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Application of SMED Programme of Lean Manufacturing for Improving overall Equipment Efficiency -A Case Study

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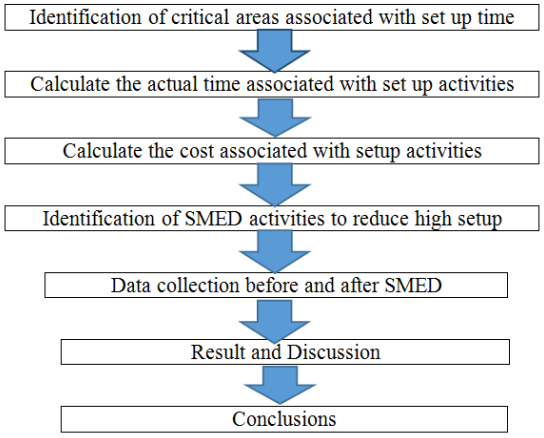
ABSTRACT: Now a day market increasingly demanding more customized product the manufacturing under pressure to reduction the production cost in order to survive in the highly competitive market. So firm must be capable of producing a large variety of product in small time and consequently must provide for much more frequent die change to reduce the setup time. Setup determine downtime, capacity, product quality, and to some extend costs. Thus there are single minute exchange to die tool is used to reduce the setup time to reduce the quality loose and increase productivity. The conversion of internal and external operation in any industries is among the key drive to increase the production rate improvement with decreasing of setup time, there is also increase in overall equipment efficiency. SMED plays a vital role improving the performance of manufacturing industry. In forging shop and forging press was selected for reduction in setup time by using of single minute exchange to die tool.

I. INTRODUCTION

Single minute exchange of die. Single minute exchange to die is an important lean tool to reduce waste and improve flexibility in manufacturing processes allowing lot size reduction and manufacturing flow improvements. SMED reduce the non-productive time by streamlining and standardizing the operations for exchange tool, using simple techniques and easy application. Single minute exchange of die approach of increase output and to reduce setup time, to reduce quality losses etc. Throughout review of these research papers realize the signification of quick change overtime. Through SMED techniques such as distinguish and shift internal activities of external one, by internal activities if possible and by streamline operation and activities overall setup time can be reduce. Overall setup activities are vital part of production lead time and also affect overall production cost. These SMED techniques apply basically on small and medium scale industries in research paper. Review literature of papers that will help for applying techniques of SMED in small scale industries or medium scale industries.

II. RESEARCH METHODOLOGY

The critical area were identified by reviewing the present changeover procedure of machine of various shops (machine and forging shop) in forging shop, forging press was recognized for reducing change over time due to its high setup.



The activities associated with setup of forging machine were noted from production reports. After that rationalization of activities, the conversion of internal activities into external activities was done. A compression of result and achievement before and after SMED implementation made to measure the effectiveness of SMED [1-10].

III. RESULTS AND DISCUSSION

SMED plays a vital role in improving the performance of manufacturing industry. High setup time may lead to less production rate and less productivity. In forging shop forging press was selected for reduction in setup time. Various SMED techniques were used in present research. The results are given below:-

A. Reduce set up time

These changing activities and technique are used. Before SMED, activities associated with setup of dies (forging press) took 209.36 min/day.

After study the activities associated with setup of dies (forging press), then it was observed that there were changes to reduce setup time by SMED techniques. Using SMED technique, two activities such as heating and measurement of packing shifted from internal to external. Introduction new tools such as hot gauges, sample die used for hot inspection of forged crank and pneumatic spanner used for loosening or tighten the bolts of bottom dies. After using associated with setup of dies. After using SMED, time associated with setup of dies are 167. 09 min/day and saved time up to 42.27 min[1-10].

Table 1: Activities shifted and technique used.

Sr. No.	Activities	Category	Category Changed	Technique used
1	Unloading and loading of bottom finisher and blocker	Internal	Nil	Use pneumatic spanner
2	Die packing	Internal	External	Standardized re-cut of die length
3	Heating	Internal	External	Preheating
4	First pc forging	External	Nil	Hot gauges used, sample die used

Table 2: Time saved in main activities (per day).

Sr. No.	Main activities of setup	Before SMED	After SMED	Time saved
1	Die changing	118.21 min	113.11 min	5.10 min
2	Die packing	16.56 min	Nil	16.56 min
3	Heating	74.59 min	53.58 min	21.01 min

Total internal activity setup time =167.09min

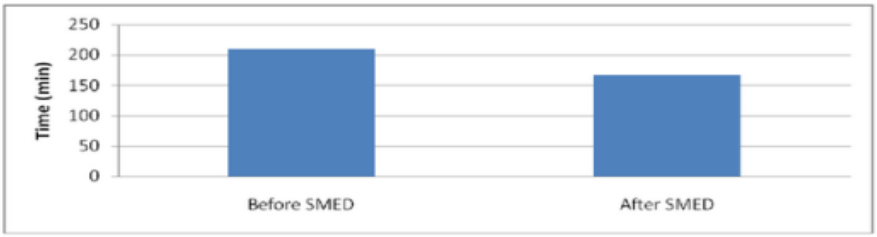


Fig. 1. Comparison of Time before and after SMED.

In die changing, the bolts and bottom dies tightened or loosened by using pneumatic spanner and saved 5.10 min. with the help of pre heating of bottom dies, the time also saved to 21.01 min. Minimize setup time related with other activities (fool-proof & absence of tool).

Fool–proof activities in system and absence of tool, it took 30 min/day during setup of dies (forging press). The fool proof activities in the system consumed 20 min/day. The time of fool proof activities in the system in minimized by poko yoke. In this technique, responsibilities are implemented on the worker or supervisors. Absence of tools during setup consumes 10min/day during setup of dies. This time is minimized by introduction new tools in the SMED trolley and introduced shadow board near the machine. Misplacing of tool while working on setup of dies, it is best option to take tool from shadow board rather than issue from store.

Table 3: Time saved in other activities related with setup time.

Sr. No.	Other activities related with setup time	Before SMED	After SMED	Time saved	Total used
1	Fool proof activities related in system	20 min	10 min	10 min	Poka yoke
2	Absence of tools	10 min	8 min	2 min	Introduced new tool to SMED trolley, Introduced shadow board
	Total	**30**	**18**	**12**	

Increase production and improve overall equipment efficiency

Before SMED

Assume number of days/month =25(approx)
Average setup time = 209.36 min/day
=209.36*25 = 5234min/month
=5234/60 = 87.2 hours/ month
=87.2/24 =3.63 days/month

Lost production

Average number of crankshaft per shift = 2700 piece
Average number of crankshaft per days = 8100 piece
The loss in production per month due to setup =8100*3.63 = 29403.

After SMED

Assume number of days/month = 25 (approx)
Average setup time = 167.09min/day
= 167.09*25=4177.25
= 4177.25/60 = 69.62 hours/month
= 69.62/24 = 2.90days/month

Loss production

Average number of crankshaft per shift = 2700 piece (approx.)
Average number of crankshaft per days = 8100 piece (approx.)
The loss in production per month due to setup = 8100*2.90
= 23490 pieces
Increase in production in per month = 29403-23490
= 5913 piece per month
Increase in Production annually = 12*5913
= 70956 pieces
The increase in production of crankshaft in forging shop is 70956 piece annually. With the increase of production, means minimize the setup time and also increase overall equipment efficiency
Assume minimum profit 15% of the industry on the one piece of production
Cost of one piece forged crank = Rs. 170
Profit of one crank = 170*15=2550/100
= Rs. 25.50
Increase in production annually = 70956 pieces
Increase in profit annually = 70956*25.50
=Rs 1809378

IV. CONCLUSIONS

SMED in an important tool to reduce the setup time and streamline the operations. By using SMED technique, it is possible to study the activities associated with setup and reduce setup time by separation of internal and external activities.

The conversion of internal to external operation is among the key drivers to increase the production rate improvement with decrease of setup time, there are also increase in overall equipment efficiency. It also help to minimize fool proof activities present in the system. The conclusion drawn from case study are show following.

(i) The setup time of forging press reduced from 209.36 min to 167.09 min.
(ii) The significant increase in production to 70956 pieces annually.
(iii) Increase in profit of RS 1809378 annually.
(iv) Increase in overall equipment efficiency to 4%

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