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Research Article

Productivity Enhancement in Manufacturing Industry by Cycle Time Reduction

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Abstract

Rotary tube bundle dryer is commonly used for different industrial applications right from corn fiber drying, corn gluten drying, corn germ drying and wheat fiber drying. A manufacturing company has various units for manufacturing critical process equipment such as heat exchanger, tube bundle dryer which provide different application across the world including chemical industry and pharmaceutical industry. The industry provides tube bundle dryers as per requirement to the customer. The average cycle time taken to manufacture a rotary tube dryer at is around 62 days, out of which 20 percent of the processes have 80 percent of throughput time. Hence, the study was conducted to identify and improve on the wastes in these major processes to reduce the waiting time and to increase the touch time of the dryer, leading an overall reduction in cycle time. This study was conducted to analysis each and every process of dryer manufacturing. Time study was conducted to collect the data of the entire process by videography. The major process was analyzed to identify bottlenecks and waiting time. The improvements were done to reduce the throughput time of the process.

Keywords: *Process improvement, Cycle time, Work System Analysis, Bottlenecks, Resource optimization*

Introduction

Cycle time reduction play vital role when organization is aiming to increase its efficiency, productivity and customer responsiveness. Cycle time is the time taken to do any particular task from the starting point of one source on a particular machine until the end of the last process in the sequence for the production of a part. This cycle time can be measured using time study technique such as, stop watch, MOST Study. During this study process can be divided on VA, NVA & NNVA. The ABC Company is one of the global multinational process and project engineering company with a bouquet of sustainable solutions for bioenergy, high purity water, critical process equipment, breweries and industrial wastewater treatment. They are engaged in fabrication of pressure vessels & critical equipment such as column, heat exchanger, Uni-Tank & Tube bundle dryer. The goal of the ABC Company reduces cycle time of tube bundle dryer because according to organization they can't achieve defined goal, their goal is annually manufactured total 60 to 62 tube bundle dryer but in present they only manufacturer 30 to 35 dryer per year.

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Because this issue cycle time reduction of dryer will help result in lower WIP, increased capacity of organization, ability to develop new technology or technique and to make current process faster which in turn can release the product to market quickly.

Literature Review

The tube bundle dryer slowly rotates in a fixed housing and conveys the product to be dried axially thru the dryer. Shovels are established at the tube package in big quantity. The primary purpose of shovels transports the product along the circumference of the housing. This product heated and dried only contact with steam heated tubes, and no longer directly with steam. Tube bundle dryer manufactured with considering flow traits moist and dry product, tube package dryer operating on low temperature, beneath dryer moist fabric placing and its rotating on heated tubes. Moisture gets evaporated due to radiation and conduction substances turn out to be dry. The tube bundle dryer mainly utilized in chemical enterprise, pharma enterprise. Tube bundle dryer clean to install, this product availed wide range of length & designs, low power consumption inside the range of 1.25 to1.3 lbs. of steam/lbs. of water evaporation, minimized oxygen content material, lowest explosion & hearth chance, smooth & environmentally pleasant.

Tube bundle dryer encompass many components like lengthy tubes, feed shaft, discharge shaft, dish, bearing, shovels & many more. First off, tube inserted into dryer then on tube bundle shaft is outfitted, then dish quit are hooked up like that many operations carried out to fabricate an entire dryer. The principal function performs tubes in dryer due to the fact this component is transformed chemical covered water debris into dry shape. This dry powder used as fertilizer into farm. It has use as each granular as well as slightly adhesive may be dried, it can be used in starch & grain industry, alcohol, ethanol & brewery industry and so on.

Productivity Improvement Techniques such as Method Analysis and Work Measurement are very useful. Work System Analysis covers these techniques. Methods analysis aims at finding a most efficient way of doing the work by systematic recording and critical examination of the existing ways of doing work so as to affect an improvement in ways of doing work. Work measurement is used to determine the time required for a skilled worker to complete a task using a stopwatch.

Methodology and Data Collection

Productivity Improvement Technique used were Method Analysis and Work Measurement. This study started with process mapping using flow process chart of the all processes of tube bundle dryer.

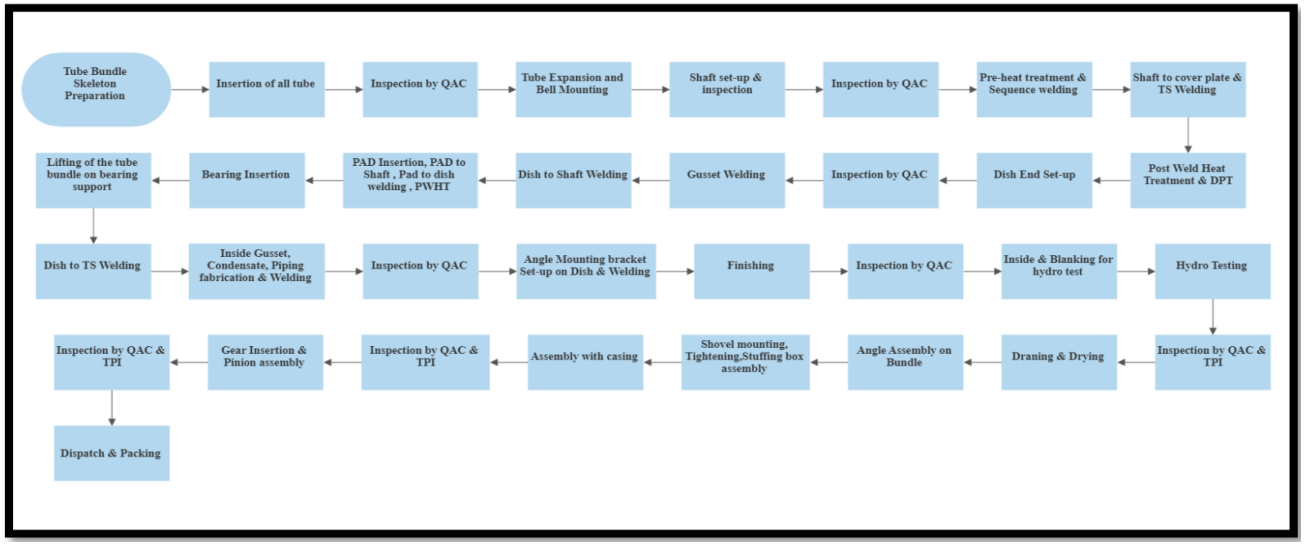

Figure 1 Flow process chart

All the processes for manufacturing tube bundle dryer were observed and data collection was done by videography. Time study was conducted and the following major process were recorded.

Table 1 Manufacturing processes of tube bundle dryer

Sr.no	Process
1	Tube bundle skeleton preparation
2	Insertion of all tubes
3	Tube Expansion & Bell Mounting
4	Shaft setup & Inspection
5	Shaft to cover plate & TS Welding
6	PAD Insertion, PAD to Shaft, Pad to dish welding, PWHT
7	Dish to Shaft Welding & Gusset welding
8	Dish end setup
9	Dish to TS Welding
10	Angle Mounting bracket Set-up
11	Gear Insertion & Pinion Assembly
12	Shovel mounting, Tightening, Stuffing box assembly

Data Analysis

The objective of the study reduces the cycle time of the tube bundle dryer by improving touch time minimum by 20 percent. Available time per shift is estimated for calculating takt time of each production process.

Table 2 Available time / shift

Shift Available time		480
Planned Breakdown activities	Lunch	30
	Tea Break	30
	Snacks	0
	Operator Maint.	0
	Morning Meeting	0
	Personal	0
Actual Available time (min)		420

By considering available time, each activity of tube bundle dryer was analyzed, using videos of each activity. Time study sheet were prepared to estimate cycle time and crew size.

Table 3 Task tracking sample sheet

Task Tracking Template:-

Project Name Here :- Dryer (Unit-2)
Manufacturing (HA-1350)

Task Name/ Description	Start Date	End Date	Cycle Time in Days	Status	Manpower	Delay Reason

Table 4 Sample time estimation sheet

Planned days of 1350	Actual days for 1st	Actual days for 2nd	Actual days for 3rd
1	4	3	2
5	5	5	3
1	1	1	1
4	4	5	4
1	3	2	1
1	1	1	1
7	2	3	10
1	1	2	2
1	2	2	2
1	2	1	1
6	12	11	6
3	5	3	7
1	1	4	
1	3	3	
4	8	8	
3	2	3	
1	1	1	
4	2	3	
1	1	1	
1	1	1	
1	1	1	
2	1	1	
1	1	0	
1	1	1	
2	2	2	
2	2	3	
1	1	1	
1	1	0	
2	2	4	
1	1	2	
1	1	2	
1	1	0	
64	76	73	

Table 5 Common bottleneck activity with frequency

		1350				
Sr.no	Common Bottleneck activity	Planned Days	Actual days for 1st	Actual days for 2nd	Actual days for 3rd	Frequency
1	Tube bundle skeleton preparation	1	4	3	2	3
2	Tube Expansion & Bell mounting	4	-	5	-	1
3	Shaft Set-up & Inspection	1	3	2	-	2
4	Shaft to Cover Plate & TS Welding	7	-	-	10	1
5	Dish End Set-up	1	2	2	2	3
6	Dish to shaft & Gusset Welding	6	12	11	-	2
7	PAD Insertion, PAD to Shaft , Pad to dish welding , PWHT	3	5	-	7	2
8	Bearing Insertion	1	-	4	-	1
9	Lifting of the tube bundle on bearing support	1	3	3	-	2
10	Dish to TS Welding	4	8	8	-	2
11	Angle Assembly on Bundle	2	-	-	-	1
12	Shovel mounting, Tightening,Stuffing box assembly	2	-	3	-	1
13	Gear Insertion & Pinion assembly	2	-	4	-	1

For estimating cycle time following steps were considered.

The study commenced by selecting the object to analyze production time, the tube bundle dryer manufactured by the industry most of the times was selected and taken up for estimating the cycle time.

After monitoring operations of the dryer, bottleneck activities were identified.

Results and Discussion

After analysis, optimum time required to complete manufacturing and assembly of one unit of dryer was estimated details of which are mentioned in the following tables.

As per the analysis, 2 more workers in both the shifts were required to complete manufacturing of dryer in desired time of 62 working days.

Table 6 Productivity Improvement solution

		1350					
Sr.no	Common Bottleneck activity	Planned Days	Actual days for 1st	Actual days for 2nd	Actual days for 3rd	Improvement ideas	Saved time in days
1	Tube bundle skeleton preparation	1	4	3	2	Add extra 2 helper to perform this activity	1
2	Tube Expansion & Bell mounting	4	-	5	-	Use 2 expansion machine at a time on both side & add 2 manpower	2
3	Shaft Set-up & Inspection	1	3	2	-	Add 1 more (W,H) to perform activity	1
4	Dish End Set-up	1	2	2	2	Use 1 more extra welder to do dish end set-up activity early	1
5	Dish to shaft & Gusset Welding	6	12	11	-	Use 2 welder because they can able to do welding on both side	6
6	PAD Insertion, PAD to Shaft , Pad to dish welding , PWHT	3	5	-	7	Use 2 welder	2
7	Dish to TS Welding	4	8	8		Use 4 welder because they can able to do welding on both side	4
	Total						17

Table 7 Manpower analysis

1350									
Sr.no	Common Bottleneck activity	Actual				Planned			
		W	G	F	H	W	G	F	H
1	Tube bundle skeleton preparation	2	2	2	4	2	2	2	6
2	Tube Expansion & Bell mounting	0	0	1	1	0	0	2	2
3	Shaft Set-up & Inspection	1	0	1	1	2	0	1	2
4	Shaft to Cover Plate & TS Welding	2	0	0	0	4	0	0	0
5	Dish End Set-up	1	2	1	1	2	2	1	1
6	Dish to shaft & Gusset Welding	1	0	0	1	2	0	0	2
7	PAD Insertion, PAD to Shaft , Pad to dish welding , PWHT	4	1	0	2	4	1	0	2
8	Dish to TS Welding	2	0	0	2	4	0	0	2
9	Gear Insertion & Pinion assembly	1	1	1	2	1	1	1	2

Conclusion

In this study, we were able to analyze the entire flow process of a tube bundle dryer, sort the bottlenecks and the processes that were the major contributors to the increase in waiting time. These processes were further analyzed by conducting a time study. Based on this analysis, solutions to reduce the cycle time of the process which would directly impact on production time. Optimum crew size of each activity was also estimated. All suggested improvements in terms of manpower were approved and it would be implemented.

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