International Journal of Engineering Research
Volume No.3, Issue No.5, pp : 321-323
ISSN:2319-6890)(online),2347-5013(print)
01 May 2014

Reduction in setup change time of a machine in a bearing manufacturing plant using SMED and ECRS

Gaurav J. Pawar, Nishant S. Sirdeshpande, Aniket B. Atram, Prachi R. Patil
Dept. Of Mechanical Engg., Vishwakarma Institute of Information Technology, Pune, Maharashtra, India
Corresponding Email: gauravjpawar@yahoo.in, nsirdeshpande@gmail.com

Abstract— ***Single minute exchange of dies along with ECRS can be used efficiently to reduce setup time. The present paper provides an analysis of current changeover methods of bearing ring grinding machine in a manufacturing plant having line layout. The study gives methods for reducing setup time using above mentioned tools.***

Keywords—**SMED, ECRS, Setup time, Line layout**

I. Introduction

Nowadays, industries are adopting new tools and techniques to increase productivity, operational availability and better overall efficiency of the production line. Due to flexibility in market demand and competitiveness many manufacturers are opting to reduce machine down time. Setup change time includes the time elapsed from last good piece to first good piece. In a batch manufacturing plant, setup change time leads to increase machine down time. While operators or technicians change tooling from one job to the next, machine or assembly operation is idle and the time that is passing by cannot be stored or be recovered for future use.

In the past two decades, setup time reduction and quality improvement programs have become prevalent in manufacturing industry. These programs had contributed towards higher efficiency and agility needed by manufacturers. At present manufacturers must be able to manufacture a wide variety of highly differentiated and high quality products in a cost-effective manner, and respond quickly to changes in the product volumes in order to compete effectively.

This paper is concerned with the study of reducing setup change time for a bore grinding machine in a bearing manufacturing company. The SMED philosophy along with ECRS(Eliminate, Combine, Reduce, Simplify) concept was adopted to achieve reduction in setup change time. The initial step was gathering information about the present setup times and its proportion to the total productive time. A detailed video based time study of setup activities was done to classify them into major and minor setup activities in terms of their need (i.e. removing, fixing, avoidable adjustments, unavoidable adjustments, searching, inspection, etc.), time taken and the way these could be simplified, combined, reduced or eliminated.

II. Material and Methodology

1.Data Collection: The data that was collected was, setup procedure and setup time. The setup procedure can be divided into various elements like preparation/ presetting, removal of fixtures, cleaning, changing of fixtures, adjusting, first part machining and inspection. Presetting phase is used to prepare the tools and fixtures for the setup. Tool preparation includes keeping tools ready according to the tooling list for specified machines. Parameters like shoe setting, clamp and de-clamp and ring jump are checked. Assembled chuck is checked manually. Existing fixtures are removed using spanner and Allen key. Cleaning is done using coolant. New fixtures are brought up from presetting room to the respective machine. These fixtures are then mounted. Adjustment is done for stroke of spindle, face matching of driving plate and ring shifting. Sample rings are tested with the adjustments made. The results obtained are analyzed and compared with standard results. If the results obtained are within the tolerance limits, the machine is considered to be ready for production.

Time study using video recording was carried out to get the details of time required for each activity.

Table I. Time required for each activity

No	Activity	Time (minutes)
1	Removal of clamping plate	12
2	Removal of driving plate	10
3	Lifting and removal of chuck	6
4	Driving plate lapping	26
5	Driving plate mounting	10
6	New chuck mounting	5
7	Driving plate adjustments	10
8	Stroke adjustment	22
9	Ring shifting adjustment	24
10	Mounting of clamping plate	12
11	Ring checking	40
12	Idle Time	10
13	Tool Search	8

These elements do not necessarily follow a fixed sequence. In most case, operators randomly arrange these elements according to their habits.

2.Data Analysis: The purpose of data analysis is to find out the critical activities i.e. activities which take more time compared to other activities involved in setup process. **Two minute analysis** tool was used for the analysis of captured data. The method includes breaking down the video into intervals of two minutes. Then activities completed in particular interval are noted down.

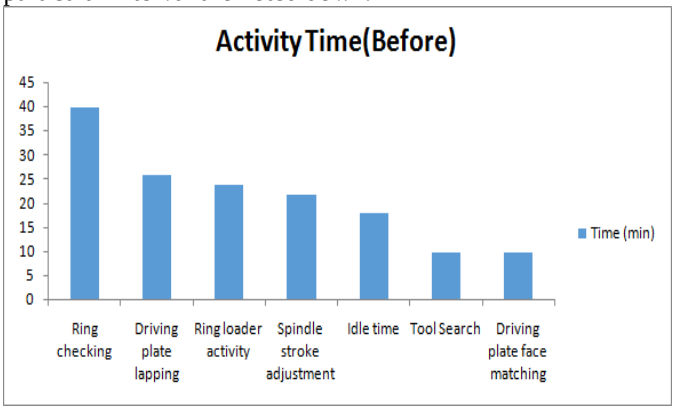

Fig. 1: Time taken by Critical activities

ISSN:2319-6890)(online),2347-5013(print)
01 May 2014

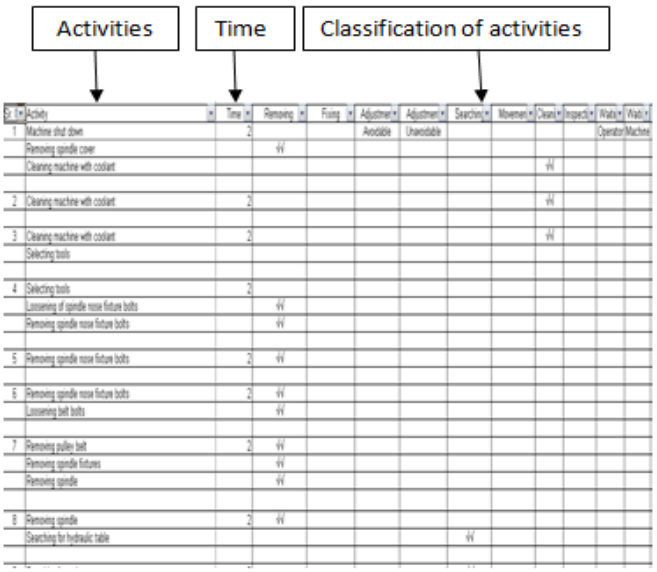

Fig. 2: Screenshot of Two Minute Analysis sheet

Categorization and break down of activities in two minutes, helps to identify the critical activities. After two minute analysis, the activities which took more than 10 minutes (critical activities) were filtered from the remaining activities following the SMED principle.

3. Brainstorming: For the brainstorming session, a meeting was held with the manufacturing line team which included managers, supervisors and operators. In this session, each critical activity was studied thoroughly and the problems for delay of activity were found out.
Accordingly, solutions were identified, discussed and finalized for implementation in an actual setup procedure. Table II shows implementation of ECRS for critical activities.

Table II. Implementation of ECRS

Critical	ECRS	Solution
1.Ring Checking	R	Test Rig
		Test Rig
		Angle scales
2. Ring Loader Mounting	E	Test Rig
		Test Rig
		Test Rig
3. Driving Plate Lapping		Common adapter plate
		Adapter plate lapping
4.Spindle stroke	S	Standardization of spindle nose
5.Tool searching	E	Tool checklist for before and
		Organized tool tray
6.Face matching	S	Two people activity
7. Idle Time	R	Organizational changes to be
8. Cleaning	R	Unavoidable as it is mandatory

III. Results and Tables

The following chart(Fig.4) first categorises the time taken by critical activities from total setup time. This sets a target time to be achieved after implementation of the above mentioned changes.

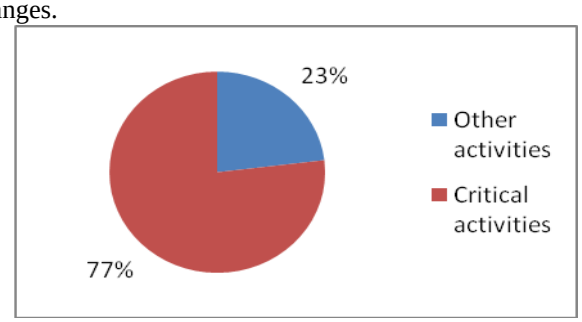

Fig.4 Percentage of total time taken by critical activities

The comparison between previous setup times and setup times after implementation of the above mentioned changes is highlighted in Fig.5 and Fig.6 respectively.Fig.7 gives a direct comparison between before and after time using a time graph. The time spent in critical activities has been considerable reduced indicating the effectiveness of the utilised tools to conform to SMED and ECRS principle.

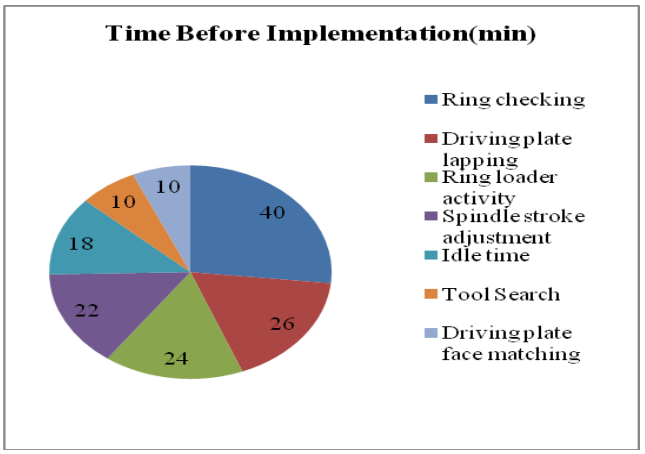

Fig. 5 Time consumed by each critical activity before ECRS

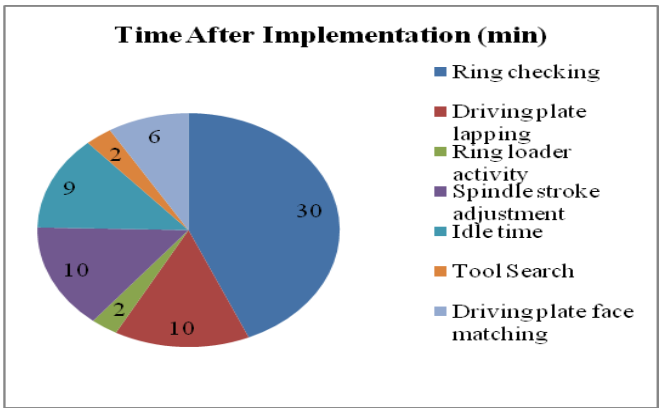

Fig. 6 Time consumed by each critical activity after ECRS

ISSN:2319-6890)(online),2347-5013(print)
01 May 2014

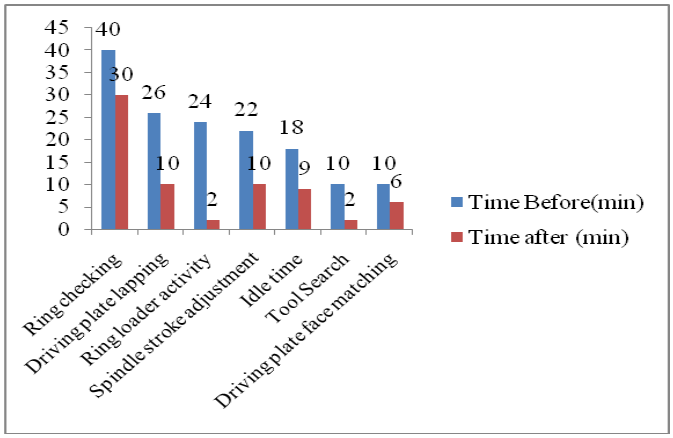

Fig. 7 Activity time graph before and after ECRS

IV. Conclusion

A Two Minute Analysis method is easy to use for analysis and finding out the critical activities involved in setup procedure.

The implementation of SMED and ECRS principles on the setup procedure of a machine in line layout in the bearing manufacturing plant reduces the total setup time from an initial time of **195 minutes** to **114 minutes,** saving **81 minutes** i.e. **41.53%** of total time. This indicates that SMED along with ECRS is an effective tool to reduce production loss in a similar batch manufacturing plant having a line layout.

References

i. *Onho, Taiichi (1988). Toyota production System. Productivity Press,*
ii. *p. 8. ISBN 0-915299-14-3, p4, p6.*
iii. *Taiichi Onho, Toyota Production System, Productivity Press, 1988,p.58*
iv. *Lean Six Sigma Operational - Delegate Workbook, The British Standards Institution,SSG06101ENUK - SMED/Issue 11/ Septemberl 2008*
v. *IJanez Kusar - Tomaz Berlec - Ferdinand Zefran - Marko Starbek ,Reduction of Machine Setup Time, Strojniški vestnik - Journal of Mechanical Engineering 56(2010)12, 833-845*
vi. *Adanna I. W, Prof. A. Shantharam, Improvement of Setup Time and Production Output with the use of Single Minute Exchange of Die Principles (SMED), International Journal of Engineering Research (ISSN : 2319-6890)*
vii. *Volume No. 2, Issue No. 4, pp : 274-277*
viii. *vi. Mr. Rahul.R.Joshi, Prof.G.R.Naik, Reduction in Setup Time By SMED A Literature Review, International Journal of Modern Engineering Research (IJMER) Vol.2, Issue.1, Jan-Feb 2012 pp-442-444*
ix. *vii. Berna Ulutas, An application of SMED Methodology, World Academy of Science, Engineering and Technology Vol:55 2011-07-24*
x. *viii. Antonio Carrizo Moreira 1, Gil Campos Silva Pais 2, Single Minute Exchange of Die. A Case Study Implementation, J. Technol. Manag. Innov. 2011, Volume 6, Issue 1*
xi. *ix. R. S. Barot, H. S. Beravala, B. S. Patel, Reducing Set-up Times: A Foundation for Lean Manufacturing, National Conference on Recent Trends in Engineering & Technology May 2011*
xii. *x. Maurizio Faccio, Setup time reduction: SMED-balancing integrated model for manufacturing systems with automated transfer, International Journal of Engineering and Technology (IJET) Vol.5 No.5 Oct-Nov 2013*