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Research Article

Productivity Improvement by Waste elimination and Cost Saving in Paperboard manufacturing Industry

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Abstract

Now a days industries are looking for higher quality of products with reasonable cost and customer satisfaction. Customer wants high quality of products with minimum cost. To achieve good quality of products with reasonable cost, cost of production has to be optimized. Eliminating various wastages in the industry is one of the measures to optimize. This paper relates to reduce energy wastages in a paperboard manufacturing industry. The aim of this paper is to reduce the cost of production of steam by arresting various energy wastages in the industry. It was found that total 20% of saving has been achieved by identifying and eliminating these wastages.

Keywords *–Energy wastages, Steam pressure, Steam Traps, Temperature, Cost optimization, Productivity improvement*

1. Introduction

In today's era, every industry is looking for customer requirements. Customers are the key focus for all industries. Customers are looking for high quality products with minimum cost and with minimum delivery time. To achieve this all organizations are working on implementing lean principles, Six Sigma methodologies, World class manufacturing tools, etc.

The work is carried out in a renowned Paperboard and Paper manufacturing industry in India. The company is largest manufacturer of paperboard and paper in world wide. In the endeavor to move up the value chain, their portfolio of products and services has consistently grown over the years. The company is leader in volume, product range, market reach and environmental performance and is the clear market leader in paperboard and paper value added segment. They are providing competitive quality and cost. The company is spread over 500 acre land and has a manpower of nearly 30,000 employees. There are seven machines named as PM1, PM2, and PM3 .....PM7. The plant has capacity of producing around half a million TPA of paperboard and around 1, 25,000 TPA of paper. It also manufactures specialty boards for playing cards, scratch cards, ivory boards.

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They are generating electricity from steam turbine and this electricity is used in plant for production. To produce high volume of steam there are 7 high capacity boilers. All of them are high pressure boilers about 60 bar. All the seven machines and turbines and its byproducts are consuming steam.

The energy source used for producing paperboard and paper for heating, drying, forming process is steam. The cost of producing steam affect the cost of product. If steam consumption is less, the cost of production is less and hence final product cost also decreases and the cost of fuel required in boiler is also reduced. Many manufacturing industries are trying to reduce this cost of producing steam. To reduce this cost, elimination of all the losses in steam-line is necessary and use of appropriate steam equipment is necessary.

This paper relates to reduction in energy losses of paperboard and paper manufacturing industry by identifying wastages in steam line. Wastage of steam could be due to steam trap leakages, not using pressure reducing devices, steam trap bypass open, condensate not recovered etc., but the most important is steam trap. Steam trap is an integral part of steam system. Steam traps play the important role in maintaining the productivity and efficiency of steam system.(Steam-Trap-The-Complete-Guide, 2019-20).Steam trap is a equipment that traps the steam and allows condensate to drain. The purpose of steam trapping is to use maximum heat of steam. The steam is generated at boiler house and used at machine at long distance. We have to carry this steam energy to machines through

piping. During transfer, the heat of steam is lost due to convection and steam gets condensed. The condensate has to be removed as soon as it is formed, to get high quality of steam at machine. To do this at every 30-40m distance steam trap is used. If this steam trap fails, there is huge amount of steam waste happens. When steam trap fails steam consumption increases, due to which the boiler load also increases. Steam trap failure causes two main losses, first the steam is lost to atmosphere and other quality of steam is reduced at machine level. By eliminating the steam trap wastages or losses, any organization will get higher benefit.

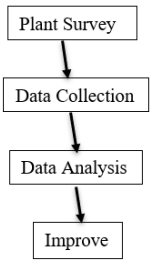
This paper relates to eliminate or improve this type of wastages in one of the paperboard and paper manufacturing industry.

2. Problem Statement

As in a steam using industry, the cost of production of steam is also the major element that adds cost to the final product. Many industries are not still not looking at its production cost. It is challenge for all industries to reduce this cost of producing steam and how we can utilize this steam so that its consumption will decrease and we will get maximum benefit from minimum production of steam. To reduce the steam consumption, we have to use steam at lower pressure so as to get maximum heat available in steam and produce it at higher pressure. In many industries they are not looking at steam wastages in the plant so cost of production of steam is increasing. Small wastages such as steam trap leakages, pipe insulation not done, not using steam at required temperature and pressure are not attended. Most of the plants are not looking at steam trapping as it is the most important component in steam line. If steam traps are installed correctly it can save huge amount of steam in the plant. Only one small leakage, 4kg/hour, in steam trap can cost Rs.750 to Rs.1000 kg per kg. (TLV. Steam specialist company, 2020). Due to all these reasons, we tried to eliminate steam trap losses in this plant. In this work, efforts are put to find out various wastages and eliminate, improve steam trap wastages to reduce specific steam consumption, reduce the cost of fuel required to produce steam. This is done by finding out failed steam traps and fixing them up to avoid the wastage of steam and improve the productivity and performance of steam system.

3. Methodology

To identify these wastages, survey of whole plant is done. We divided the location as utility section, SRP section, evaporator section and machines consuming steam, collected all the data in all these sections. Then we worked on these steam trap wastages to improve or eliminate and final solutions are given.



A. Survey of plant

To find out these wastages in the plant we divided area into sections and checked every line. As in steam-line, wastages are generally due to leakages, opensteam trap bypass valves, not using pressure reducing stations, steam trap motor-boating. The root causes are shown by fishbone diagram in Fig. 1.

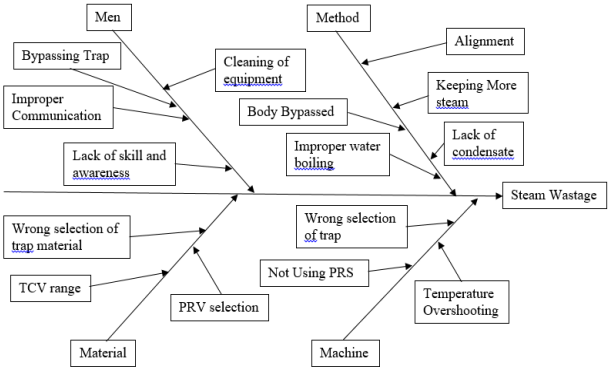


Fig.1 Fishbone Diagram for root cause analysis of steam wastage
(TCV- Temperature control valve, PRV- Pressure reducing valve, PRS- Pressure reducing station)

B. Data collection

During the plant survey, data is collected relating to steam-line. each and every location to find out steam-line wastages. All the required locations of steam traps whether used or not are checked, whether these steam traps are working or not, measurement of temperature and pressure at inlet and outlet of these steam trap is taken, whether steam trap selected at application is appropriate, whether at machine steam is used at required pressure and temperature. This data is collected during plant survey by using temperature measurement tool i.e. temperature gun., by visual observation and by noise detection. The data is collected by three methods- visual, temperature and ultrasound.

Tag I	Location in the Pla	Type and	Pressure (ba	Inlet Temp	Outlet temp	Working Conditi	Remarks	Steam Loss
UTI-01	TG-7LP Header No.7 Dra	25 BF	4.5	150	90	OK		
UTI-02	TG-7LP Header No.7 Dra	25 BF	4.5	144	97	OK		
UTI-03	TG-7LP Header No.7 Dra	25 TD	4.5	135	97	OK		
UTI-04	Old MP Header I/C	25 TD	4.45	157	97	OK		
UTI-05	TG7 LP SteamDrain	25 BF	4.5	35	35	Cold	Wrong Instalation	
UTI-06	LP-4 Header I/C Line TG7	25 TD	4.5	122	92	ok		
UTI-07	LP-4 Header I/C Line TG7	25 TD	4.5	132	92	ok		
UTI-08	CFB9 Deareator LP Drain	25BF	4.5	30	30	Chocked		
UTI-09	CFB9 Deareator LP Drain	25 TD	4.5	135	92	Motorboating		15.09
UTI-10	Behind TG7 LP Header	25 BF	4.5	30	30	Cold		
UTI-11	MP Header No.2 Drain	25 TD	11	120	98	ok		
UTI-12	Near MP Header No.2 D	25TD	11	125	95	OK	Isolation ValveLeak	
UTI-13	MP Header No.2 Drain	25 TD	11	130	99	Motorboating		36.89
UTI-14	MP Header No.2 Drain	25 TD	11	125	98	ok	Bypass Open	
UTI-15	PM7 MP Drain	25 TD	11	125	97	OK	Wrong Selection	
UTI-16	Near PM7 MP Drain	25 TD	11	30	30	Cold	Isolated	

Fig. 1. Data collected at one of location

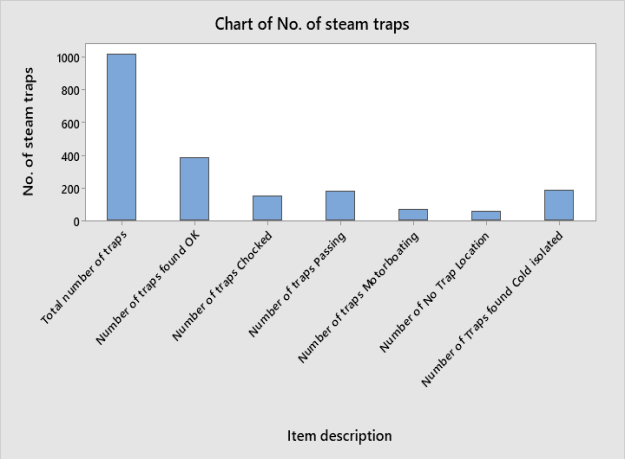


Fig. 2. Survey of Plant for steam wastages

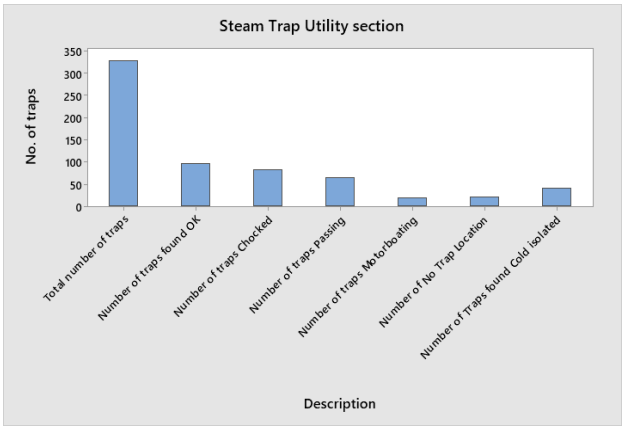


Fig. 3 Utility Section

C. Analysis

All the data collected during plant survey is then analyzed and the graphs are generated section wise. Analysis of this data is very complicated as this data relates to many combinations. As we are dealing with steam energy, its measurement is done by variables temperature and pressure. Temperature and pressure at each location will decide whether it is in good condition or wasting the steam. Steam engineer also analyzed the data. Steam trap analysis is done by inlet temperature to process and inlet temperature to steam trap, if there is no or marginal difference between this two temperature, the trap is performing well. If the temperature difference between inlet and outlet of steam trap is high, nearly more than 30 deg c, the steam trap is alright.(Plant Engineering, 2020). If this difference is less, then there are chances of steam leakage. In such cases, we have to replace this steam trap. Another way is by identifying noise at steam trap. This will require great experience to analyze by noise. By visual inspection we can find out the leakages, insulation problems at various pipeline location. It is found that there are total 1018 steam trapout of which only 382 are found working satisfactory. Out of The remaining 636 steam trap 68 steam trap can be repaired and remaining 568 steam trap has to be replaced with new steam trap.

C. Solution

From the above analysis, it is found that there are huge wastages of steam due to steam trap bypassing, valve leakages, corrosion of steam equipment, steam trap motor-boating.

Out of 1018 steam traps 55% of total traps should be replaced with new steam traps and maintenance should be done. There are many pipes where insulation is not done. Proper insulation of this pipeline will ensure that there are no heat loss to atmosphere due to convection and in turn will increase the quality of steam. Proper condensate recovery has to be done, so as to reduce use of makeup water consumption and due to condensate removal and feeding it to boiler, the heat required to generate steam is reduced which in turns reduces the fuel consumption.

D. Result

All the suggestions are implemented. Steam trap replacement and maintenance phase is completed. The output, by just replacing with new steam trap and maintaining it is huge. After improving or eliminating these losses, it is found that total of 9023.98 kg/hour of steam wastage is eliminated and which resulted in approximate total saving of Rs. 70,00,000/- per year. By implementing all the suggestions and improvements are done. Total of 20% steam saving, water saving and fuel saving is achieved. This achieved cost saving and enhanced the productivity of the industry.

Conclusion

It is concluded that now a days in a process industries there are 'open doors' for lean manufacturing. We are always trying to implement these lean tools in manufacturing industries but now we can say that we can equally implement these lean tools in process industries like chemical, pharmaceutical industries. Lean can offer Process Industries:

- Reduced Manufacturing Cost.

- Reduce Environmental Pollution.
- Improved productivity.

The use of lean tools in process industry for waste elimination of any type and enhancing productivity is very much effective.

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