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Case Study: Mass Production in Small Scale Industries

Velpuri Gopi Krishna

Department of Mechanical Engineering, Better Castings Company,
Vijayawada, Andhra Pradesh, India.

Abstract: **The case study discuss about production process in Better Castings Company. Consider for a moment what it takes to produce a product in manufacturing industry that has to produce different products at various times. Major, there are the logistics of scheduling and raw material handling. Then, add the human labour factor affecting both quality and efficiency. The production process in the company is similar to the other production process of companies where the raw material transfer from foundry to store, store to the lathe machining for parting material, from lathe machining to the CNC (computer numerical control) machines where the first operation and the second operation are carried out to obtain the final design of the ring joint gaskets. After the final machining the obtained product is carried to the quality control where the visual inspection, dimensional inspection, Quality of product & the specifications of the product are checked depending on the customer requirement. While machining product the tolerance in tool fit will affect the dimensions of product. Due to that product can't reach its specification limit given by customer. So company losing its machining time in the form of reworks and rejections, man power and production. This is common problem in many small scale manufacturing industries. In order of considering all these process a single change in production process leads better quality and efficiency production of company. The paper shows a solution to reduce machining time and man power in order to increase production of a company.**

Keyword: **CNC (computer numerical controlled machines), better castings, job, Q.C (quality control), Q.A (quality assurance), ring joint gasket, O.D (outer diameter), Quality inspection.**

I. Introduction

A Company named BETTER CASTINGS uses two types of production methods [1].

- Batch production and
- Mass production.

These two productions involve continuous production of the gaskets to the industries.
Types of Gasket produced are:-

- R model
- RX model
- BX model
- V-BAND MALE & FEMALE model
- 2" pre match ball model

The actual process chart of company is shown below Fig.1

Fig. 1. Process chart of a manufacturing company

The process chart shown in above Fig.1 shows how an actual process takes place in any manufacturing company. The process starts with raw materials to the foundry. The casted material is carried in to the machine shop where lathe operations are performed and moved in to CNC machine shop to give an actual shape and finishing for the job with better surface finish and accuracy. Then the job is moved to quality control where quality inspection was performed to maintain better quality in order to satisfy customer. Defects in the machining section are high due the production cost of company increases due to reworks and rejections. So, a small change is made during the machining process particularly during the CNC (COMPUTER NUMERICAL CONTROL) Machining. By this idea we can make sure that the BETTER CASTINGS will have great quality in quality control of the production. Before looking at change we made let us have a brief look at actual machining process taken place in company.

A. Machining

Machining is a place where casted parts get machined and turns in to the final product required for customer [1]. By using various set of operations like turning, facing, and milling etc.

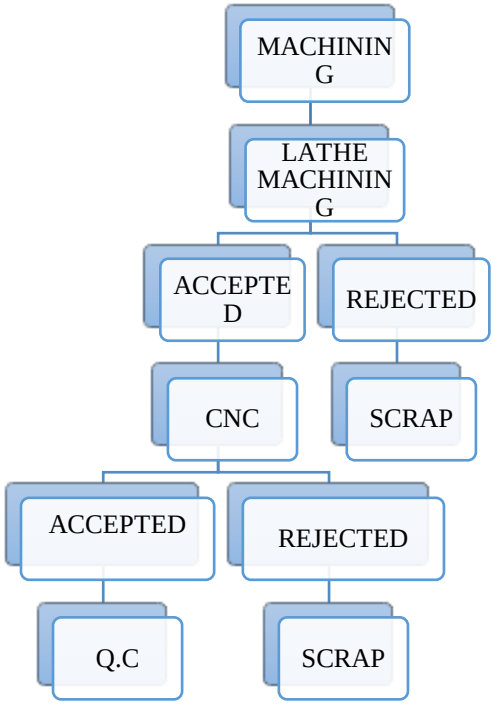

Fig. 2. Process chart for Machine Shop

If we have a look at fig.2 shown above it shows us that accepted jobs are shifted to quality control and rejection pieces are shifted to scrap. In machine shop rejecting work piece process takes place if it is out of shape (or) subjected to the vibrations when the machining process is going on. It is the place where we have to concentrate more in order to reduce rejection in a particular industry.

B. Quality Control

Quality control (QC) is a set of procedures anticipated to ensure manufactured product or performed deal surveys to define set of quality standards to meet need of customer. It is similar, however not undistinguishable with, quality assurance (QA). Quality control in any industry plays a key role to satisfy the customer requirement. Quality control looks at only customer satisfaction other than the process [1]. After the final machining the obtained product is carried to the quality control where the visual inspection, dimensional inspection, Quality of product & the specifications of the product are checked depending on the customer requirement. Where tolerance and non-destructive testing are performed to maintain better quality. After these the product is moved for the punching and the final dispatch.Where rejected pieces are moved to store and then to the casting as a raw materials. Let's take a look at quality control process in manufacturing company which is shown in below Fig.3.

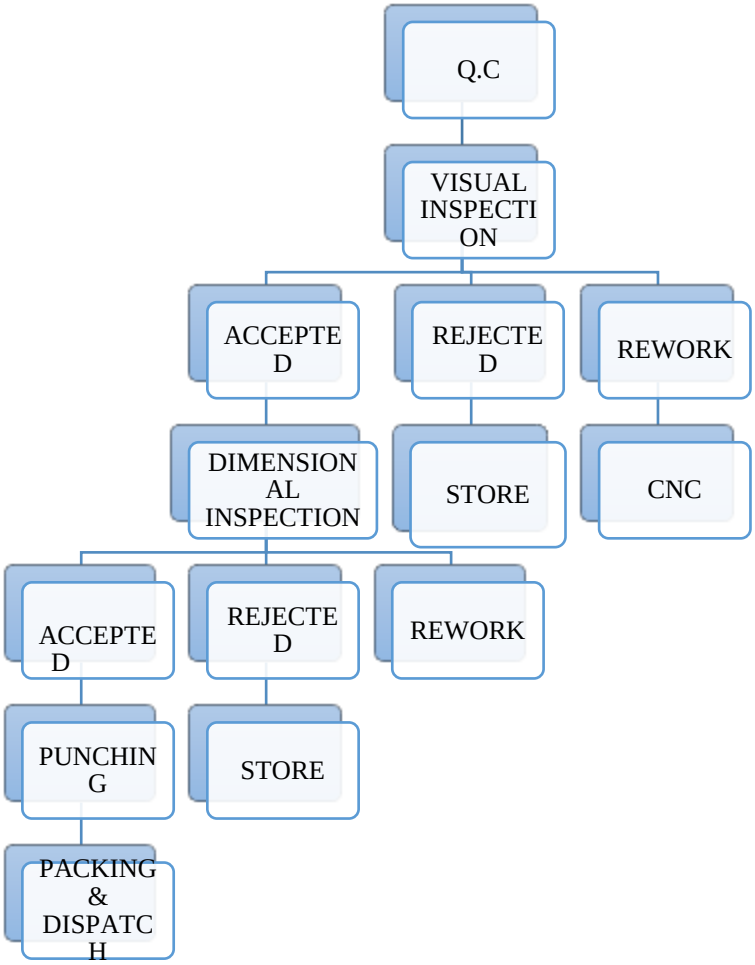

Fig. 3. Process chart for quality control

II. Problem Solving

The chart show in below fig.4. Shows the analysis and changes I have made during the study on the CNC (computer numerical control) machine. Usually a CNC performing operator will know greatly about the job that is machined on the machine. When a CNC operator performing the operations on the machine. Whatever the operations may be first or second operation. During those operations on a machine a particular cycle time will be set for a job depending upon the material, speed, feed & depth of cut.

As we know a CNC operator can operate at least 2 machines at a time. But the BETTER CASTINGS industry has total 6 CNC machines and the 7 operators including supervisors. Here we have required man power to perform the job. So, the CNC operator was requested to perform the visual inspection & dimensional inspection during the cycle time of the job performed on machine.

By this method the CNC operator can know & restrict his mistakes by performing visual inspection & dimensional inspection. So the operator can maintain a standard value for the Rings produced. And they can learn more from those mistakes and never be repeated. The industry can save the tool fixing time for the re work material & save power. If the CNC operators are well in performing the visual inspection & dimensional inspection then we can reduce the man power of the company. The process was checked by performing a test on RX24 ring.

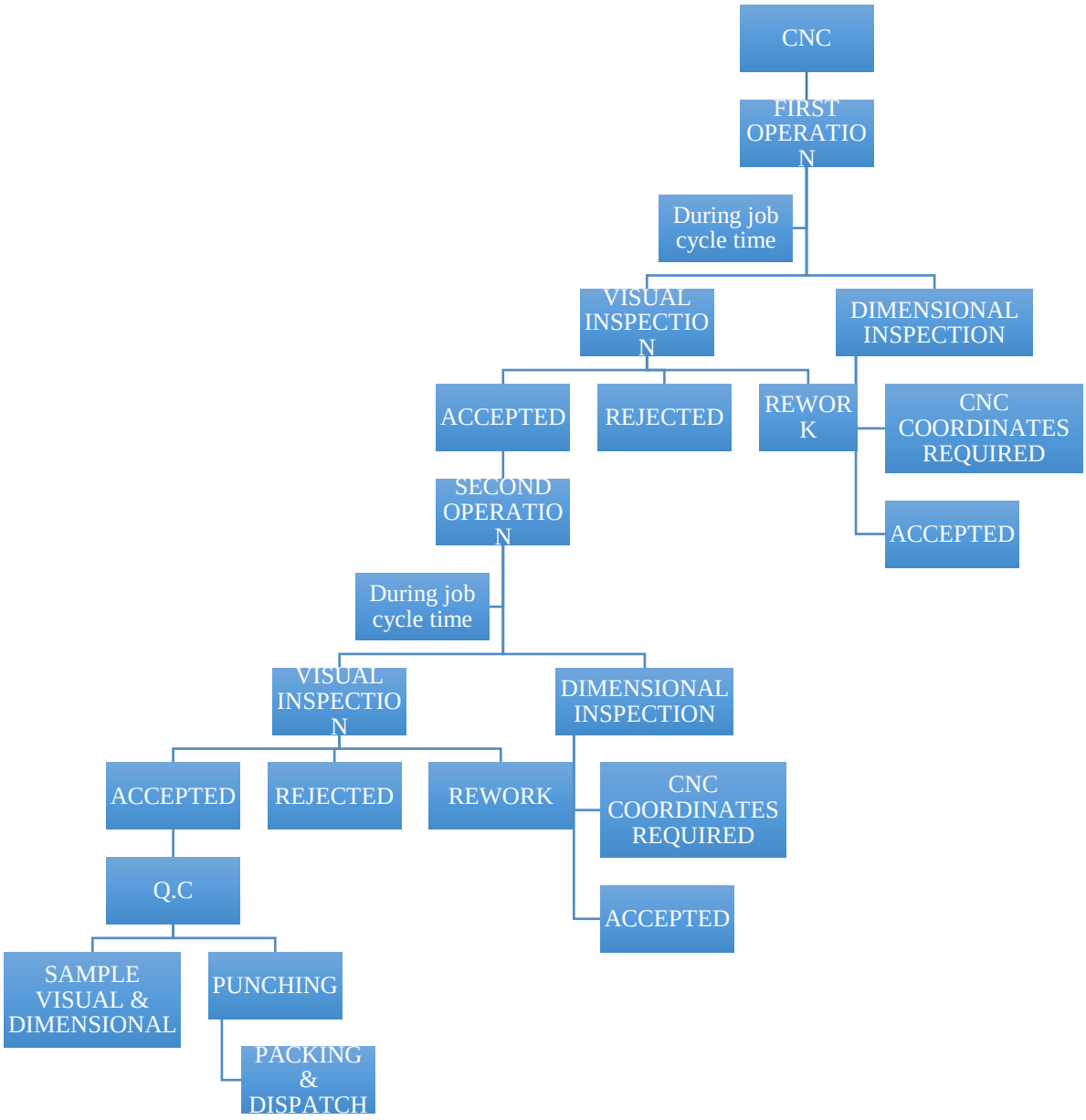

Fig. 4. Process chart modified in CNC shop

III. Study with RX-24 model

Considering a RX24 (ring joint gasket) model. The practical analysis for the case study is done by considering various parameters like.

- Tool setting fixing time.
- Lead time
- Cycle time etc.

In order both the visual inspection and the dimensional inspection is done by the operator and the record of the visual inspection and the dimensional inspection is maintained by the operator.
To maintain the record for the visual inspection & dimensional inspection we have created a separate record sheet for it and it is very useful for the company.
The report sheet involves the following

- Type of model
- Operator
- Supervisor
- First operation
- Second operation
- O.D (with tolerance)
- width (with tolerance)
- height (with tolerance)
- flat "c" (with tolerance)
- Visual inspection.

The following specifications help the operator to easily identify his mistakes and restrict them.
The actual time taken by an operator to fix the setting is 30 Min.
The cycle time for a single job is 3Min 30 sec.
The lead time for a single job is 4min 30 sec.
The results for the above analysis are shown in the form of dimensional report and the bar chart.

CNC DIMENSIONAL REPORT

MODEL: RX24 | QUANTITY: | DATE: 29/4/13

OPERATOR: G. Anand Sagar | SUPERVISOR: Pawan

	FIRST OPERATION						SECOND OPERATION					
S. NO	OD	WIDTH	HEIGHT	FLAT C	CYCLE TIME	VISUAL	OD	WIDTH	HEIGHT	FLAT C	CYCLE TIME	VISUAL
SPECIFICATION	106.23 ±0.25	12.01 ±0.1	25.5 ±0.1	6.53 ±0.07			106.23 ±0.25	12.01 ±0.1	25.5 ±0.1	6.53 ±0.07		
1	106.17	12.0	26.70	6.46	3.30	ok			25.0	6.60	3 min	R/J
2	106.18	12.0	26.70	6.54	3.30	ok			25.60	6.60	"	ok
3	—	—	23.30	—	—	Rej			—	—	—	—
4	106.16	12.02	26.70	6.52	3.30				25.58	6.58	3 min	ok
5	106.20	12.04	26.70	6.50	"	ok			25.56	6.58	"	ok
6	106.16	12.06	26.70	6.54	"	ok			25.58	6.54	"	ok
7	106.18	12.02	26.72	6.52	"	ok			25.60	6.60	"	ok
8	106.16	12.02	26.70	6.52	"	ok			25.52	6.56	"	ok
9	106.18	12.02	26.70	6.50	"	ok			25.56	6.52	"	ok
10	106.20	12.06	26.70	6.52	"	ok			25.52	6.54	"	ok

Fig .5. Dimensional report of study

From the above fig.5. Job no 3 is subjected to the rejection that may be visual rejection or dimensional rejection. If the operator did not perform the both visual and dimensional inspection then the same program will run for all the remaining rings.

The cycle time taken for the each job is 3 min 30 sec.

The lead time taken for each job is 4 min 30 sec.

After the job no 3 total 7 jobs are operated on the CNC machine the total cycle time for all the 7 jobs is 24 min 30 sec.

And the total lead time taken for all the 7 jobs is 31 min 30 sec

By this simple example we can say that the company has lost 31 min 30 sec of its valuable time during the production of rings with the waste of man power and power supply.

Suppose if we consider a lot of 300 rings with this kind of production then we can easily imagine what kind of loss will be faced by the company.

To eradicate those losses this type of studies will help the production company to restrict their mistakes during the production and to maintain constant check for every ring and change the coordinates of the machine to maintain the same value for every ring in order to improve the quality of ring.

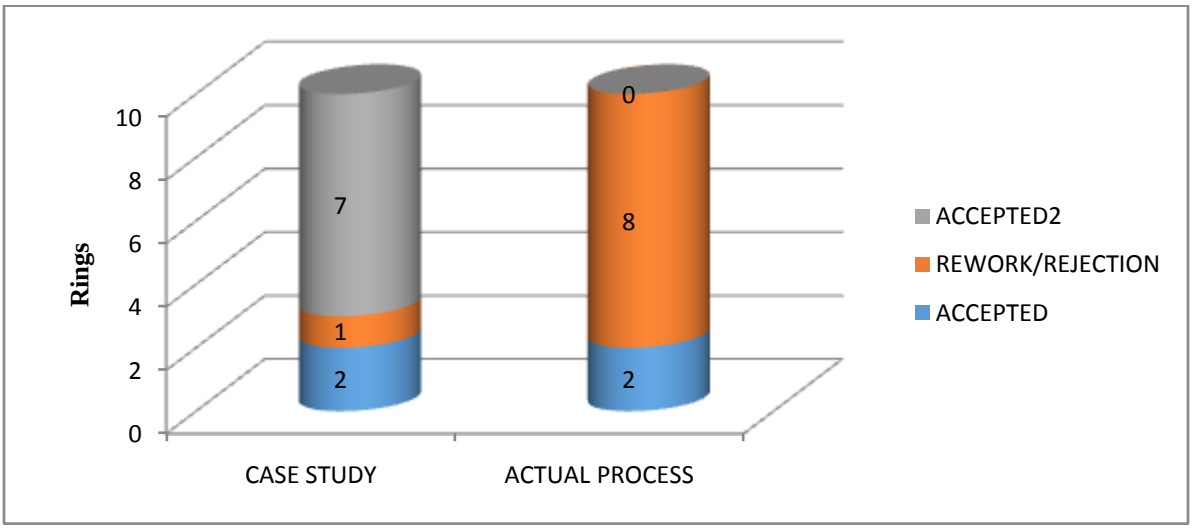

Fig. 6. Chart showing difference between study & actual process of company

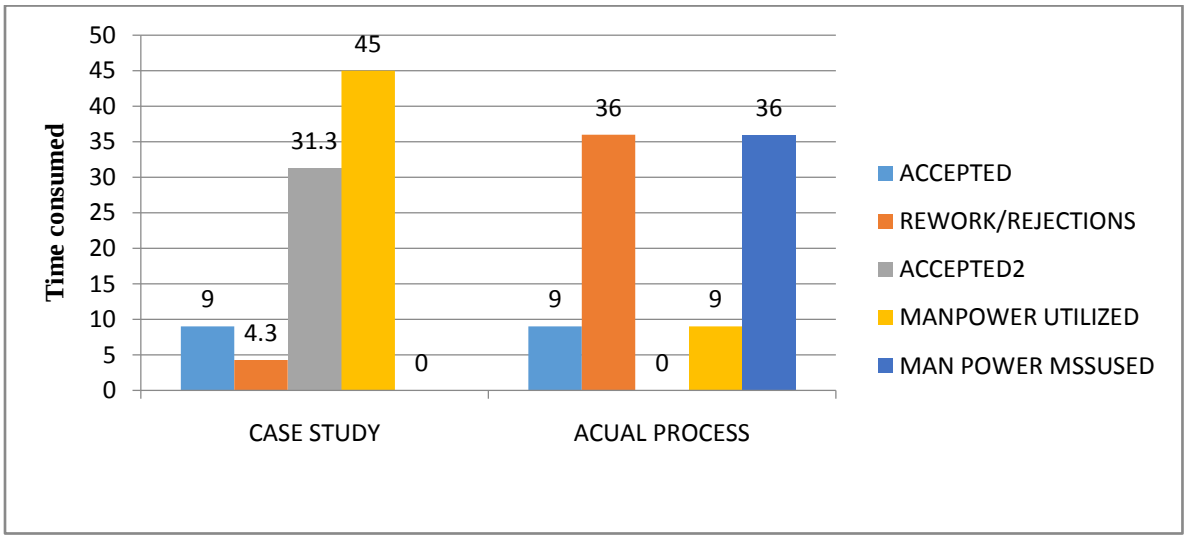

Fig.7. chart shows time utilized and misused by company

The above chart shown in Fig.6, 7. The differences between the case study and the actual process of the company are clearly shown.From the above results we can say that the implementation of the case study in the industry will give better results than the actual process of the company.

IV. Conclusion and Recommendations

By this we can conclude that the methodology shown by the case study has the better results compared to the methodology of the company. With this case study we can save:

- Power consumed during rework & tool fixtures.
- Man power
- Increase production.
- Reworks & rejections of the job.

To have a technically skilled operators to operate a CNC machine.

References

[1] http://www.bettercastings.com/