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Set-up Time Reduction of a Manufacturing Line using SMED Technique

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Abstract: *In the era of globalization manufacturing industries needs to increase their flexibility in production by using smaller batch sizes. However, this will lead to significant increase in setup time. Therefore, quick setup processes involving small batch sizes and greater flexibility is a need of hour. This paper focuses use of SMED (Single Minute Exchange of Die) and Lean Management concepts in forging industry to increase productivity, operational availability and better overall efficiency of the production line. The paper describes application of SMED concept and methodology as customized for reduction of changeover time in forging industry and demonstrates a live case that reduced change over time of 1000 Ton capacity press line. Further, the work uses SMED methodology and other Lean Production tools such as 5S, Visual Management, Kaizen and Standard Work procedures were applied to reduce the die setup time. As a result, the process setup time was significantly lowered (from 87 to 60 minutes). The percentage reduction in the set-up time 18.03%..*

Keywords*: Setup Reduction, Bottleneck, Single Minute Exchange of Die (SMED) Internal and External Activity.*

1. Introduction

Lean manufacturing is a production practice that considers the expenditure of resources from any goal other than the value for the end customer to be wasteful, and thus a target for elimination. Working from perspective of the customer who consumes a product or a service Value is defined as any action or process that a customer would be willing to pay for. SMED is one of the techniques from lean manufacturing. The need for short setup times is not new; it has been around for quite a while. Indeed, the time between producing the last product of a series, and producing the first product of a new series that meets all quality requirements; has always been considered as a production waste. More recently, in all types of industries, there is an increased focus on reduction production waste, so the need for short setups is now bigger than ever. A setup can be defined as the elapsed time between the last product A leaving the machine and the first good product B coming out. The SMED project work is carried out in forging industry.

2. Literature Review

Shashikant Shinde, Satyasheel Jahagirdar in (2014) reduced the setup time of Straightening Press by using SMED technique. Anabela Alves (2013) developed a solution for SMED technique with the help of 5S, Visual Management and standard work. Yashwant R.Mali1, Dr. K.H. Inamdar in (2012) reduced the changeover time in manufacturing industry and increased the efficiency of machine. À Single-Minute Exchange of Die (SMED) refers to the theory and techniques used for the reduction of equipment setup times. SMED has as its objective to accomplish setup times in less than ten minutes, i.e. a number of minutes expressed by a single digit. Although not all setups can be literally reduced to this time, between one and nine minutes, this is the goal of the SMED methodology. The SMED concepts was applied accordingly to certain pre-determined conventional process to minimize wastes, reduce downtime & eventually increase production.

3. Methodology

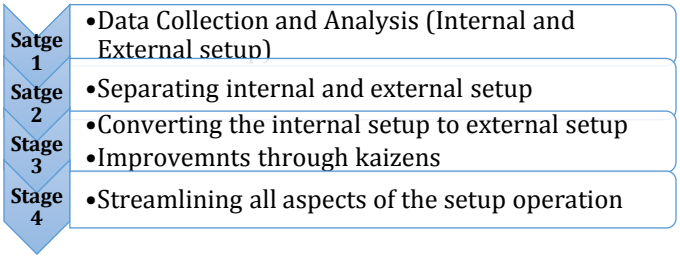

Figure 1: SMED Conceptual Stages.

3.1 Data Collection and Analysis

Data collection is done for forging 1000 TP press. An operation was used in this study to summaries and describe the data. After Studying the Production process

flow identification of bottleneck, set-up time and standard operation procedure are reviewed briefly before setting up the data collection table is done. Based on the present production, data was collected and recorded on a daily basis. , it can clearly identify that the set-up time of the forging press is a bottleneck process. Therefore to reduce line set-up time, forging Press set-up time should be reduced. A detailed process study of setup on forging machine is carried out. This contains activity number. Activity carried out, time required, internal and external activities are sorted. Table.1 below shows the detailed set-up of forging Press.

Table 1: Current setup time.

Summary sheet		
Sr.no	Activity	Current Time (Min)
1	Loosning and Tightning of bolts	10
2	Cleaning	2
3	De clamping and unloading (upset,blocker finisher)	10
4	Clamping and loading (upset,blocker,finishier)	21
5	IBH setting	8
6	Die heating	17
7	1st piece production (Not ok)	1
8	Hot inspection	12
9	Other activity	5
10	2nd piece (ok)	1
		87
		1 Hr 27 Min

Following table2 shows the improvements carried out for SMED project. All the figures are depicts the before and after conditions of activity. Figure 1 shows that instead of heating die internally it should me heated externally in small furnace. Figure 2 shows the idle worker use pneumatic gun machine instead of Allen key and in figure 3 before condition is they used to measure the packing plates during setup which increased the setup time so in after condition there is a provision of tooling trolley in which separate racks are provided for placing packing plates form 0.5mm to 5 mm. trolley also provide rack for placing new die and old die.

Problem / Present status:	**Countermeasure :**
Die heated after loading/clamping on bolster.	Pre-heat die upto 100°c in electric furnace externally.To reduce heating time of die after loading it.Remaining temperature would be achieved by heating die online.
Before : 	**After :** 

Figure 2: Externally die heating.

Problem / Present status:	**Countermeasure :**
Time wasted for tightening & loosening of bolts.	A Pneumatic gun for tightening & loosening of nuts/bolts instead of allen key (current) should be provided to reduce die setup time. Pneumatic gun should be dedicated to one press along with the colour codes on it.
Before : 	**After :** 

Figure 3: Use of pneumatic gun.

Table 2: conversion of internal into external.

Sr.no	Improvements & Effect	Conversion of internal into external (min)		Kaizen (min)
		Internal	External	
1	use of pnumatic gun	10	0	4
2	No Effect	2	0	
3	Make adjustable trolly	10	0	7
4		21	0	19
5	Make provision of a chart of voltage and current required for perticular die	8	0	1
6	Use of small furnace which heated dies parallel when setup is carried out	17	7	0
7	No Effect	1	0	0
8	No Effect	12	0	0
9	No Effect	5	0	0
10	No Effect	1	0	0

Problem / Present status-	Countermeasure: Racks for putting packing plates.
Measurement of packing plates due to no identification of thickness.	
Before: 	After: 

Figure 4: Use of tooling trolley.

In fig 3 before conditions the worker carries all the tools and fixture by hand which causes wastage of time for set-up process. But in after condition the tools and fixtures are carried by using trolley which resulted in the resulted in set-up time reduction and safety is improved.

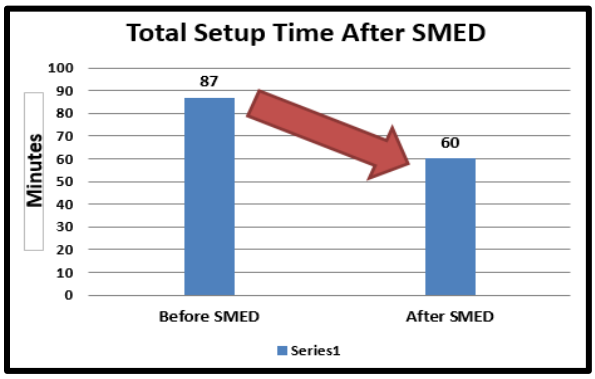

Figure 5: Total setup time after.

4. Result

The goal to reduce machine downtime during the setup operations and reduction in setup time is achieved. By implementing the SMED techniques, the total time taken to perform setup activities at forging press was reduced by from 87 minutes to 60 minutes i.e. 27 minutes reduced and the percentage reduction in set-up time is 18.03%. The other details of Internal and External Activities are depicted in the table 2. In fig 4 shows the time of all Activity Before and after SMED. In fig 5 shows the total setup time after SEMD technique used. Its indicates setup time of forging 1000 Ton press is reduced by 27 min

5. Conclusion

The lean manufacturing technique implemented and a significant result was achieved. SMED methodology was applied to prepare an optimal standard procedure for changeover operations on forging press. Based on a series of time study data collected during the setup activities in the forging press, a comparison of results, achievements before and after the SMED implementation was made to measure the effectiveness of SMED to reduce setup time.

6. References

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