

## Productivity Improvement by Minimizing Losses in Paint Line of Sheet Metal Component – A Case Study

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### ABSTRACT

Today's business growth is totally dependent on the productivity and the customer satisfaction through in time delivery and services. This paper reflects the case study conducted at one of the well known sheet metal manufacturing plant AKAR industry which is located in S-70 M.I.D.C. Hingna road Nagpur. The study was carried out in paint line with an aim to reduce the cycle time during operation masking and unmasking the threaded hole of sheet metal component (battery tray) before and after painting process. This study started with observing the operation in paint line, understanding the existing process flow; identify the problem and areas of possible improvements reached. This paper illustrates the Productivity improvement technique formed an integrated platform to help identify the weak areas and improves the lead time for manufacturing process.

**Keywords:** Sheet Metal Manufacturing Plant, Paint Line, Productivity Improvement Technique, Masking Plug

### I. INTRODUCTION

Productivity is the quantitative relation between what we produce and what we use as a resource to produce them, i.e., arithmetic ratio of amount produced (output) to amount of resource (input). Productivity can be expressed as:

$$\text{Productivity} = (\text{Output}/\text{Input})$$

Productivity refers to the efficiency of the production system. It is the concept that guides the management of production system. It is an indicator of how well the factors of production (land, capital and energy) are utilized.

The productivity improvement techniques used to improve the productivity in paint line is work study which is categorized in two types are as below:

- 1) Method study
- 2) Time study

Work study: "Work study is a generic term for those techniques, method study and work measurement or time study which is used in the examination of human work in all its context and which leads systematically to the investigation of all the factors which affects the efficiency and economy of the situation being reviewed, in order to effect improvement."

**1) Method study:** Method study is the systematic recording and critical examination of existing and proposed ways of doing work, as a means of developing and applying easier and more effective method.

**2) Time study:** Time study or work measurement is used to determine the time required to complete the operation by skilled worker by using stopwatch.

## II. LITERATURE REVIEW

[1] Among the subjects that were most frequently studied by researcher Fredrick w. Taylor [1] developed work study technique in 1880. Work study was the first technique to improve the productivity. Fredrick w. Taylor also developed time study in 1880 which is a part of work study in which he is the first person to use a stopwatch to study and measure work content with his purpose to define "a fair days work."

[2] Productivity Improvement in Manufacturing Unit Analyzing Production Machine & Facilities by Rajkumar Sharma, prof. Sajid Qureshi and Dr. Vivek Bansod, the main aim of this analysis is to improve layout in manufacturing unit with clear focus on improving productivity. An effort is made to study the entire layout design of production line right from raw material stage until finished product output & redesigned layout after thorough analysis of data in line with software simulation techniques.

[3] Enhancement in Productivity in Sheet Metal Industry through Lean Principles by Gaurav Kumar & S.K. Gupta, the purpose of the research paper is to investigate how to improve productivity and in time delivery as expected plant. This paper illustrated the impact of using lean manufacturing as a tool to identify the weak areas and improves the lead time for manufacturing process which is being used in rim manufacturing of sheet metal industry.

[4] Improving Productivity in a Paint Industry using Industrial Engineering Tools & Techniques by Aakash Jaiswal e.t.al. This paper reflects the study of the implementation of industrial engineering tool in a paint industry.

[5] Increasing Productivity by Reducing Cycle Time in Assembly Line on an Automotive Industry using Work Study Techniques by Ashish Kalra e.t.al. This study was carried out on before paint assembly line with an

aim to reduce the cycle time of different workstation to complete the operation at the assembly line in time.

## III. STUDY METHODOLOGY

There are a number of techniques in industrial engineering which are suitable for identify the weak areas and improves the cycle time in sheet metal manufacturing plant. Among these techniques we opted for work study technique which is method study and time study. The study methodology carried out in following ways:

- a) Identify various operations carried out in a paint shop and create original layout of paint shop.
- b) Create flow process chart for pre-treatment process, drying process, painting process and oven.
- c) Collect important data & conduct time study technique to identify the time required for painting process for a particular sheet metal product (battery tray).
- d) Analyze the collected data.
- e) Conduct method study to understand existing method of doing work and identify the areas where cycle time can be reduce, develop faster method of doing the same work.
- f) Conduct trial run for 2 industry visit for new method and collect the data by time study technique and compare the old method to new adopt method.
- g) Recommend the new method to the concern.

## IV. CASE STUDY AT COMPANY

The AKAR industry manufacturing the various sheet metal parts like battery tray, battery retainer, tap cover plate, bracket fuel builder, bracket filter mounting commercial for automobile vehicles. This industry fabricates the parts through sheet metal process for leading automobile vehicle manufacturing industries like Mahindra & Mahindra, Ashok Leyland.

### A] Problem Statement:

This paper reflects the case study carried out in a paint line particular on a battery tray component shown in figure 1. The industry facing the problem during painting process. There is a time loss during masking and unmasking operation. The organization is using paper masking plug for mask the threaded hole.



**Figure 1.** Battery tray component

The plugs are made up of sand paper ( recycled paper) that are irregular in shape therefore it takes more time for masking and unmasking operation also there are more chances of getting paint stuck inside threaded holes & at the time of mating of nut with bolt it faces difficulty. To avoid this kind of issue Re-tapping process has to be employed. Re-tapping process increases the production cost as well as time.



**Figure 2.** Paper masking plug

### B] Case Study Procedure:

Step 1: Determine all the sub-operation in painting section and create flow process chart.

**Table 1**

Sr. no.	Sub operation
1.	Masking
2.	Battery tray hanging to hanger
3.	Painting
4.	Unmasking
5.	Painted battery tray to oven trolley

Step 2: Determine the cycle time required for painting operation and calculate normal time for painting operation.

Step 3: Define a new masking plug material which is suitable for wet painting process so that during operation it should give a quality product.

Step 4: Collect all the necessary data about the new existing method by critical examination of existing method

### C] Selection of Masking Plug Material & Size:

There are lots of materials for standard masking product, mainly due to the diverse process that are used in finishing process.

The properties of masking plug material should be high temperature resistance, wear resistance, chemical and water resistance and it should be reusable.

We recommend the wooden masking plug shown in figure 3, for protect the threaded hole of battery tray component. The wooden masking plug has properties like it is high temperature resistance at 149 degree Celsius.



**Figure 3.** Wooden masking plug

#### D] Cycle time description sheet

**Table 2**

Sr. no.	Operations	Paper plugs CT (sec)	Wooden plugs CT (sec)
1.	Masking	21	8
2.	Battery tray hanging to hanger	10	12
3.	Painting	129	127
4.	Unmasking	12	5
5.	Painted battery tray to oven trolley	23	26
		195	178

#### V. RESULT AND CONCLUSION

On the basis of data collected & made the calculations for mask and unmask the threaded portion of sheet metal component (Battery Tray), we found that by the using of wooden masking plug it required less time for masking and unmasking operation are shown in table 3 & table 4

**Table 3**

Time required ( sec)	
Masking by <u>paper</u> masking plug	Unmasking by <u>paper</u> masking plug
21 sec	12 sec

**Table 4**

Time required ( sec)	
Masking by <u>wooden</u> masking plug	Unmasking by <u>wooden</u> masking plug
8 sec	5 sec

#### VI. REFERENCES

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