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Optimization and Improvisation of Production Assembly Line of Two Valve Engine of Light Commercial Vehicle

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ABSTRACT
In automobile engineering terminology a multi-valve engine is one where each cylinder has more than two valves. A multivalve engine has better breathing and can operate at higher revolutions per minute (rpm) than a two valve engine, delivering more power.

Nowadays Eicher Motor is generating only two valve engines. But the need of the hour is to develop more efficient, four valve engines, which provide better fuel efficiency. Eicher Motor has started working on four valve engines because two valve engines apart from delivering inferior fuel efficiency compared to four valve engines also fall short on the front of emission norms compliance. To keep the transition two valve to four valve economical, it was proposed that instead of having an entirely new set up for assembling the four valve engines, two valve engine assembly line be use after required modification. For this change were made to engine assembly common line (Block), and cylinder head assembly line conveyors, location of cylinder head assembly line, manpower, machine and tools etc. of Eicher Motor as per the requirement of four valve and two valve assembly line and also engine assembly process was changed.

Keywords – Engine assembly line & method, lean production & cost cutting, Machines, Tools, Engine assembly line layout etc.

I. INTRODUCTION

Multivalve engines i.e. engines having more than two valves per cylinder are the need of the hour. Their desirability can be ascribed to various factors like better birthing thus ensuring fuller combustion of charge (mixture of fuel and air) and their by helping to make the emission less polluting (due to reduced load of harmful Nitrogen, Sulphur and lead compounds) such engines due to fuller burning of air fuel mixture deliver better fuel efficiency and outing to their ability to operate at higher RPMs than their two valve counterparts, they produce enhanced power output.

Eicher Motor had, seeking to bring itself in line with the stringent emission norms, which are get to more strict in the years to come, had got down to working on multivalve engines and more specifically on four valve engines. When it took up the project of assembling four valve engines, it had two options- either it could make use of the same assembly line it had been using to assemble two valve engines, with some alterations and modifications. After making a detailed study and comparison of both the assembly process, it was concluded that changes were only required to be made on head line and common (Block) assembly line to incorporate the assembly of four valve engine cylinder on the two valve engine assembly line. To accomplice this, some new stations on the assembly line had to be created and some of the existing workstation was to be modified according to the demands of the new process. To expedite the process of assembly of four valve engines, change were also made to the machines, tools, and process involved, which was imperative to speed up the process. They also had to switch over to a chain conveyor instead of a simple one that they were using. Changes also had to be made to the line layout, all within the constraint of the limited assembly area and in keeping with general safety standards and process standards of Eicher Motors. Engine head line was quit for away from the main line which lead to time and manpower losses that had to be addressed. Common line run over by simple conveyor was also not convenient for assembly of four valve engines, so it was decided to switch over to a chain conveyor. I have done all work under the standard of Eicher Motor so as to enable the assembly of four valve engines on the two valve engines assembly line thus increasing the productivity of the company in minimum cost and also help to reduce manpower.

II. PREVIOUS WORK

[1] Many researchers have been experimented on the lean production and assembly line balancing and time based design at various condition. Rahani AR et al. [1] case study about the production flow analysis through value stream mapping for a lean manufacturing process. Alireza Anvari et al. [2] a study on total quality management and

lean manufacturing by the applying a lean thinking approach. Dilip Roya et al. [3] to balancing optimum assembly line by minimizing balancing loss and a range based measure for assembly system loss. G. Michalos et al. [4] to review the automotive assembly technologies: challenges and outlook for a flexible and adaptive approach. Tarcisio Abreu Saurin et al. [5] case study to the impacts of lean production on working conditions for a harvester assembly line in Brazil. Editorial et al. [6] to introduce a design and analysis of production systems. Nigel Slack et al. [7] operations management 5th edition. Marcus Sandberg [8] by using a knowledge engineering to describe a design methods and applications for manufacturing. Ortiz et al. [9] to using a kaizen assembly methods for a designing, constructing and managing a lean assembly line. Mahmoud Houshmanda et al. [10] an extended model of design process of lean production systems by means of process variables. Selcuk Karabat et al. [11] assembly line balancing in a mixed-model sequencing environment with synchronous transfers. Baudin et al. [12] lean assembly: the nuts and bolts of making assembly operations flow. Joseph Bukchin et al. [13] mixed model assembly line design in a make-to-order environment. Llu!ıs Cuatrecasas Arb!os [14] design of a rapid response and high efficiency service by lean production principles: methodology and evaluation of variability of performance. Stephan Eskilander [15]

To Design a product design method for automatic assembly: DFA2. RC. Barker [16] to describe a lean time based design production systems without mrp.

III. DATA COLLECTION

This data collection contains some tables which show common assembly line and cylinder head assembly line for existing and proposed set up. Collection also contains the experimental set up of proposed engine assembly line.

Note – Time is calculated by stop Watch and length is calculated by inch tape.

Table.1. EXISTING COMMON (BLOCK) LINE

S.no.	Description	Process time in second	Manpower	Length of conveyor in meter
1	Cooling jet	151	7	14.2
2	Thrust plate	186		
3	Main bearing	135		
4	Piston sub-assembly	67		
5	Piston oiling	186		
6	Piston installation	170		
7	Piston projection	146		
8	Idler shaft	233		
Total time in second		1274		

Table.2. PROPOSED COMMON (BLOCK) LINE

S.no.	Description	Process time in second	Manpower	Length of conveyor in meter
1	Cooling jet	147	6	12.03
2	Thrust plate	185		
3	Main bearing	135		
4	Piston sub-assembly	67		
5	Piston oiling	182		
6	Piston installation	165		
7	Piston projection	140		
8	Idler shaft	221		
Total time in second		1242		

Table.3. EXISTING CYLINDER HEAD LINE

S.no.	Description	Process time in second	Manpower	Length of conveyor in meter
1	Cylinder head assembly-i/o valve station	265	6	13.18

2	Cylinder head assembly-tc station	372		
Total time in second		637		

Table.4. PROPOSED CYLINDER HEAD LINE

S.no.	Description	Process time in second	Manpower	Length of conveyor in meter
1	Cylinder head assembly-i/o valve station	261	5	12.76
2	Cylinder head assembly-tc station	368		
Total time in second		629		

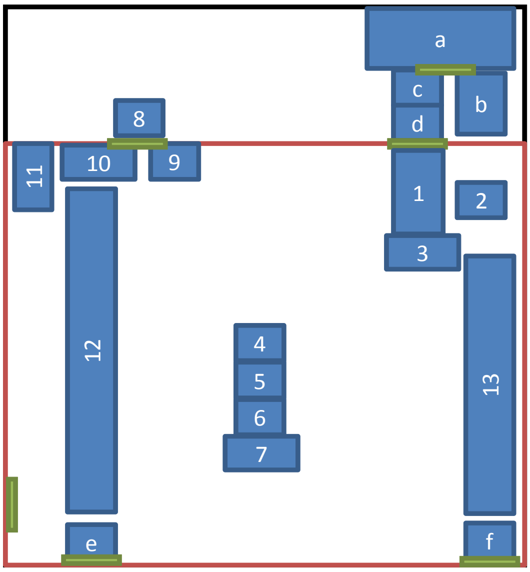

Figure.1. proposed assembly line set up.

a. sub-assembly bay, b. storage of components to be washed, c. engine number punching, d. chemical washing, 1.common assembly line, 2.piston & con rod subassembly, 3.idler shaft fitment, 4.T.G. case subassembly, 5.cylinder head subassembly, 6.TC-exhaust bends subassembly, 7.storege of cylinder head for main line, 8.ultra sonic washing, 9.front plate subassembly, 10.inlet manifold subassembly, 11.thermostate subassembly, 12.main assembly line LCV, 13.main assembly line HCV, e & f. simple roller conveyor.

IV. RESULT

For better understanding we compare the values with the comparatives graph of existing and proposed assembly line.

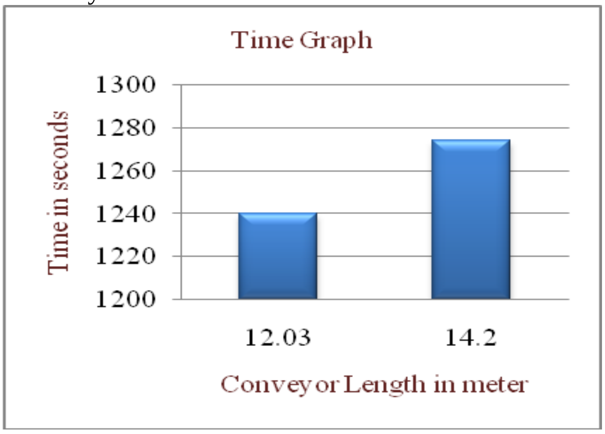

Figure.2. time graph of common (block) assembly line.

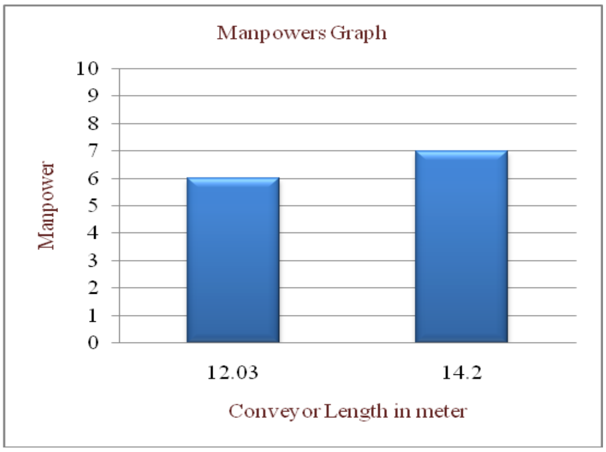

Figure.3. manpower graph of common (block) assembly line.

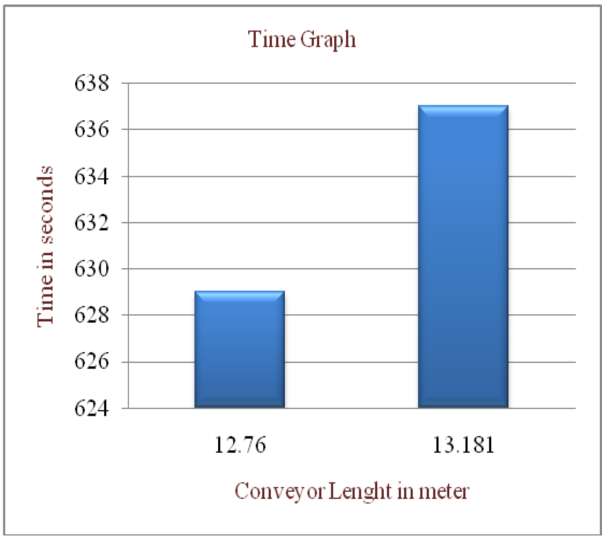

Figure.4. time graph of cylinder head assembly line.

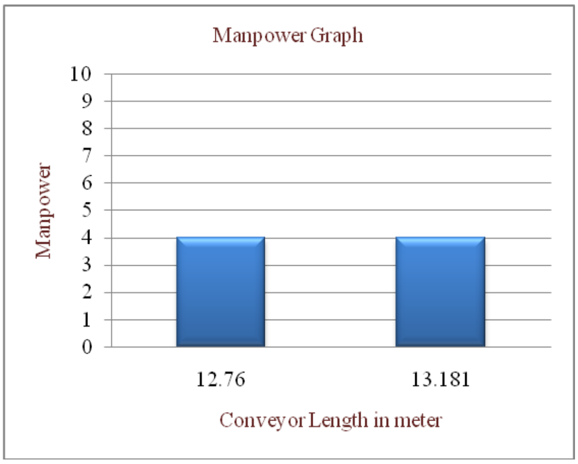

Figure.5. manpower graph of cylinder head assembly line.

After displace of cylinder head assembly line is original position to proposed potion.

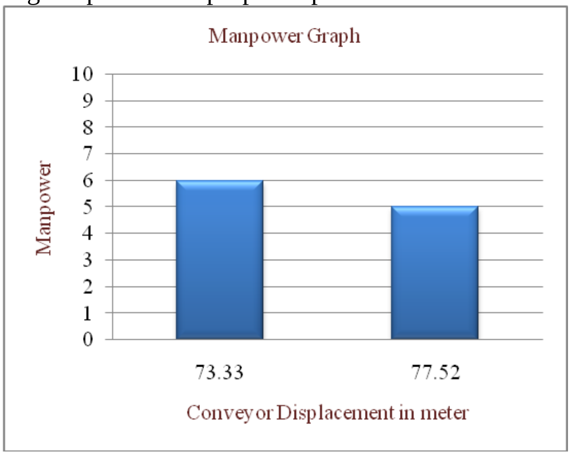

Figure.6. manpower graph of proposed cylinder head assembly line.

Comparative graph are taken for both existing and the proposed assembly lines are as follows-

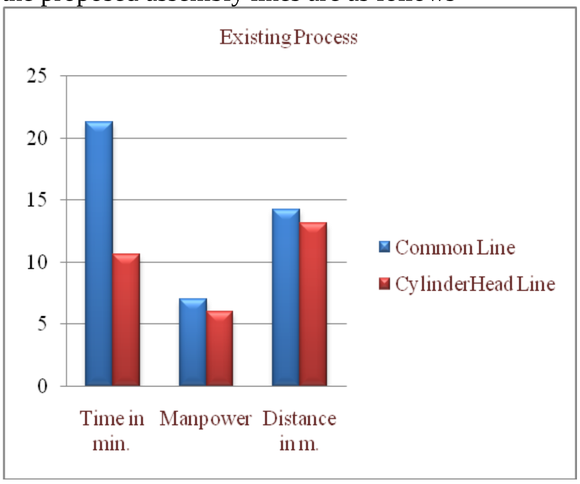

Figure.7.existing graph of both assembly lines.

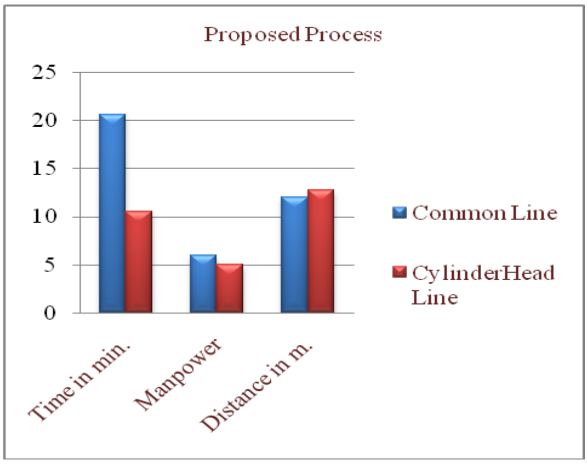

Figure.8. proposed graph of both assembly lines.

V. CONCLUSION

After comparing both the assembly line layouts it was found that the proposed design has better and delivers good efficiency of the assembly lines. The results for both the layouts are taken to find the real time efficiency and manpower which also has a bearing on optimal working area for both HCV and LCV lines.

We can improve the efficiency of any manufacturing unit by incorporating better technique and design methods. Better conveyor can improve the efficiency of plant.

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