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Line Balancing Technique for Labour Optimisation and Productivity Improvement

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Abstract:
The purpose of this research is to apply the line balancing technique for labour optimisation and productivity improvement in a compressor manufacturing industry. The study is done on the 2 Hp air compressors. And then by using suitable Lean tool for eliminating the non-value added activities. Line balancing technique is used to meet the customer demand. This paper concludes that by implementing line balancing technique for labour optimisation and productivity improvement. Therefore the objective of this research is to increase the effective use labour and to meet the customer demand

Keywords: 5S, Lead time, Line balancing, Takt time, Cycle time, Labour optimisation, Productivity improvement.

1. INTRODUCTION

This paper discusses about the analysis and implementation of various line balancing techniques used for labour optimisation and productivity improvement. The focus of study is to improving the productivity and to meet the customer demand by using proper line balancing techniques the 5S system is good tool for all improvement efforts aiming to drive out waste from the manufacturing process and ultimately improve productivity.

2. OBJECTIVES

To improve productivity by line balancing and design feasible work stations. Eliminate the bottlenecks and effective use of labours.

3. METHODOLOGY

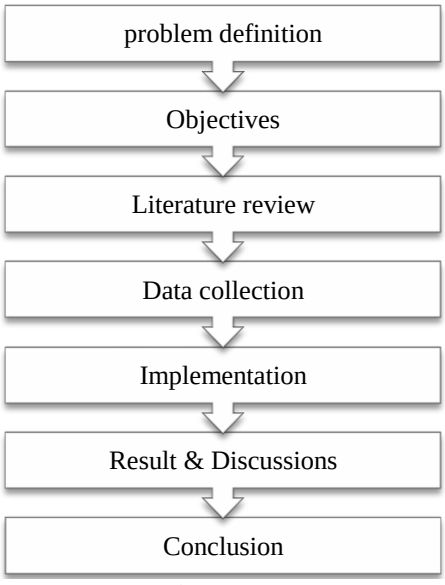

Figure. 3.1

3.1 Assembly Line Balancing

The line balancing technique is industrial engineering concept to balance the work load among workers and stations. A properly balanced line will have fewer issues related with fulfilling demands, bottlenecks and labour utilization. Gupta et.al ([1]. Enhancing productivity by strategic improvement in throughput-time on assembly line: Case study**.** Design for production (DFP) is a tool to identify the losses in the line and iron out these losses in a systematic way to achieve improved throughput time, higher efficiency, higher productivity and improved manufacturing cost Hudli Mohd et.al [2].Areas of Lean Manufacturing for Productivity Improvement in a Manufacturing Unit Many organizations are nowadays interested to adopt lean manufacturing strategy that would enable them to compete in this competitive globalization market.. There are some key areas developed to evaluate and reduce the most optimal projects so as to enhance their production efficiency and increase the purpose of the economic benefits of the manufacturing unit.

Table.2. Details of Activities: (Time study)

Activity	Cycle Time (mins)	Value added time (mins)	Non value added time (mins)
Compressor head machining	08	6.3	1.7
Crankcase machining	45	29.6	15.4
Cylinder machining	33	26	07
Connecting rod machining	6.3	3.3	03
Valve plate grinding	10.5	7.5	03
Shaft coupling machining	05	03	02
Inspection	13	00	13
Assembly	26	20	6
Testing	15	00	15
Painting	11	05	06
Packaging	20.5	16.5	04

3.2 Data Collection

Data collection is done based on 2 Hp air compressor manufacturing. First the takt time is calculated for 2 Hp air compressors. Takt time is unit production rate that is needed to match customer requirement. Takt time is available time divided by customer demand.

Time per shift	8.5 hrs=510 min
Break and clean up time	60 min
Total available time per shift	450 min
Customer Demand per shift (Average)	8
Takt time=Available time/ customer demand	450/8=56.25 min

3.3 Implementation

The implementation stage consists of step by step implementation of lean tools .The problem is studied and analyzed. Now this stage gives the lean tool implementation.

Figure.3.1 5s before

Figure.3.2 5s after

Figure.3.3 5s before

Figure.3.4 5s after

Operation	Description	Time (min)	Predecessor
A	Compressor head machining	8	-
B	Crankcase machining	45	-
C	Cylinder machining	33	-
D	Connecting rod machining	6.3	-
E	Valve plate grinding	10.5	-
F	Shaft coupling machining	05	-
G	Inspection	13	A,B,C,D,E,F
H	Assembly	26	G
I	Testing	15	H
J	Painting	11	I
K	Packaging	20.5	J

Figure.3.5 5s 5s after

4. LINE BALANCING

Figure.4.1

Tool Searching Time

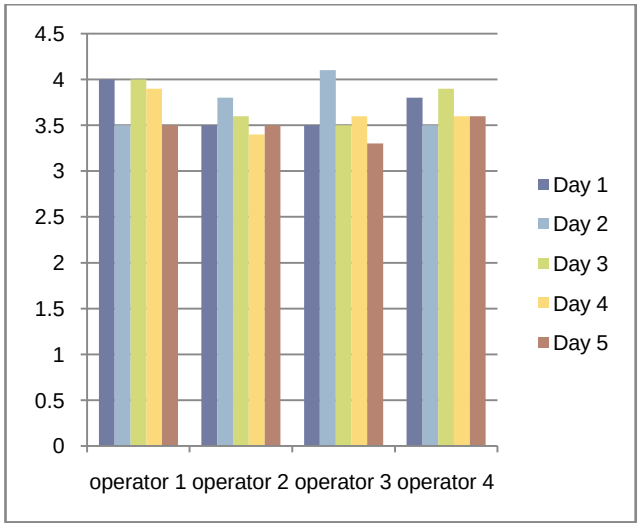

Figure.4.2 Tool Searching Time (Before)

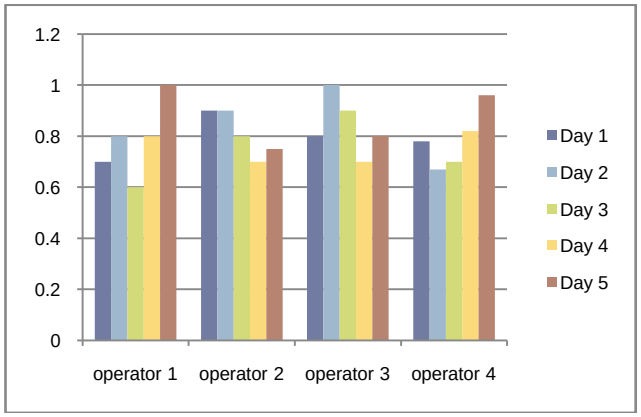

Figure.4. 3 Tool Searching Time (After)

The industry manufactures different types of air compressors. The cycle time is very high compared to the takt time. Line efficiency varies from 52 % to 62 %. The issues are due to idle time in work stations, improper utilization of labour and bottlenecks. An approach is made using industrial engineering philosophy to solve issues faced in meeting the demand.

Takt time = $\frac{\text{Available time}}{\text{Demand}}$

Available time = Total time – Scheduled breaks

Available time= 510 – 60 = 450 mins

Takt time = 450/8 = 56.25 mins

Theoretical no of workstations (n)

$$= \frac{\text{Total work content time}}{\text{Takt time}}$$

= 193.3/56.25

= 3.43 = 4 workstations

4.1 Precedence diagram

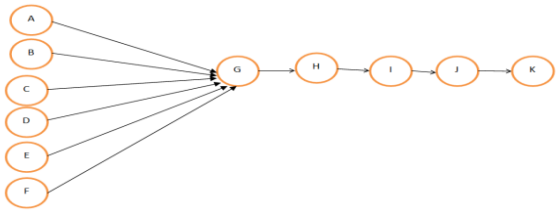

Figure.4.1Precedence diagram

Station 1 Station 2 Station 3 Station 4

Line efficiency = $\frac{\text{Total work content time}}{\text{No of workstation * Max station time}}$

$= \frac{193.3}{4 * 55.5}$

= 87.07 %

4.2 Kilbridge westers method

Station 1 Station 2 Station 3 Station 4

Line efficiency = $\frac{\text{Total work content time}}{\text{No of workstation * Max station time}}$

$= \frac{193.3}{4 * 54.8}$

= 88.1 %

4.3 Ranked positional Weight age method

Station 1 Station 2 Station 3 Station 4

Line efficiency = $\frac{\text{Total work content time}}{\text{No of workstation * Max station time}}$

$= \frac{193.3}{4 * 55.5}$

= 87.07 %

5. RESULTS AND DISCUSSIONS

After implementing line balancing the results are found out. After implementing lean tool step by step the suitable results are found out and results are discussed as follows

5S

5S is workplace organization .so it is directly affecting on reduction in non value added time. By ***Process Improvement*** the benefits of process improvement are lot of reduction in lead time as well as the material handling cost. There are total three operators for material handling. By implementing process improvement there is significant reduction in cost. Two operators can be reduced by implementing this.

Operator cost/month=Rs.6000 * 2 = 12000

Annual cost saving=Rs.144000/-

6. CONCLUSION

The line balancing was done to effectively utilize the labour available in the production line and to increase productivity.

By doing line balancing the productivity was increased to a favorable level. The project work removes some forms of waste that is present in the system like waiting time, non-utilized talent, transportation, inventory and motion.

7. REFERENCES

[1]. Hudli Mohd. Rameez, K.H.Inamdar "Area of lean manufacturing for productivity improvement in a manufacturing unit". World Academy of Science, Engineering and Technology pp. 45, 2010.

[2]. Pranavi Yerasi "Productivity improvement of a manual assembly line". A Thesis Submitted to the Office of Graduate Studies of Texas A&M University Aug 2011.

[3]. Effendi Mohamad, Teruaki, Mohd Rizal Salleh, Noor Aniza Nordin "Simulation study towards productivity improvement for assembly line". Journal of Human Capital Development Vol. 5 No. 2 pp. 59 July-December 2012.

[4]. Gupta S.K, Dr. Mahna V.K., Dr.Singh. R.V, Rajender Kumar "Enhancing productivity by strategic improvement in throughput-time on assembly line: a case study" .Proceedings of the National Conference on Trends and Advances in Mechanical Engineering, YMCA University of Science & Technology, Faridabad, Haryana, Oct 19-20, 2012

[5]. Balakumar.M, Rajenthira Kumar .D," Improving productivity in assembly line by reducing cycle time-kaizen approach". Proceedings of the National Conference on Manufacturing Innovation Strategies & Appealing Advancements MISAA2013 April 19, 2013, PSG College of Technology, Coimbatore, India.