Utilizing Kaizen System Methodology to Increase Productivity of Shell Fabrication

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Abstract— The improvement in the productivity is a very challenging task. To improve productivity, it is important that the full involvement of the personnel. The productivity is simply defined as the ratio of rate of output to the unit rate of input. Productivity depends on factors such as process, quality, labour & production. To increase or improve the productivity we must improve the factors affecting it. In this paper, the productivity is improved by solving the problem related to process. In this problem is understood through the Kaizen technique. In that the all personnel are involved to solve the problem related to processes in the shell fabrication shop (SFS) & reached to the proper solution which is elaborated in this paper. This project utilizes Kaizen Methodology to determine the probable cause and the solution for the productivity issue in the fabrication shop. The technique involves removal of the Non-Value Added Activities in order to bring about a reduction in setup time. This leads to reduced redundancy of activities in process.

Keywords: shell fabrication shop (SFS).

I. INTRODUCTION

Kaizen is a Japanese word meaning gradual never ending improvement in all aspects of life. It represents a Japanese approach to improvement and can be interpreted as continuous improvement in all areas. The classical western approach to improvement has been one of technology innovation. Large sum of money have been spent on new equipment and systems using the latest technology to give step changes in performance. This has lead to dramatic improvements but they have typically not been standardized and maintained. Kaizen on the other hand relies on an investment in people. It is a continues series of small improvements made on existing equipment or system by the people who actually work in that area. It does not rely on specialist involved in making the improvement. Important aspects of kaizen are the standardization and maintenance of improvements which are as crucial to the process as improvement itself.

A. Kaizen approach:

There is a structured approach to Kaizen based improvements and each step must be followed to ensure lasting improvements. The seven stages do not represent a single process which can be followed from start to finish, after which a 'right' answer will be obvious. These stages are a well orchestrated process: the process may have to be repeated many times before a reasonable accommodation Or agreement may be reached.

The seven stages are:

(1) Define the area of improvement.
(2) Analyze and select the appropriate problem
(3) Identify its causes
(4) Plan Countermeasures
(5) Implement Countermeasures
(6) Confirm the result
(7) Standardize.

The whole process of Kaizen is a process of mutual learning: the practitioner learns about the organization; the members of the organization learn about the diversity of views about and within their organization, and about their colleagues. The most important site for this learning is in the comparison between conceptually derived models and the real world. When such a comparison is made, the learning gained usually means the model needs to be revised. At the same time, exposure to the model often changes the problem situation, or at least perceptions of what the problem consists of. Through this conversational process of thinking, discussing, accommodating and re-thinking, practical ways forward may eventually be found.

1) Step 1

This stage involves understanding and analyzing the basic process with all the involved parameters and resources. Creating a crystal picture of present ideology utilized to convert the input into output. This leads to choking out the areas to be worked upon by changing the conventional way of working. Helping in maintained quality with cycle time reduction and effective resource utilization.

2) Step 2

Once the no of areas are found out same are to be analyzed with practical approach for implementation and overall effect in cycle time reduction. And through those problems to be finalized, which are to be worked upon.

3) Step 3

The Problems evolve through various causes. For eliminating the same to be understood and to be listed down.

4) Step 4

As soon as the root causes of the problem are identified, to avoid the same some countermeasures to be worked upon. While doing so it is important to not to affect the output measures in any terms.

5) Step 5

Once the counter measures are decided, same to be implemented on actual workplace in desired process.

6) Step 6

After implementing the countermeasures the results coming out to be evaluated and compared with existing once so as to finalize the solution for the problem identified.

7) Step 7

As soon as the results found satisfactory the solutions implemented to be standardized in the operating procedure on regular basis.

II. CASE STUDY

A. Implementing kaizen:

1) Defining the area of improvement:

In shell fabrication shop, various types are fabricated to meet vessel requirements. When a process flow of a single shell fabrication was studied it was found that the actual cycle time is affected by no. of NVAs as machine idle time due to handling constraints, resource unavailability etc. But the major one was "Shell Rerolling Process."

2) Analyze and select the appropriate problem

The measures taken into account for problem selection are through time specified in NVA's during actual cycle of rolling operation. Material Handling, Resources unavailability, Machine constrains etc were affecting factors. But looking more in technical aspects "Rerolling of Shell "is an activity which was done to correct the shape and size distortion in shell after completion of welding processes.

The cycle time data collected for the shell fabrication activity clearly indicated that rerolling consumes almost 17 to 18 % of total time.

SR NO	PROCESS	CYCLE TIME
1	Setup	2hrs
2	Outside Welding	8hrs
3	Chip back grinding & P.T	1.5hrs
4	Chip Back Welding	5hrs
5	Rerolling	3.5hrs
6	Miscellaneous Time	1 hrs
	Total Cycle time	**23.5hrs**

Table.1: CYCLE TIME DATA FOR SHELL ROLLING

3) Identify its Causes

After completion of shell long seam welding process, the shape and sizes get distorted due to heat variance. This introduces a term called "Shell Ovality" (Maximum Diameter observed - Minimum Diameter observed). Same was coming around 10-15 mm after welding which was to be corrected to 2 mm by rerolling method. Also the shape to be corrected by checking with wooden templates. Pick out and Pick in to be corrected at affected areas to get the shape corrected.

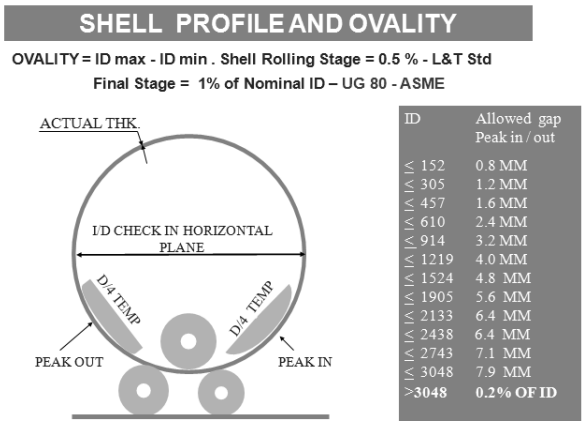

Fig.1: Shell Profile and Ovality

4) Plan countermeasures

So to eliminate this prime non value added activity a concept of "Two Way welding" was introduced.

Joining of shell seam was done by double V joint. This includes a root face and V shaped weld edge on either side. The one which is filled from outside is called Outside Welding and the one to be done from inside of shell is called Chip back welding. In earlier practiced way outside to be finished first and then chip back to be proceeded. These cause extreme distortions on either side causing imbalance in metallurgical movements which lead to distorted shapes and size. So a new way of welding adapted wherein each run of outside and chipback filled alternatively. This method resulted in balanced laminar zones nullifying the distortion effect on either side. Thus resulting in Shape and Ovality maintained within specified values.

The sequence of welding and no of stages were finalized after taking mock up trials and tabulating data with each experiment.

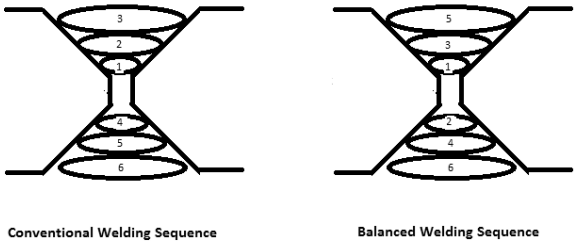

Fig.1: Difference between Conventional and Balanced Welding

5) Implementation of Countermeasures

Once the sequence of weld filling was finalized same was implemented on actual project with specified parameters and procedures. Same carried out on few no. of similar shells so as to analyze the good amount of data for further decisions.

6) Confirm the result

After completion of each welding seam respective readings of diametric ovality were noted and tabulated for analyzing the quantum of implementation. The data clearly showed that the required specifications were achieved within limits and avoiding the non value adding activity of rerolling causing significant reduction in total Cycle time.

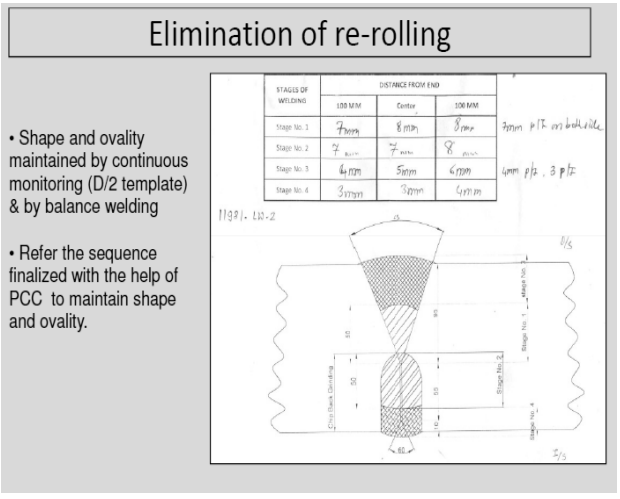

Fig.3: Data Monitoring during Welding

7) Standardization

Two way or balanced type of welding proved to be suitable and effective tool for eliminating the biggest NVA ie rerolling of shell activity from entire fabrication process. So

the same method was adapted and implemented for rest of the ongoing projects. Also the forthcoming shell fabrications were scheduled considering two way method only.

III. RESULTS AND DISCUSSIONS

After successful implementation of two way welding concept the aim set forward of productivity improvement was achieved to a great extent.
Enlisting below are the major advantages after implementation of this new concept:

(1) Since the shell ovality was reduced due to nullified effect of heat imbalance, it avoided the critical operation of shape correction and size correction.
(2) From the calculations it was found that the cycle time of a single shell fabrication has been substantially reduced to 18 % of the previous one.

IV. CONCLUSION

In this way the Kaizen systems methodology targets organizational business and process modeling and identifies unstructured problems as well as identifying non-obvious problem solutions in a holistic view. Specifically, this approach provides the possibility of more clearly capturing the change that is necessary to improve the productivity of the shop. Applying this methodology to the welding method shows the potential of Kaizen application in the real course problems.

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