

Implementation of Lean Manufacturing System on Oil Pump

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Abstract - The purpose of this study is to investigate the scope for adoption of lean manufacturing system on oil pump OP 475 (machine shop) in Autolec division plant-4. We chose oil pump OP475 because there has been a ramp up of volume in this model. To improve the productivity and to give a higher output we are doing this project. A detailed study was done to explore key areas of lean manufacturing system namely, scheduling, inventory, equipment, quality, employees, layout and suppliers. Based on this study, we decided on the key areas which are to be addressed for introducing lean manufacturing system. Thus from the key areas, we have thrown light on the failures and errors. We have also suggested and recommended the possible ways of implementation of the lean manufacturing system on oil pump 475 (machine shop) in Autolec division plant-4.

KEYWORD: lean manufacturing system on oil pump, Bill Of Material (BOM) , Throughput Time for OP475

I. INTRODUCTION

1.1 LEAN MANUFACTURING PROCESS

Lean manufacturing process is the process of empowering companies to be able to implement manufacturing methodologies that attempt to maximize the value of goods and minimize the waste that comes with it. Every company has been asking what lean manufacturing process is, as compared to the present manufacturing methods and why should it be considered. Lean manufacturing process hopes to satisfy not only the customers of a company but its employees and shareholders as well.

1.2 LEAN MANUFACTURING PROCESS TO THE STAKE HOLDERS

a) Lean manufacturing process - To the customers: A customer only pays for what they need. This is called value in the perspective of a company. Value is termed as something that the customer is willing to buy or pay for. So basically, lean manufacturing process gives the customer what it wants. What is lean manufacturing process as an effect to customers is that it decides to make the manufacturing companies more customer centric and therefore gives more satisfaction to the customers. A company usually does surveys or just plainly asks particular customers of his needs or wants and then focuses all its available resources and energies to that particular need.

b) Lean manufacturing process - To the employees

Employees have long been part of the manufacturing line. They are considered to be a major part of the manufacturing line. If a company implements a lean manufacturing process, the employees will benefit from the ease of work and less redundant or loops in the manufacturing line. As a result accidents at the work spot are prevented and monotony avoided. The effect of Lean manufacturing process on the employees is that the lean manufacturing process will eliminate the processes or things that are considered as waste in the manufacturing process. To every employee, work enrichment and work enhancement will happen, because every operator manages more than one machine/process and so gets a holistic view of the process and the product.

c) **Lean manufacturing process - To the company**

The lean manufacturing process will bring great benefit to the company since its programs are focused on how the company can improve its manufacturing lines. What is lean manufacturing process for the company is that its ability to eliminate wastes and redundant processes improves. Thereby it shall get more output from the same inputs. Thus its productivity increases.

The lean manufacturing process to the customers, employees and shareholders is that it aims to develop a coordinated and more effective manufacturing process beneficial to all.

II. LEAN MANUFACTURING SYSTEM

The lean manufacturing system is a general term applied to the latest methods of manufacturing that maximizes value and minimizes the waste. Lean manufacturing systems are varied systems designed to improve the manufacturing line of any company.

Definitions of Terms in Lean Manufacturing Systems

1. Value in terms of the lean manufacturing systems is basically what the customer is ready to pay for. A company will have to study and find out what the customer really needs and then focus all its energies and resources towards those in its products.

2. Waste in terms of the lean manufacturing system is the opposite of the value. Everything that is outside the value that was assigned to particular products is deemed a waste. Anything that the customer is not willing to pay for is also deemed a waste. Waste is normally manifests itself in eight different forms:

2.1. Overproduction

Overproduction in lean manufacturing system terminology is the production of a particular good in higher numbers than what is needed. When a customer orders a particular product, a company will have to manufacture it and deliver it on time. The problem gets exposed, when the company overproduces the goods and upon delivery, the customer will only buy what he needs. What is left of the product is then deemed as waste since it is excess and the customer is not willing to pay for it. If a company has lean manufacturing systems, then it will be able to monitor how much it should produce and avoid overproduction.

2.2. Inventory: Problems in inventory arise when the stock is less/more than the demand by the customers. If a customer does not get what he wants then it will be a loss of sale and dent the image of the company. Lean manufacturing systems can be tailored to monitor the levels of inventory. Once the stock is near depletion it must be replenished. Excess inventory is also a problem. If stocks are more than what is required then the company has to invest more working capital which is a burden. Further, proper storage and preservation of such inventory is also an expensive proposition.

2.3 Defects: Eliminating defects has always been a part of lean manufacturing systems. Lean manufacturing systems desire to decrease defects in the manufacturing line by improving processes and applying automation in specific areas along the manufacturing line. Defects can be caused by human errors as well as improper functioning of equipment. Lean Manufacturing System addresses human errors through a process called mistake proofing (POKA YOKE) and takes care of the functioning of equipment through TPM.

2.4 Extra processing: Extra processing are processes that are seem to be redundant in the system. Extra processing can be eliminated by micro monitoring and identifying specific processes that are not needed anymore by the manufacturing line. What the lean manufacturing systems are doing is to cut down unnecessary processes and improve the manufacturing line. This is done periodically.

2.5 Waiting time: Waiting time as per lean manufacturing systems is the unnecessary time that is spent and wasted along the manufacturing line. A Lean Manufacturing System ideally aims at zero waiting time for men, machines and the part that is being processed.

2.6 Underutilized people: Underutilized people are a concern. Lean manufacturing systems addresses this problem by triggering a micro level study of the process cycle times and the manual activity of the operators and offers

solutions by reducing/combining/eliminating activities. Low cost Automation processes implemented along the manufacturing lines have improved the utilization of people as they reduce the manual activity of the operators. This has resulted in what is now called the MULTI MACHINE MANNING (i.e.) Single operator operating many machines (arrived after a scientific study) without any increase in the fatigue factor.

2.7 Motion: The motion of the manufacturing line is also a concern for the lean manufacturing systems. The processes of the manufacturing line must be streamlined and improved and lean manufacturing systems have solutions to cut down unnecessary motion. This reduces the fatigue of operators.

2.8 Transportation: The lean manufacturing system focuses on unnecessary transportation & storage. Unnecessary transportation is a waste. It increases the throughput & also needs more material handling equipment. All these are avoided by eliminating unnecessary transportation.

III. THE IMPORTANCE OF LEAN MANUFACTURING STRATEGY

Sometimes companies cannot manage the competition and are forced to lower the charges and lose profit. While doing this, they might also lose customers. Sometimes such strategies, applied only lead to disaster. The lean manufacturing strategy has proved to be one of the greatest advantages when it comes to changing company's strategy. It is one of the most effective ways to decrease costs and increase profit on long term. Its philosophy is called "elimination of wastes". What lean manufacturing wants to obtain is effectiveness. Although producing more is good, lean manufacturing teaches us that producing exactly how much we need is better because producing more means more effort wasted. So what people should obtain is effectiveness inside and outside their company.

IV. IS INVENTORY INFLUENCED BY LEAN MANUFACTURING?

The strategy used in lean manufacturing is actually making everything efficient. Production has to be efficient, no more no less. Why would your company need more products when it needs less? So the best strategy you should consider is producing exactly to the requirement. Avoid overproduction. When producing more than needed a lot of space is required and sometimes products can be damaged if they just rot in your warehouse. Sometimes, even old products can be sold but not at their initial price because they are considered old. So what kind of business is this? Making more products and selling a lot of them at a lesser price. Be careful and analyze your situation before applying lean manufacturing strategies. It can sometimes be a little difficult if you don't know best what you are going to do. Although it may seem like a long and difficult process you should consider the long term benefits. You will surely find more advantages than disadvantages when it comes to lean manufacturing strategy. As soon as you have your strategy implemented, you can go out there and show other companies how real business is made.

V. THROUGHPUT TIME

The period required for a material, part, or subassembly to pass through the manufacturing process. The time required to make a completed unit of product starting with raw materials. Throughput time is also known as cycle time. The amount of time required to turn raw materials into completed product.

TABLE 3.1 THROUGHPUT TIME FOR OP475

OP475 COMPONENTS IN	NO. OF DAYS
	CURRENT STATUS
Main raw material store	7
Machine shop	1
Dispatch	1
	Total = 9 days

3.4 DRAWBACKS WITH THE CURRENT STATE

- The time of the material movement is high
- Delay is more
- Productivity is low
- Inventory is mismatched
- Man power is high
- Improper layout

TABLE 3.3 MACHINE & OPERATION TIME ANALYSIS FOR OP475 BODY

MACHINE	MOVING TIME	LOADING TIME	MACHINING TIME/ COMPONENT	UNLOADING TIME	DISTANCE(m)
	Main room store to M/C shop store room = 1min30sec				57
M/C-1 VMC	M/C shop store room to M/C-1 = 5sec	19sec	5min20sec	31sec	1
M/C-2 CNC	M/C-1 to M/C-2 = 5sec	15sec	2min20sec	10sec	2
	M/C-2 to T.S = 4sec				3
M/C-3 MANUAL DRILLING (2 Reaming process)	T.S to M/C-3 = 1min50sec	4sec	27sec	4sec	74
M/C-4 MANUAL DRILLING (Leak hole)	M/C-3 to M/C-4 = 5sec	4sec	25sec	3sec	3
M/C-5 (Deburring)	M/C-4 to M/C-5 = 26sec	1sec	8sec	1sec	17
M/C-6 (Washing & Cleaning)	M/C-5 to M/C-6 = 4sec	2sec	2min15sec (W+C)	3sec	1

TABLE 3.4 MACHINE & OPERATION TIME ANALYSIS FOR OP475 COVER

MACHINE	MOVING TIME	LOADING TIME	MACHINING TIME/ COMPONENT	UNLOADING TIME	DISTANCE(m)
	Main room store to M/C shop store room = 1min45sec				63
M/C-1 MANUAL DRILLING	M/C shop store room to M/C-4 = 3sec	5sec	10sec	6sec	2
M/C-4 VMC	M/C-1 to M/C-4 = 10sec	29sec	5min55sec	28sec	8
M/C-3 VMC	M/C-4 to M/C-3 = 3sec	11sec	5min15sec	17sec	3
M/C-2VMC	M/C-3 to M/C-2 = 3sec	15sec	6min5sec	11sec	3
	M/C-2 to T.S = 6sec				3
M/C-5 MANUAL DRILLING	T.S TO M/C-5 = 1min50sec	11sec	30sec	11sec	75
M/C-6 (Deburring)	M/C-5 TO M/C-6 = 28sec	1sec	30sec	1sec	15
M/C-7 (Washing & Cleaning)	M/C-6 to M/C-7 = 4sec	3sec	2min20sec (W+C)	4sec	1
M/C-8 (Leak hole testing)	M/C-7 to M/C-8 = 6sec	11sec	1min	13sec	4
M/C- 9 (Cleaning)	M/C-8 to M/C-9 = 6sec	1sec	15sec	1sec	4

TABLE 3.5 MACHINE & OPERATION TIME ANALYSIS FOR OP475 ASSEMBLY

PROCESS	MOVING TIME	LOADING TIME	PROCESS TIME	UNLOADING TIME	DISTANCE (m)
ASSEMBLY SHOP STORAGE	Gears, shafts & child parts- main store to assembly shop store = 1min53sec				100
NUMBER PUNCHING	Assembly shop store to number punching = 6sec	2sec	15sec	2sec	5
SUB ASSEMBLY	M/C-6 TO S.A(BODY)=12sec, Gear store to S.A =2sec, N.P to S.A(H.S) = 5sec	6sec	12sec	6sec	5+1+5
ASSEMBLY	Sub assembly to Assembly shop(body) = 2sec, M/C-9 to Assembly(cover) = 4sec	2sec	2min30sec	2sec	2+2
PERFORMANCE TEST	Assembly to Performance test = 3sec	48sec	4min	50sec	3
NUMBER PUNCHING	Performance test to Number punching = 5sec	2sec	18sec	1sec	7
INSPECTION & PACKING	N.P to Inspection & Packing = 5sec	2sec	42sec	2sec	2

COMPARISON FOR MOVING TIME

	MACHINE	MOVING	TIME (sec)		
			EXISTING	PROPOSED	SAVINGS
FOR BODY	M/C-3 Manual Drilling	Temporary storage to M/C-3	110	6	104
	M/C-5 Deburring	M/C-4 to M/C-5	26	5	21
FOR COVER	M/C-4 VMC	M/C-1 to M/C-4	10	6	4
	M/C-5 Manual Drilling	T.S to M/C-5	110	6	104
	M/C-6 Deburring	M/C-5 to M/C-6	28	6	22
TOTAL			284	29	255

TABLE 4.4 COMPARISON FOR MOVING DISTANCE

	MACHINE	MOVING	DISTANCE (m)		
			EXISTING	PROPOSED	SAVINGS
FOR BODY	M/C-3 Manual Drilling	Temporary storage to M/C-3	74	3	71
	M/C-5 Deburring	M/C-4 to M/C-5	17	2	15
FOR COVER	M/C-4 VMC	M/C-1 to M/C-4	8	3	5
	M/C-5 Manual Drilling	T.S to M/C-5	75	3	5
	M/C-6 Deburring	M/C-5 to M/C-6	15	3	12
TOTAL			189	14	175

TABLE 4.5 COMPARISONS BETWEEN CURRENT STATUS & PROPOSED METHOD

	CURRENT STATUS	PROPOSED METHOD
Time consumption	289 sec	29 sec
Moving distance	189 m	14 m
Labours	15 per shift	9 per shift
Inventory	7 days	3 days
Throughput time	9 days	4 days

IV.CONCLUSION

The primary objective of this study was to explore the scope for lean manufacturing implementation on oil pump 475 (machining shop) in Autolec division plant-4. In fact, lean manufacturing begins with a focus on customer's desires and an organization should drive out activities that do not add values from their perspectives. A greater customer satisfaction would enable a larger market share to be obtained. The project made by us is very useful for the organization and it has the following scope, This enhances single piece flow. Manpower reduction. Material movement and time is reduced.

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