MANUFACTURING PROCESS IMPROVEMENT IN TURBOCHARGER COMPONENT

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Abstract
Turbo charger is one of the automobile components. It is used to increase the efficiency of the engine. While observing one of the Turbo charger components 'BEARING HOUSING', it is the brain of the turbo charger. In this machining process, there is a zigzag movement in the material flow. Cycle time also varies from machine to machine. So, unnecessary operator idleness noticed. The following activities are identified to carry out the project Process improvement in critical machine, Line layout to be changed and Latest cutting tool to be used. By implementing the above activities, we can study the feasibility to introduce the process improvement. After carried out the above activities as a result improved quality of the product, increased productivity, Reduced cost of the product, and reduced the operator idleness. Cycle time also balanced.

IndexTerms: Turbocharger, Process improvement, Bearing Housing

I. Introduction

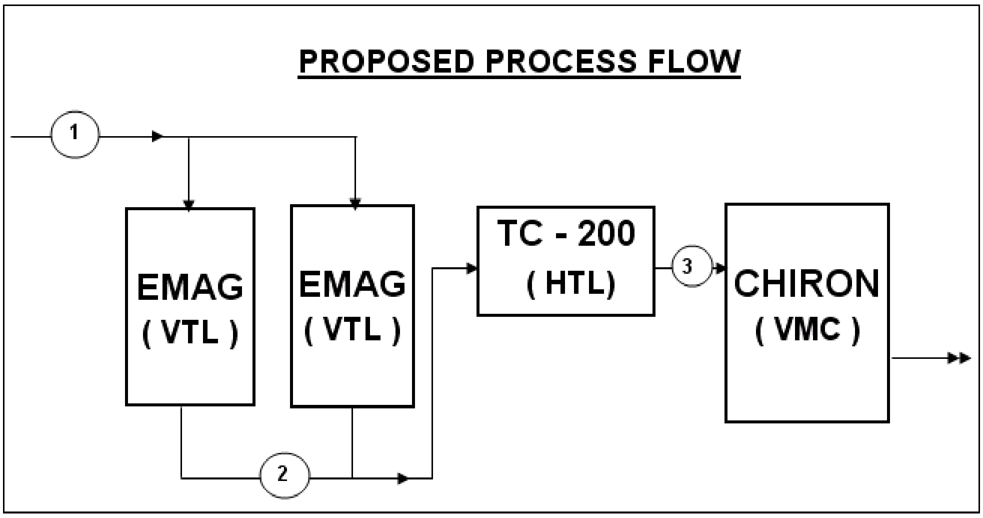
One of the products namely "Bearing Housing" While observing and studying the process it is noted that the Cell cycle time varies from operation to operations which reduces the productivity on this product considerably. This is mainly due to change in customer demand the balancing is needed. Hence It is assessed that with a minimum modification in the existing process and elimination of some operation the cycle time can be balanced and can be reduced, there by increasing operational efficiency. The overall Production cycle time of Bearing Housing cell currently does not meet the Cell balancing and unnecessary operator idleness. Present Cycle time of manufacturing, maximum idleness time is 80 Seconds. It varies from 40 seconds to 80 seconds.

The Objective of the project focuses on robust manufacturing process with improved productivity, Consistent quality, reduced operator fatigue, reduced manufacturing cost on identified critical product. These objectives are being met through implementation of planned activities towards process improvements, improved process flow, reduced the operator idleness & effective utilization of available resources**.**

Following is the approach planned in stages, to improve productivity & thereby meeting the customer demand. The Bearing Housing Cell machining consists of Stage 1(operation10) Compressor Housing seating diameter operation, stage2 (operation 20) Turbine side machining, stage3 (operation 30), Bore grooving operation and Oil inlet hole and outlet hole machining operation. The slow and long process flow results in higher cycle time and lower output. Due to the inherent complexity of current process, any delay in a single process affects the process flow, causing failure in meeting target. Currently all the processes contributing to major process cycle time were identified to reduce cycle time of process and manpower.

Every manufacturing system normally undergoes several phases. The system must be planned, implemented and controlled, generally by trained and competent manufacturing and management personnel. During the planning phase, consideration must be given to critical factors such as potential market for the product, its design, processes to be employed, facilities, equipment and materials needed for production. In the implementation phase, these resources are acquired and put in place so that production can begin. The implementation phase goes with the controlling phase, in that the system must be controlled or managed both at the time of its implementation and during production.

This addresses why it is necessary to improve manufacturing systems, and the different ways the improvements can be accomplished in the different areas of the field. Focusing on the need to use manufacturing systems curricula as a tool to instill related improvement principles in students, it also addresses the nature of the improvements needed in improving the systems for the survival of the companies where students may become potential employees. Miltenburg G. J. and Michael D., in his "U-shaped Production Lines" describes about the advantages of U-shaped line. U-shaped production line can be described as a special type of cellular Manufacturing used in just-in-time (JIT) production systems and Lean Manufacturing. The U-line arranges machines around a U-shaped line in the order in which production operations are performed. Operators work inside the U-line. One operator supervises both the entrance and the exit of the line. Machine-work is separated from operator-work so that machines work independently as much as possible. Standard operation charts specify exactly how all work is done. U-lines may be simple or complex, depending on the number of tasks to be performed, the production volume and setup times. U-lines are rebalanced periodically when production requirements change. The U-line satisfies the flow manufacturing principle.



II. Materials and methods

After analysing the reason for symmetrical problem in the component, we found the following things.

1. Loading the component in rotating pallet is not in similar manner by the operator.
2. Component orientation during chuck clamping is not identical.

To avoid this problem, brain storming is conducted. Then team decided and to ask the operator to load the component in only one orientation. Again one component loaded and machining conducted.

Then quality of the component is checked. But the result is not fruitful.

Reason found out after analyzing the problem. Component is getting disturbed during rotation of the component and its orientation is also changed.

To compensate such problem discussed with the Tool design office, and new idea is developed. So that component holding pallet design has to be changed.

In the component there is a core hole which is created by the pattern in the foundry. So that the repeatability is same in the casting. Hence the component locating pallet is designed as shown in the above figure.

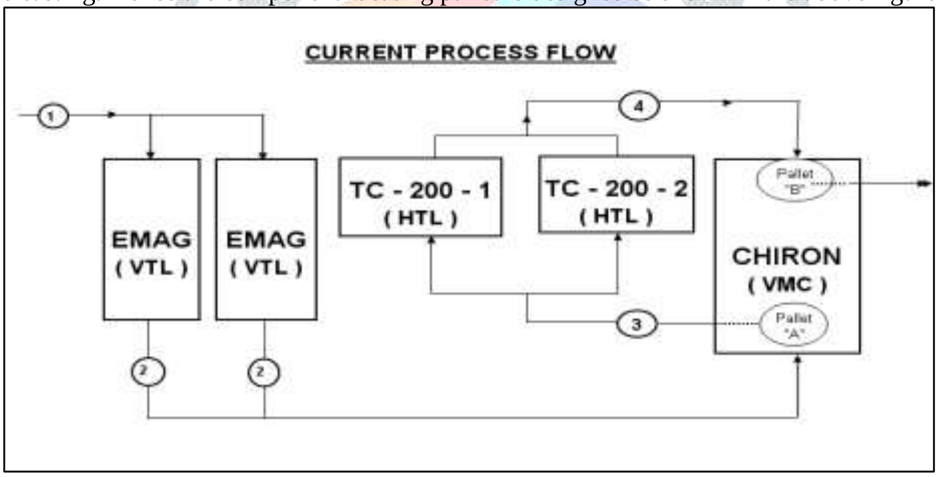


Fig. 1 CURRENT PROCESS FLOW

Fig.2 Product

Fig.3 Product view

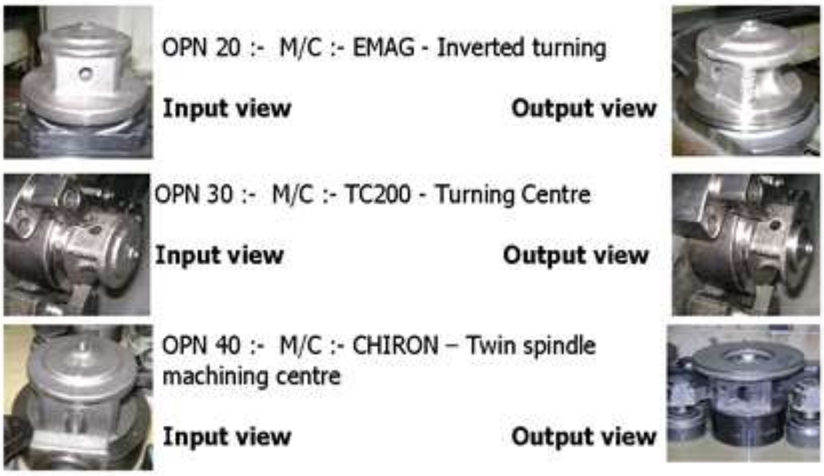


Fig.4 Bearing House

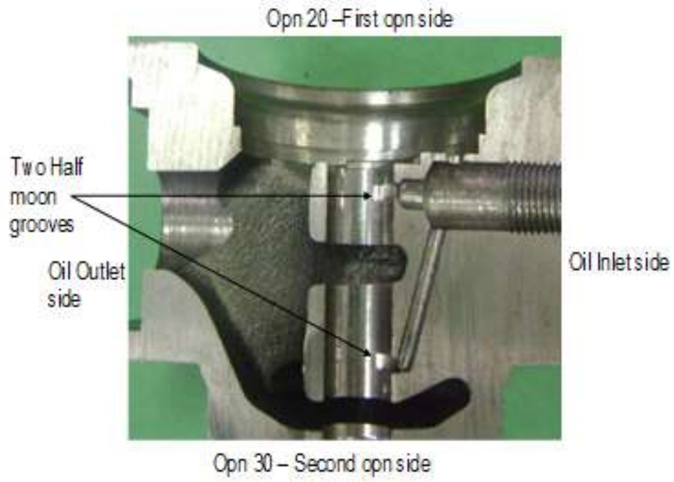


Fig.5 Product sectional View

Fig.6 PALLET

Fig.7 EMAG MACHINE

As per our activity chart bore reaming operation is to be shifted to the first operation machine. For this Mapal floating holder is mounted in the tool turret. This holder is special one and can float to accommodate the turret center shift. The reamer is adjusted to the appropriate size and trial is conducted. When the component is checked after the operation, there is bore taper noticed in the job. 20 micron taper noticed in the component. Then the problem is analyzed and discussed with the tool supplier. He advised us to keep a taper of 6 micron in the blade. As per the advice of the tool supplier, again trial conducted. Component produced and checked the result. Again taper noticed in the component and value is 10 micron. So problem analyzed and brain storming conducted. The team decided to correct the floating of the tool holder and the condition of the guiding pads.

Fig.8 Live Tool holder and Component

Fig. 9 REAMER IN TURRET

Fig. 10 FINISHED JOB IN PALLET

When checked the floating of the tool holder it was not enough for the tool floating. So floating adjusted and guide pad condition is also checked. Then component produced and quality of the component is checked. Now component is ok meeting the drawing requirement.

Fig.11 **GROOVE VIEW**

III. Results and Discussion

The main aim of the current project is to achieve increased productivity and cost reduction to maximize profit. Towards this object a careful initial study is made and finally concluded to revise the existing process, layout and tooling. This is achieved by improved process and tooling with marginal input cost for modifying existing and manufacture of new Tooling and Gauge.

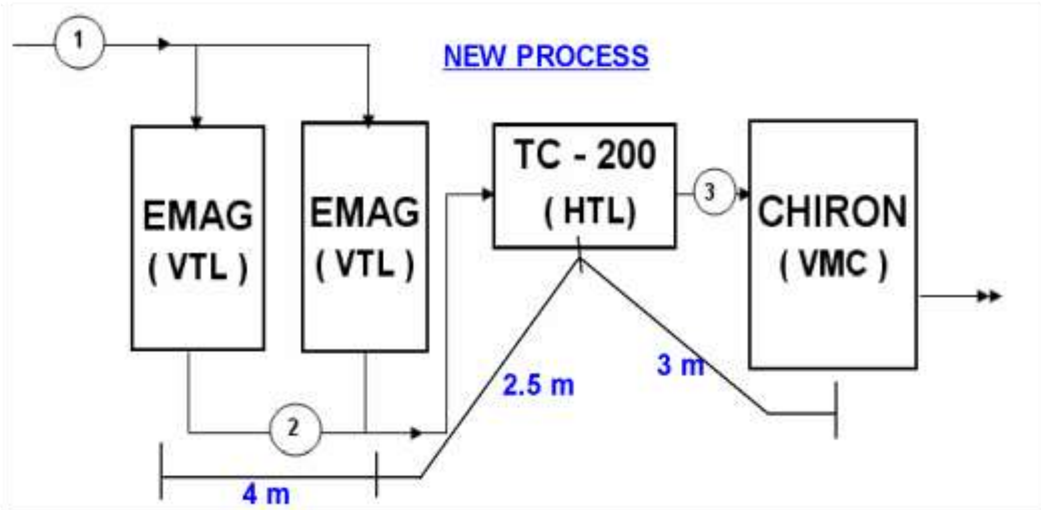


Fig.12 COMPONENT TRAVEL LENGTH

In the previous days we had customer complaint that the groove was missing in the component. There was no mistake proof to detect the presence of groove in the component. 100% visual inspection is also not impossible and it is purely man dependent. To avoid such problem we had discussed with the maintenance people to provide the tool breakage detect sensor in the machine itself. After completing the groove operation, the sensor along with chuck will move towards the groove tool to check the presence of tool. If the tool is present, sensor will give signal to controls and the further sequences are preceded. If there is no tool the signal will cut and the continuous cycle is stopped.

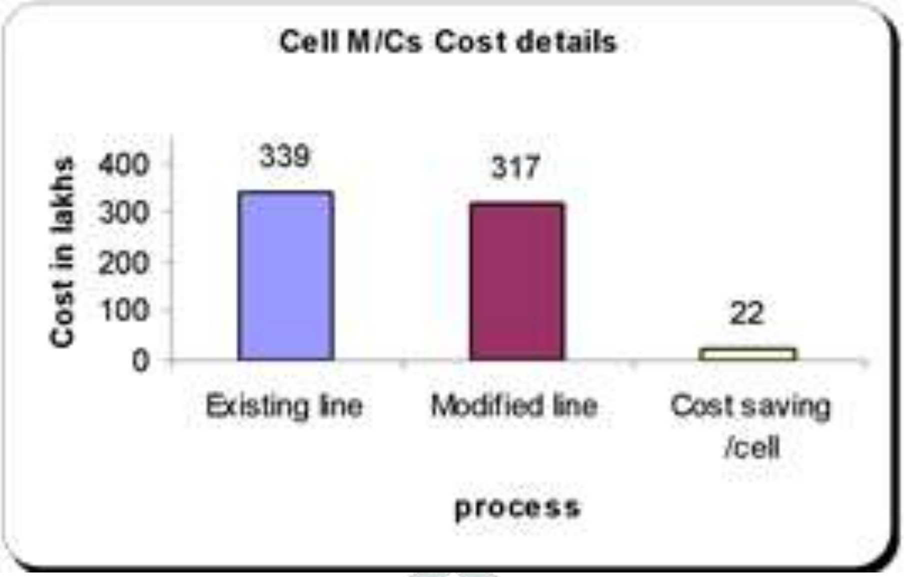
3.1 Tool life improvement in bore finishing tool

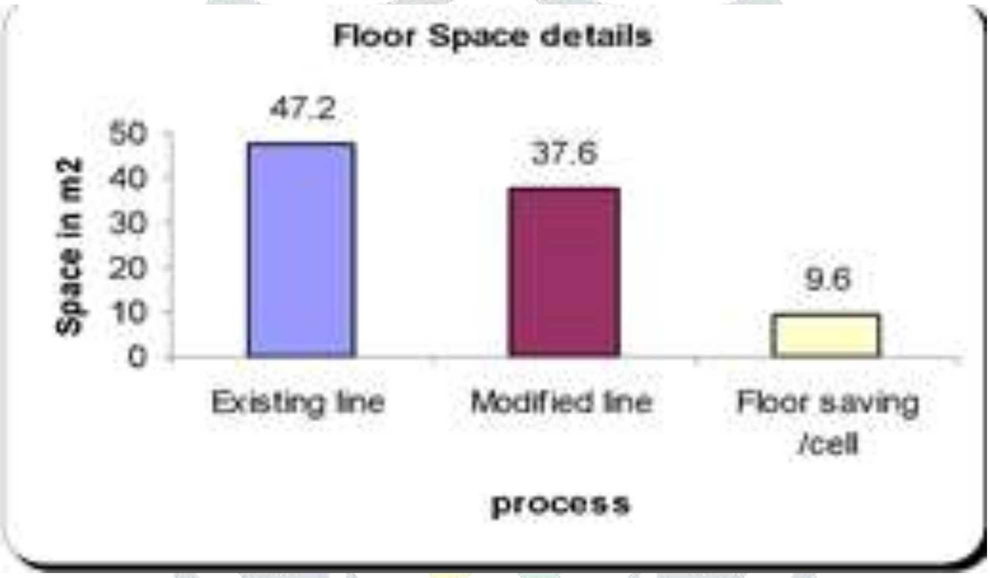
As we know that Mapal bore finishing tool is used for journal bore finishing operation. Previously we were using **AS 90 Row** insert for this operation.

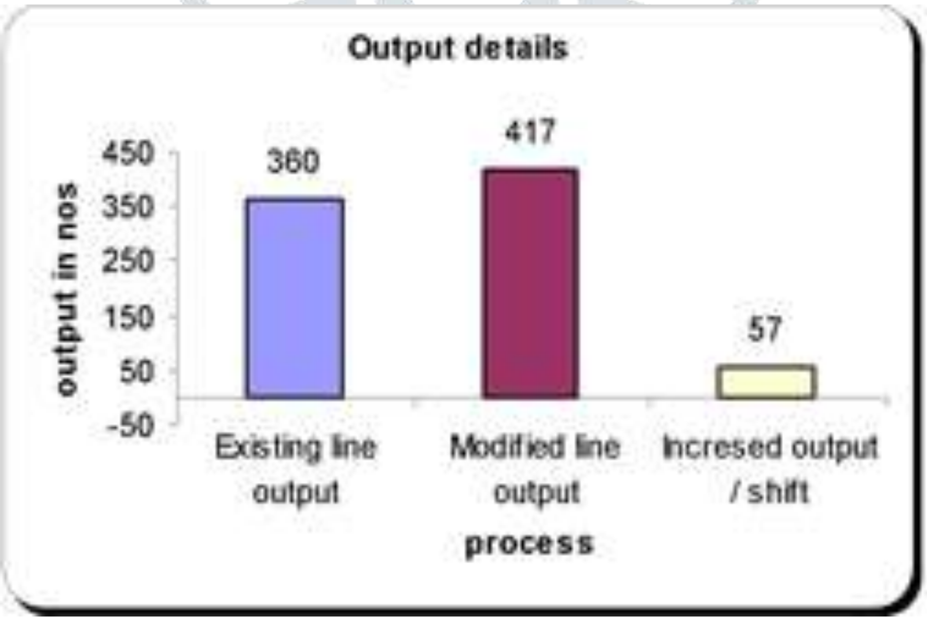
Life of this insert is only 150 nos per corner. So we discussed this with the supplier. They suggested us to use the **AS 90 Roz** inserts for our application. So we procured the new grade and used for the product. Now the life of the insert is 280 nos per corner. Cost of the insert is 10% more than the older one.

Previously we used to cut the component to check the groove position and its depth. To avoid such problem we requested management to buy a new instrument.

They cleared our request and new instrument brought to the shop floor.







Also consequential benefit is, usage of such discarded standard instruments for indirect -production work place area like Maintenance, Tool Room. This has resulted in reduction of value on inspection equipment purchases, which are very costlier & needs periodic replacement at increasing recurring cost while using for direct production in shop floor. The Revised and improved inspection method with Gauges resulted in maintaining dimensions within mean band limit of tolerance, so that chance of in process rejection is completely eliminated, which will otherwise could be present while using standard inspection instruments like Vernier caliper, Micrometer etc,

Fig.13 GROOVE INSERTS

IV. Conclusion

Existing resources are well utilized in doing the project, even from the data collection stage to examine, analyze the various method of process and tools, for implementing this project. The discussion of the results, benefits accrued is encouraging which gives confidence to study further project and arrive at conclusions similarly.

References

[1] Obi, S. C. (1999). A Framework for Implementing Appropriate Manufacturing Systems in Developing Economies. The Journal of Industrial Technology, volume 15, number 2,(PP. 1 – 6).

[2] Kimura O. and Terada H., "Design and analysis of Pull System, a Method of Multistatge Production Control", International Journal of Production research, Vol. 19, (1981), pp. 241.

[3] Allen J.H., "Make Lean Manufacturing Work for You", Manufacturing Engineering, Vol. 124, No. 6, June 2000, pp. 54-64.

[4] Miltenburg G. J. and Michael D., "U-shaped Production Lines "International Journal of Production Economics, Vol. 70, No. 3, (Apr 18 , 2001), pp 201-214.