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TO REDUCE THE CHANGE OVER TIME ON CAPACITOR TAPING MACHINE (USING SMED CONCEPT)

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ABSTRACT

The electronics industry is one of the most demanding market sectors, in which flexibility and response capability constitute the basis for success. Lead-time reduction is one way of increasing productivity and improving companies' competitiveness. This case study was developed at a company in the electronics sector specialized in manufacturer of discrete semiconductors and passive electronic component. Each assembly line is used to manufacture various references to optimize resources, being the reduction of setup times is imperative. This study presents the approach developed on an assembly line, assigned as a pilot project in the implementation of the SMED methodology, complemented by other Lean tools, aiming to reduce the waste inherent to tool changes. The solutions developed enabled one to achieve a weekly reduction of approximately 50 % in the time due to setups, contributing by this way to an increase in assembly-line availability as well as to a productive capacity increase.

Keywords: SMED, Lean tools, changeover, lead screw.

I. INTRODUCTION

The globalization brought an increase in companies' competition, generated as well the need for an improved Flexibility [1]. The manufacture of great diversity in small quantities is a condition which requires extremely frequent setups [2]. Thus, companies must find a way to reduce setup times and eliminate wasting time, as well limit activities without real added value [3]. Lean tools establish the principles that aim to reduce wastes by improving the methodologies used to respond to this product mix [4]. The methodology developed by Shigeo Shingo, denominated as SMED (single minute exchange of die) proposes that setups should be carried out within a maximum time period of 10 minutes. This can be achieved by means of the tasks rationalization undertaken by the machine operator [5]. This work was developed at a electronics components manufacturer, having as main goals optimizing the setup times on an assembly line by adopting SMED methodologies in association to other Lean tools. The organization and standardization of tasks changed the entire process into one that is faster and more intuitive.

II. LITERATURE REVIEW

The demand for diversity has imposed the adoption of the Toyota Production System (TPS), which results in the production of smaller lots [6]. There is a direct relation between lot size and setup times [4].The SMED methodology was developed by Shingo (1985), who essentially described it as a scientific approach to reduce

setup times. By focusing on the elimination of the waste associated to tool changeovers in the setup phase, SMED allows for the reduction of lot sizes and enables one to meet the fluctuation of demand. It further eliminates the waste inherent to stock build up and enhances a reduction in lead time [8,9]. A fundamental aspect of the SMED methodology relates to its features of internal and external activities. All of the setup activities which do not interfere directly with the equipment, and which can be carried out without interrupting production, are designated as being external activities. Those which imply a stoppage in the equipment running are described as internal activities. The correct separation of the two is what fundamentally contributes to a reduction in setup times [10,11]. In sum, the SMED methodology consists of three stages, when aiming to reduce setup times [12,13]: 1st Stage - Separating internal from external activities; 2nd Stage – Transforming internal activities into external; 3rd Stage – Reducing and eliminating internal and external activities. The preliminary phase consists of identifying setup operations and tools. The purpose of this phase lies in acquiring an extremely good understanding of the entire setup process [14]. This set of procedures demands continuous monitoring of the process, which is crucial if one is to achieve good results. The operational method ensuing from the result obtained through SMED must be recorded; the purpose of this register is to promote standard work and act as a basis for the training and improvement of teams [15]. SMED application results lie in higher productivity, less stock, improved quality, reduced lead-time, greater flexibility and smaller lot sizes [17].

III. METHODOLOGY

In this project SMED concept with other lean tools (5S, standard work), has been used to reduce change over time. SMED concept consist of three stages, In stage first internal and external set up are separated after that in second stage, internal set up converted to external set up. In third stage, stream lined all aspects of set up operation. After proceeding with an analysis of the results and quantification of the gains achieved.

5. Analysis and optimization of set up times for the assembly line:

Based on analysis undertaken regarding the procedure used in setup tasks various problem were detected; these resulted in a process which was lengthy and rather non intuitive below table represents problem and description.

Table 1.Problems identified in the execution of setups

Sr.no.	Problems	Description
1.	Linear feeder	Lead screw mechanism used for linear feeder setting.
2.	Product stopping	Position of cell stopping is fixed. Vertical movement is provided with the help of lead screw.
3.	Jaw opening	Opening of jaw is fixed at maximum capacitor thickness.
4.	Kink tool replacement setting	Kink tool jaw movement is standardized with proper opening setting. Disorganized tools is arranged in proper arrangement.
5.	Product holding jaw tape replacement	Tape used for grabbing of capacitor is replaced by rubber gripper
6.	Product pushing cylinder	Height Adjustment of capacitor on anvil is standardized.

5.1 Working of capacitor tapping machine:

In capacitor taping machine, there are seven steps (refer following figure).These are as follows;

5.1.1 Vibro-bowl feeder:-This is a vibrating bowl which contains number of capacitors and this work on electromagnetic field. Due to this field causes and vibration in the bowl and rotate circular. This has given provision to pass the capacitor into linear feeder.

5.1.2 Linear feeder:-This feeder holds capacitor and passes to product feeding assembly. Sensors are provided for controlling vibro-bowl feeder.

5.1.3 Product feeding assembly:- These are as follows;

5.1.3.1 Holding of capacitor.

5.1.3.2 Product pushing cylinder- This pushes capacitor on anvil which gives range for taping capacitor.

5.1.3.3 Kinking Assembly- Kink is done as per our requirement. For example: 6e to 6e, 6e to 4e

5.1.3.4 Electric parameter checker- It check electric parameter.

5.1.3.5 Defect founder - If any defects like electric parameter as well as capacitance is not fulfill company's requirement then it will rejected.

5.1.3.6 Pitch correction - Correction of capacitor's pitch check by this pitch correction.

5.1.4 Tape feeding assembly - There are two types of tapes (white and brown). Which passes through heater and between them capacitor is hold .After pressing of roller two tapes are fixed.

5.1.5.Tape Punching - Punching of tape is done in this process.

5.1.6.Ammo packing- Packing is done by circularly shape on fixed table.

5.1.7. Profile Project- This checks profile of capacitors, only right profiles are accepted.

Fig 1.Capacitor tapping process

5.2 Implementation of solutions:

The next section make a detailed of the description and solutions proposed to organize and identify the set up tool in an intuitive way, as well as to adopt fast changing the tools. One also sought to ensure that tool component always available and that internal activities were separated from the external ones

5.2.1 Linear feeder setting:

As there were three nut and bolt for adjusting distance between two metal strips which allows path for capacitor. These screws were adjusted by try and error method for every changeover which in turn increasing time. We added lead screw mechanism which allows adjusting of all three screws by means of one screw only.

Fig 2.Linear feeder setting

5.2.2 Product Stopper setting:

Similarly here also same mechanism is used stop capacitor at the end of linear feeder of different height

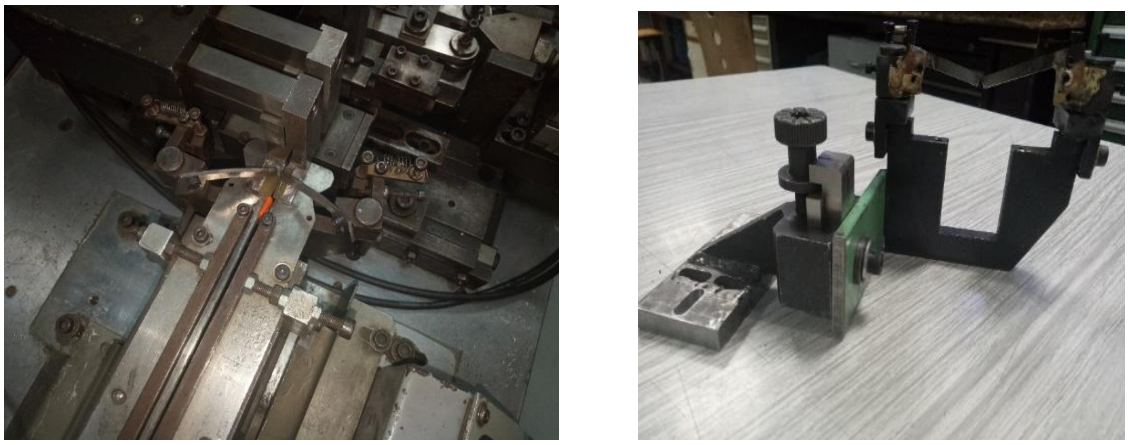

Fig 3: Product stopper setting

5.2.3 Jaw opening setting:-

Opening of jaw is fixed at maximum capacitor thickness, so that frequent jaw opening setting is eliminated.

5.2.4 Kink tool replacement setting:-

Kink tool jaw movement is standardized with proper opening setting Disarrange tools are arranged in proper arrangement.

5.2.6 Jaw tape replacement:-

Tape used for grabbing of capacitor is replaced by rubber gripper. Rubber used for gripper is made of Polyurethane.Before, tape were used for grabbing capacitor which needs to be replaced after some time as its stickiness causing problems while traveling of capacitor between jaws. It is replaced by rubber by creating groove in jaws and fixing permanently.

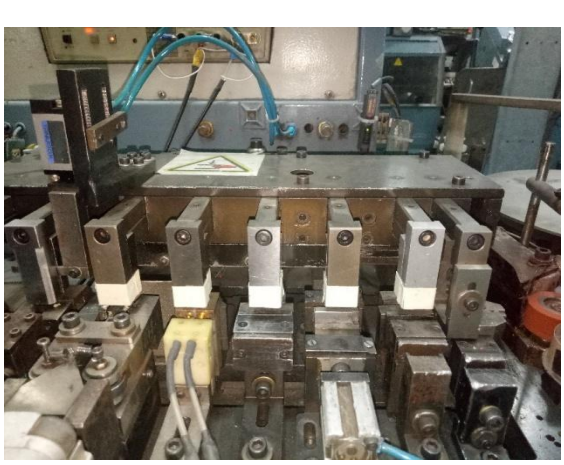

Fig 4.Jaw tape replacement setting

5.3 Result Analysis:

Table2. Result table

Sr.No.	Activity	Before time(min)	After time(min)
1	Linear feeder	22	2
2	Product stopping	8	1
3	Jaw opening	3	0
4	Kink tool replacement setting	24	8
5	Product holding jaw tape replacement	14	0
6	Product pushing cylinder	19	2

Before the implementation, operator required too much time for the changeover also it was trial and error method. After improvements were implemented, on daily basis time required for changeover dropped from 90 mins to 13mins.

IV. DISCUSSION AND CONCLUSION

The study was developed with the aim of reducing setup times through the application of SMED methodology, in association to other lean tools (5S, visual management) so as to increase flexibility and productivity on capacitor taping machine at the electronic sector company. The main goal was achieved by means of the implementation of various improvement action targeted to tools organization and identification, tool types, reorganization of internal and external tasks, detailed set up files, visual aids and the operator training. During whole day on the line to execute setups was reduced by at least 50% to corresponding to 90 min.

REFERNCES

Shigeo Shingo: A Revolution in Manufacturing: The SMED System, Productivity Press, 1985

[1] E.S.M. Costa, R.M. Sousa, S. Bragança, and A.C. Alves, 4th Int. Conf. Integrity, Reliab. Fail. Mech. Syst., vol. 1, no. 1, pp. 1–8, 2013.

[2] Y. Dave, N. Sohani, Int. J. Lean Think., vol. 3, no. 2, pp. 27–37, 2012.

[3] A.C. Moreira, G.C.S. Pais, J. Technol. Manag. Innov., vol. 6, no. 1, pp. 129–146, 2011.

[4] M. Cakmakci, Int. J. Adv. Manuf. Technol., vol. 41, no. 1–2, pp. 168–179, 2009.

[5] B.S. Kumar, S.S. Abuthakeer, J. Appl. Sci., vol. 53, no. 9, pp. 1689–1699, 2013.

[6] B.M. Deros, D. Mohamad, M.H.M. Idris, M.N. Rahman, J. Ghani, Int. J. Syst. Appl. Eng. Dev., vol. 5,no. 5, pp. 618–625, 2011.

[7] P.L. King, Ind. Eng., vol. 41, no. 9, pp. 30–35, 2009.

[8] M.C. Kocakülâh, J.F. Brown, J.W. Thomson, Cost Manag., pp. 16–27, 2008.

[9] R. Sundar, A.N. Balaji, R.M.S. Kumar, Procedia Eng., vol. 97, pp. 1875–1885, 2014.

[10] R. Rodríguez-Méndez, D. Sánchez-Partida, J.L. Martínez-Flores, E. Arvizu-Barrón, IFAC Proc. Vol., vol. 48, no. 3, pp. 1399–1404, 2015.

[11] A. Azizi, T. Manoharan, Procedia Manuf., vol. 2, no. February, pp. 153–158, 2015.

[12] V. Kumar, A. Bajaj, Int. J. Recent Technol. Mech. Electr. Eng., vol. 2, no. 2, pp. 32–39, 2015.

[13] B. Ulutas, World Acad. Sci. Eng. Technol., vol. 5, no. 7, pp. 100–103, 2011.

[14] E. Costa, S. Bragança, R. Sousa, A. Alves, World Acad. Sci. Eng. Technol., vol. 7, no. 5, pp. 379–385, 2013.

[15] M. M. Esa, N. A. A. Rahman, M. Jamaludin, Procedia - Soc. Behav. Sci., vol. 211, pp. 215–220, 2015.

[16] D. Ribeiro, F. Braga, R. Sousa, S. Carmo-Silva, Rev. Precis. Mech. Opt. Mechatronics, vol. 3, no. 40, pp. 115–122, 2011.

[17] K. Ram, S. Kumar, D. P. Singh, M. Engineering, K. Ram, vol. 6, no. 9, pp. 38–41, 2015.