Cylinder For Reduction Of Operation Time

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Abstract - This project work is pertaining to improvement in manufacturing process of casting cylinder and reducing the lead time of manufacturing the shock absorber assembly and its un-interrupted flow in production line without any bottleneck. This project work and report is an attempt to apply the Engineering techniques for improvising the manufacturing process of Casting Cylinder to achieve the effective utilization of the available resources, improve the productivity and meet the Customer requirements and cost reduction while managing the business in global competitiveness in industries. This is also an attempt to provide safe working condition for the worker who is producing the cylinder. In this project work application to resolve the bottlenecks and delays in processing of the casting cylinder component which in turns leads to production delays and hold-ups due to the non-availability of material at final assembly. Various methods were evaluated to address causes of Bottleneck and delays, to achieve effectiveness and efficient procedure in manufacturing to have improved productivity level. This project was incepted to achieve some predetermined objectives. The key objective of the project was to design and development of a fixture for casting cylinder with regards to predefined requirements as easy loading and unloading, reduced operator difficulties, reduced cycle time, increase production rate.

Keywords — Fixture, Cylinder, Cycle time, Machining operation, Setup time.

I. INTRODUCTION

This project report titled as “**Design & Manufacturing Of Fixture For The Casting Cylinder for reduction of operation time**” is pertaining to improvement in manufacturing process of casting cylinder and reducing the lead time of manufacturing the component and its un-interrupted flow in production line without any bottleneck.

This project work and report is an attempt to apply the Engineering techniques for improvising the manufacturing process of Casting Cylinder to achieve the effective utilization of the available resources, improve the productivity and meet the Customer requirements and cost reduction while managing the business in global competitiveness in industries. This is also an attempt to provide safe working condition for the worker who is manufacturing the cylinder.

In this project work application to resolve the bottlenecks and delays in processing of the casting cylinder component which in turns leads to production delays and hold-ups due to the non-availability of material at final assembly. Various methods were evaluated to address causes of Bottleneck and delays & to achieve effectiveness and efficient procedure in manufacturing to have improved productivity level

The need for improved productivity and reduced time to market has been increased significantly in manufacturing processes in recent decades. Fixtures have a direct impact upon product manufacturing quality, productivity and cost hence there are many factors playing roles in manufacturing processes in order to improve productivity and reduce production time. Fixtures are one of the important tools that

are widely used to achieve this goal. Fixtures are mechanism used to rapidly, accurately, and securely position work piece during machining such that all machined parts fall within the design specifications. This accuracy facilitates the interchange ability of parts.

Fixtures are normally designed for a definite operation to process a specific workpiece and are designed and manufactured individually. Jigs are similar to fixtures, but they not only locate and hold the part but also guide the cutting tools in drilling and boring operations.

➤ Methodology:

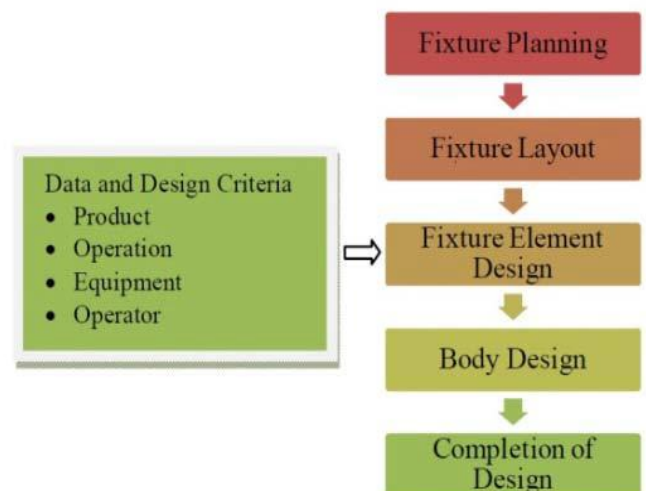


Figure 1 Methodology

II. COMPONENT DETAILS



Fig. 2 - 3D Model and Actual Work piece

- Flange Outer Diameter: 136mm
- Flange Inner Diameter: 44mm
- Flange Thickness: 10mm
- Cylinder outer diameter: 83mm
- Cylinder Internal diameter: 62mm
- Length Of Cylinder: 241mm

III. OPERATIONS

As Method may main cause for the delay of the components. All methods are studied and analyze one by one.

Followings are operation on the component under specified method.

- Pre machining:
- One side turning operation
- Second side turning operation
- Cylindrical grinding
- Drilling

IV. TIME ANALYSIS

To understand the delay in the manufacturing of casting cylinder we studied require time for each operation.

Table 1: Time Study

Operation	Total Machining time	Total setup time	Total time
Pre Machining	20	10 minutes	30 minutes
1 st side turning operation	60	20 minutes	80 minutes
2 nd side Turning operation	140	20 minutes	160 minutes
Cylindrical grinding	30	15 minutes	45 minutes
Drilling	75	30 minutes	105 minutes
	325 minutes	95 Minutes	420 Minutes

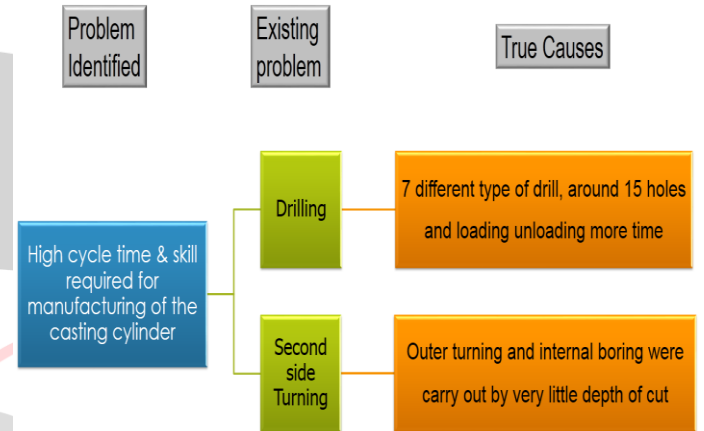
Total cycle time = total time + waiting time+ Miscellaneous time
 = 420 + 30 + 30
 = 480 minutes
 = 8 hours.

After studying the time require each operation we found that the second side turning operation and drilling holes takes lot of time. And it seems that it may cause for the delay of the production let's study again one by one.

V. TREE DIAGRAM

For studying above valid two causes we plot a tree diagram for finding out exact root cause

Tree Diagram Summary Of Root Causes



VI. DEVELOPMENT OF SOLUTION

• BRAINSTORMING

A very systematic & optimistic Brain storming session was taken place. No. of suggestions come out. The important aspect was how to eliminate overhang the casting cylinder.

Table 2-Alternate solution Study

SUGGESTED SOLUTION	DISCUSSION	REASON
Support tail stock	Not allowed	Internal diameter is Ø62 mm so special centre require for support at the end and internal operation is also not possible after support by tailstock.
Developing special fixture	It may possible	In-house fabrication can be done with proper design.

Hence it was decided to develop new fixture which could hold casting cylinder rigidly while carryout the internal and external turning operation at the second side turning operation.

VII. ANALYSIS

After plotting cause and effect diagram analysis was done on the identified causes

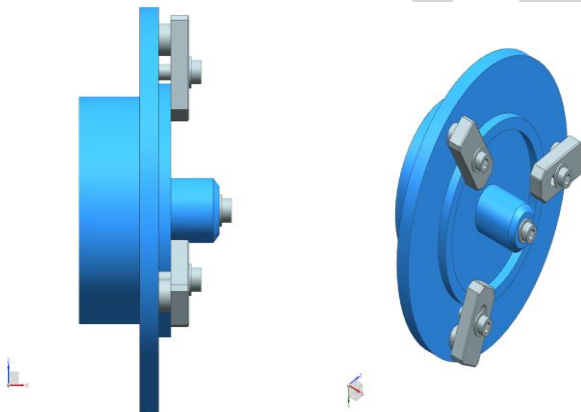
Table 3-Cause Analysis

Probable cause	Analysis	Conclusion
MAN	The operators who working are skilled & well experienced. And they have given proper training	Not main Cause
Material	Property of material is checked in laboratory and found ok. Does not contain any defect.	Not Main Cause
Machine	Machines are in well condition and proper tolling & accessories are provided	Not Main Cause
Methods	There total three operations are involved and separate study may require to identify the problem	It May main Cause

VIII. PROPOSED DESIGN

This is the proposed design of the fixture

• Model of the Fixture



• DETAIL OF THE FIXTURE

- As our main objective is manufacturing cost should be minimum we use a scrap face plate which face is already damage. We load it on lathe machine and took a face cut on it for removing damage marks.
- To load casting cylinder on it we made a pocket of 10mm depth and dia 136mm on the face plate .little tolerance of ± 0.02 mm were provided to fit job in pocket easily. But that is not sufficient provision
- Over another objective was accuracy and maintain quality for that casting cylinder should be rigidly hold
- So we provided a cylinder in pocket at centre having diameter of 40 mm and length of 50 mm. this cylinder supports the casting cylinder internally as well as it supports up to 50 mm length, Instead of 10 mm in old process. This provides high rigidity. Also surface finish may increase and similar axis is maintained in this way quality of product also increases.

Our next objective was safety to the operator so after holding casting cylinder in new fixture there may chance to eject job from fixture. To overcome this problem we provided three rigid (20mm) clamps at 120° with M10 Allen bolts. This provides sufficient force to hold casting cylinder in fixture.

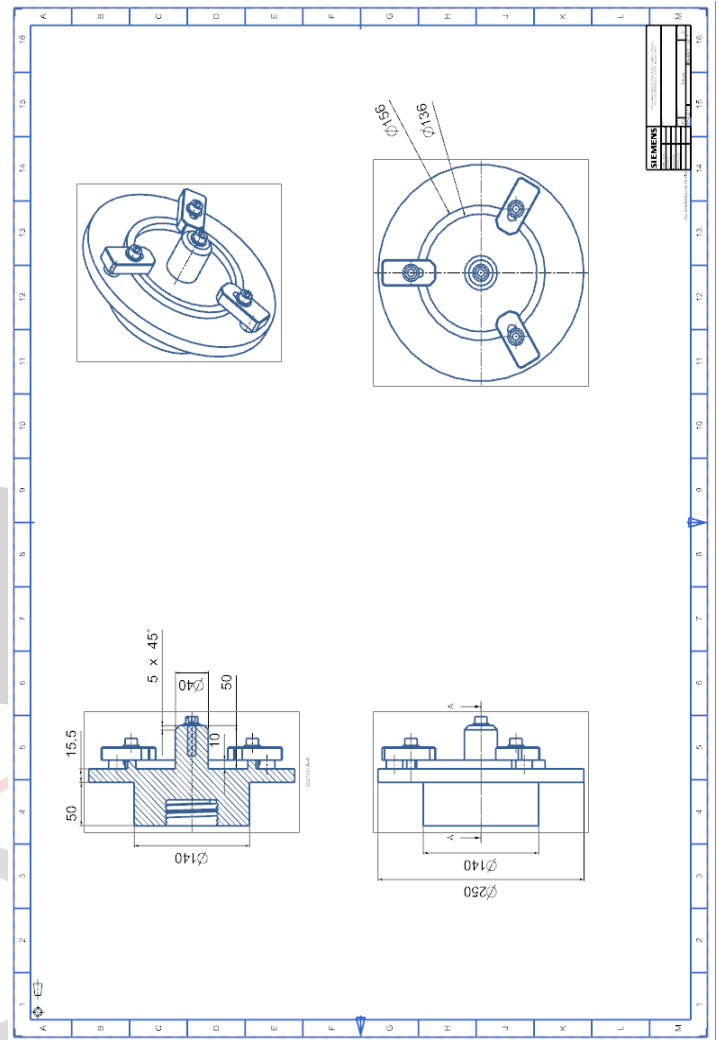


Fig: 5 proposed design

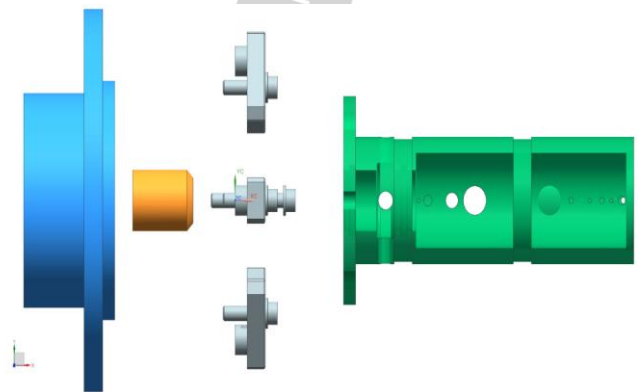


Fig. 6 Exploded view of component

IX. RESULT ANALYSIS

After completing the manufacturing of fixture, the fixture was put to test. Total three components were tested on fixture. The test Results are shown in the following Table 4 and Table 5.

All the tests conducted were successful. The parameters were analysed did meet the required specifications. We did Time Study for determining loading and unloading time as shown in Table 6.1. The

following table shows the loading and unloading time for the Fixture for Casting Cylinder.

Table 4. Time study for new Fixture

Sample No.	Loading time (min)	Unloading Time(min)	Total Time (min)	Total Machining Time(min)
1	5	6	8	78
2	5	5.9	7	70
3	5.5	6.5	8	75

From data shown in above table, average time for loading and unloading is as follow:

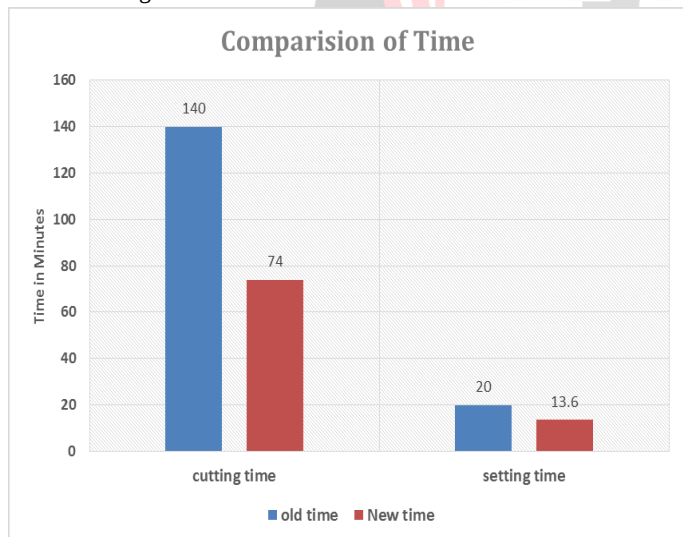
1. Average Time for Loading = 6.1 min
2. Average time for unloading = 7.5 min
3. Average setting time = 13.6 min
4. Average machining time = 74 min

Table No. 5 Total Time Saved

	Old method	With fixture	Time saved
Setting time	20	13.6	9.75
Machining time	120	74	55
Total	140	41.5	98.5

As seen from above Table , Total time saving of 98.5 minutes has been achieved.

Following Graph is showing difference of old and new setting time and machining time:



Graph 1 Comparative study

Following Table is showing the comparative study of methods before and after implementation.

Table 6. Comparative study

X. CONCLUSION

By installing new method with fixture, now we are performing 2nd side turning operation efficiently. The problem of overhanging of cylinder will not arise now. The easy clamping of fixture is resulted into reduction in loading and unloading time. And as concluded from

OLD METHOD	NEW METHOD WITH FIXTURE
Overhang the job	Overhang eliminated
Set up time was more(20 Minutes)	Set up time is minimized.(13.6 Minutes)
Cutting time was more(140minutes)	Cutting time was minimized(74 minutes)
Surface finish poor	Surface finish is good now
Not safe for the operator	New fixture is safe for the operator
Internal axis was not maintain correct	Internal axis is now correct and quality is up to the mark.

Table 1 and Table 2, the loading and unloading time is decreased on great extent as shown on graph 1.

This project was incepted to achieve some predetermined objectives. The key objective of the project was to design and development of a fixture for casting cylinder with regards to predefined requirements. The objectives that were achieved on completion of project are as follows:

- The fixture designed and manufactured is in complete agreement with the predefined requirements.
- The cost incurred for the project was reasonable.
- The operator faced very less difficulty in operating the new fixture in comparison with old method.
- The loading and unloading time is reduced considerably.
- The machining time is reduced.

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