



TPM Implementation to Reduce Downtime in Injection Molding Company

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Abstract Implementation of Total Productive Maintenance (TPM) being realized and become as an essential matter to resolve maintenance issue incurred in Injection Moulding Company. The basic impact given by down time issue was manufacturer would not able to achieve the targeted production. To overcome the case, it is required the maintenance program to be performed in accordance with TPM ideal concept so that the production activity of injection machine would be operated in optimum stage. The fundamental of TPM implementation are laying on 5S and 8 Pillars Methodology. The implementation of TPM is requiring full supporting of top management to ensure its working as well the support of all employees from all level escorting the TPM to be carried in proper way and practice. It is also noticed, in order to achieve the maximum objective against the implementation of TPM, it is required controlling on TPM implementation has to be reviewed once in 3 months.

Keywords Productive, maintenance, down time

Introduction

Competition in business requires top management of manufacturing companies to seriously monitor the performance of all parts within the company including production and maintenance for the company to have a sustainable competitive advantage. With increasing global competition, management's attention has shifted from simply increasing the efficiency internally into compliance with the market demand to be flexible, high quality and timely delivery [1-29-15]. In dynamic environment, a reliable production system should be seen as an important factor for competitiveness [1- 5]. Organizational competencies lacking in regulating the maintenance causes the production target is not achieved, resulting in increased inventory and reduced performance [1-7-19]. Traditional opinion said maintenance is operational costs, and not as a profitable investment that can improve performance. Equipment technology and development capability has been a major factor that indicates the strength of an organization and distinguish it from other organizations [1-9-23]. Maintenance has now become a strategic tool to improve competitiveness and not only become overhead expenses [1-28-19]. Investment in maintenance is one of the basic functions of an enterprise, to restore the improvement of the quality, safety, reliability, flexibility [1-26]. In the last decade there has been a change in thinking about maintenance in a world class company / World Class Manufacturing (WCM), where maintenance becomes an integral part of the production process and be a strategic way to achieve the goal [1-11]. So, maintenance has become a strategic issue and is essential for manufacturer in the world. The strong pressure of business, has been put maintenance into a very important function [1-12]. Modern manufacturing requires that organizations that want to be successful and achieve world-class manufacturing must have maintenance in effective and efficient. One approach to improve the performance of maintenance activities is to implement a system of Total Productive Maintenance (TPM).

Literature Review

Total Productive Maintenance (TPM) is a strategic action for improvement in the quality of maintenance activities [1-20-17]. TPM is an action strategy that is needed to maintain a good maintenance records [1-25].

TPM is a common activity of the business to pursue something better with low cost[1-16]. TPM has been widely recognized as a strategic weapon to improve manufacturing performance by increasing the effectiveness of the production facilities [1-9-10]. TPM represents part of a sustained effort of world-class companies in the concept of maintenance.

Total Productive Maintenance is a methodology and philosophy of strategic management tools that focus on the aim to improve the quality of products to maximize the quality of the equipment. Basically introduced a set of practical actions and methodologies that focus on performance improvements in manufacturing equipment. TPM is well known in extensive efforts oriented manufacturing equipment to increase productivity. It also relationship the concept of continuous improvement and total involvement of all employees and all departments [1-24]. The final goal of TPM is to implement perfect manufacturing [1].

Total Productive Maintenance methodology has eight pillars, (i) Autonomous Maintenance, (ii) Focused Maintenance, (iii) Planned Maintenance, (iv) Quality Maintenance, (v) Education & Training, (vi) Safety, health & Environment, (vii) Office TPM, (viii) Development Management. Eighth foundation pillars have 5S, as shown in Figure 1.

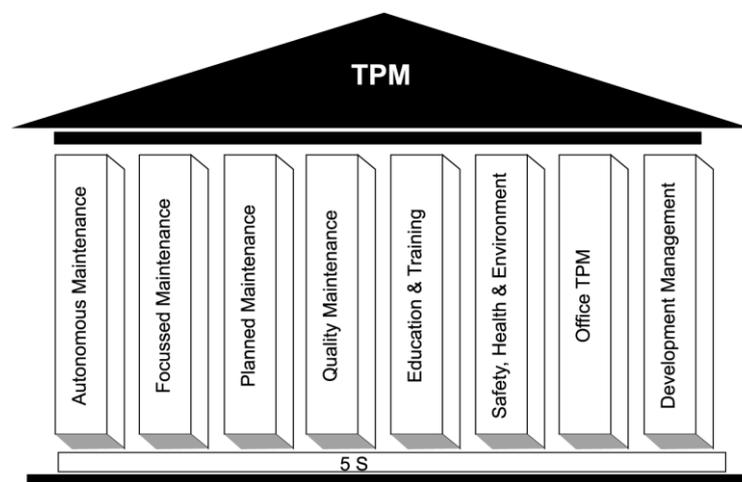


Figure 1: Eight Pillars of TPM
(Resource: Japan Institute of Plant Maintenance)

The foundation of TPM methodology is the implementation of 5S, (i) Seiri means sorting out unnecessary items from the workplace and throw it, (ii) Seiton which means arranging goods according to the appointed place, so it is easy to find if required, (iii) Seisio which means cleaning the workplace of dirt and dust, (iv) Seiketsu which means maintaining a high standard of hygiene work, so well maintained, (v) Shitsuke means to train and motivate employees to have the high discipline in cleanliness[1-13-22]. Autonomous maintenance is a daily maintenance routine by operators such as cleaning machines, or oil lubrication and inspection machines. This job is easy to do by operators, and the operator have a feeling of belonging to a machine and increase knowledge to the equipment it uses. The others goal is if any potential damage will soon be known, so as to avoid further damage [14]. Maintenance focus is like a "Kaizen" is continuous improvement. Repairs are carried out by a small team formed starting from the lowest level. This small team working to identify the problem of machine or equipment and propose improvement proposals [14]. Planned Maintenance is to create a maintenance schedule based on the ratio of the damage that has happened, so we can control the damage that often occur. Six steps in the planned maintenance is (i) Evaluation of equipment and recording status condition of the equipment, (ii) repair the damage and overcoming the weakness of the equipment, (iii) build the management system maintenance information, (iv) Setting up periodic maintenance, for equipment and replacement parts, (v) Preparing predictive maintenance for the equipment, (vi) an evaluation of the entire program planned maintenance [14]. Quality maintenance is ensuring the production machine can produce waste products. The machine can detect waste product so that the failure of the product can be avoided [14]. Education & Training is increase knowledge of operators and technicians and all employees when implementing TPM implementation. If

knowledge of operator is poor, can make to damage to the equipment during operation. The ability of the operator can be improved so that it can perform daily maintenance actions correctly. Technicians can be enhanced so that in the damage analysis and preventive maintenance actions can be done properly. Training provided to supervisors and managers can perform guidance (mentoring & coaching skills) in the implementation of TPM [14]. Safety, Health & Environment is safe and healthy conditions of workers while doing his job, so it was not an accident, and diseases caused by work. The target is (i) zero accident (no accident), (ii) zero health damage (no sick because of work), (iii) zero fire (no fire) [14]. Office TPM concept is spreading into the administrative function. Interest in the administrative pillars of TPM is that all parties in the organization (company) have the same concepts and perceptions including administrative staff (purchasing, planning and finance) [14]. Development Maintenance is maintenance activities that be recorded and become the experience in the future, to achieve optimal performance of machines. Role of Top Management in TPM implementation is crucial. In the implementation of TPM implementation in the company should start from the top management. They should always play an active role monitoring the progress of the implementation of the TPM. Thus is formed the cultural, moral and motivation of all employees for the implementation of the TPM [27].

The steps of the implementation of TPM are: A. Preparation step is recognition by top management to all employees in the company. It is intended that all employees have a strong motivation in the implementation of TPM. Top Management must be actively involved and strongly committed to support the implementation of TPM. The news about TPM published in the company magazine / pamphlet, and posted on the notice board of the company. and sent to each individual / employee in the company and recorded the receipt of the notification. In this preparation steps are (i). Training and socialization of carrying out the training program based on the needs / analysis of training needs for employees. Asking the people who've been successfully implemented TPM. (ii). TPM committees formed in each section. The Committee set up all the needs in the implementation of the TPM so that it can run in accordance with the concept of TPM. (iii). developed the TPM system to achieve the targets set. Each member must try to do improvements to achieve the targets set. (iv). formalization of TPM implementation plan. Become the implementation of TPM as a culture in the company. TPM Achievement award is a proof to achieve a satisfactory level. The second steps is introduction of TPM. The introduction of TPM implementation to all employees attended the Top Management, and stakeholders, supplier, and customer. The third steps is implementation of TPM. The implementation of TPM in accordance with the foundation and the 8 pillars of TPM. The fourth steps is the formalization of the achievement of the implementation of TPM. The targets that have been defined in the implementation of TPM was awarded as a form of formal seriousness of the company towards the TPM program [14].

Research Methodology

The research is described in the research methodology. Research begins with a preliminary survey and study of literature, then identifying the problem, and then formulation of the problem and goal setting. After it's done collecting the necessary data, including data processing aims to analyze and to make conclusions of research and suggestions. The problem identified is down time on the machines injection increased because failure of the quality of maintenance. The results of this identification formulated the problem to be investigated, "whether the maintenance activities have been carried out in accordance TPM concept?" This research only discusses and analyzes maintenance activities problems that related with Implementation of TPM for Injection Molding company. The research objective is directed towards the determination of a maintenance program in accordance with the concept of TPM thus reducing machine downtime. The object of study is the injection molding machine maintenance program. The gathering of data obtained is used for the repair of injection molding machine from August 2015 through August 2016, and other information regarding observations related to the injection molding machine maintenance program.

Discussion

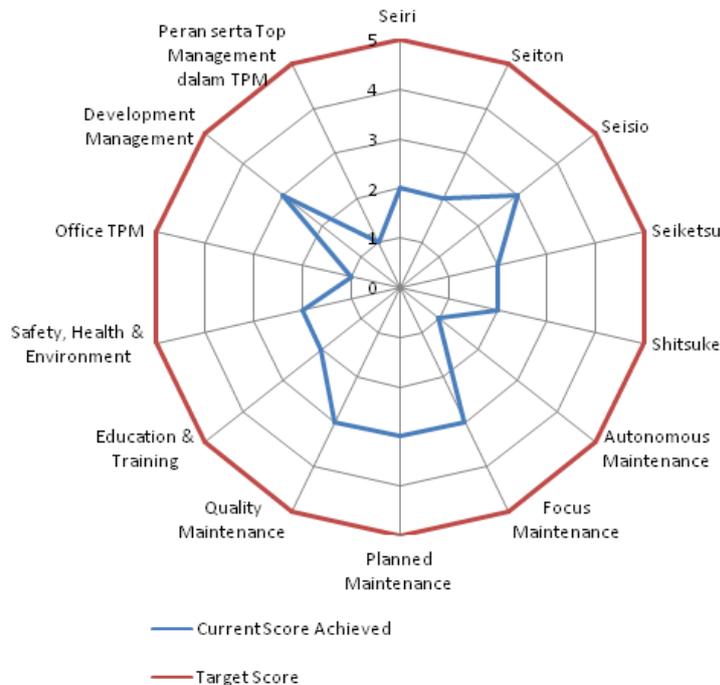
This analyze predetermined parameter TPM will be controlled in accordance with the existing concepts such as 5S, 8 Pillars of TPM, and top management involvement and participation for TPM activities, to achieve ideal implementation of TPM. Further assessment of the actual conditions present of TPM in factory compared with the ideal conditions of TPM implementation. Matrix research shows TPM ideal parameter comparison to actual conditions in the factory in accordance with table 1. In this matrix indicated also the results of numerical

assessment (scoring) of such comparisons. Scoring digits represent the level of the kindness (good score) and weakness (poor score) of each parameter is further shown in a graph to position these parameters. Scoring lowest parameter represents the weakest in its implementation so that it will be a top priority that must be carried out repairs by the company. Conditions scoring follow the rules as follows: number 1, if the company did not have a TPM program; number 2 if the company already has a TPM program but needed supervision in its implementation; figure 3 if the company already has a TPM program and its implementation is not necessary supervision and implementation is not perfect; number 4 if the company is able to use the TPM program to meet production targets and / or objectives of the company and its performance close to perfection; figure 5 if the TPM program has become an example of a standard for other companies. Here are observations TPM implementation program and remedial action should be taken to the implementation of TPM implementation at the Injection Molding Karawang factory, according to table 1.

Table 1: TPM implementation in injection molding company

No.	Description	Current Conditions in Injection Molding Karawang Plant	Score 1-5	Action Plan for TPM
A	5S			
1	Seiri			
	Sorting out unnecessary items from the workplace and throw it	No items that are not needed in the production area	2	Control Seiri implementation on Injection Molding Dept.
2	Seiton			
	Arranging goods according to the appointed place, so it is very easy to find when needed	lay out the placement of goods available	2	Goods in accordance with a predetermined layout. Keeping the placement of production injection at a designated place, and immediately sent to the next process (internal customer)
3	Seisio			
	Cleaning the workplace of dirt, dust, and all	cleaning schedule for each shift available	3	Cleaning controls each shift. Makes awareness of employees to do the cleaning action regularly, especially before and after work
4	Seiketsu			
	Maintaining a high standard of cleanliness work so well maintained	SOP available	2	Control implementation of the SOP. Maintaining control action PDCA.
5	Shitsuke			
	Train and motivate employees to have discipline in cleanliness.	Communication between the beginning of the shift and end shift	2	Briefing the beginning of each shift, and shift handover and emphasized the importance of 5S
B	8 Pillars of TPM			
1	Autonomous Maintenance	Operators are still only operate the machines	1	Make a daily check list and the operator work instructions about maintenance that can be performed by the operator.
2	Focus Maintenance	Meeting if any NG product exceeds the target	3	Made a small group or Small Group Activities whose membership begin operator level to discuss all the problems in the injection machine
3	Planned Maintenance	Maintenance Schedulle	3	Created schedule overhaul with known

		available, but overhaul of injection machine can not be done		Top Management. Schedule overhaul should be considered as t of the production process.
4	Quality Maintenance	Checking the quality of products is still manual	3	Planned maintenance of quality systems for injection molding machines according to the conditions made products. Created tools standardized quality control.
5	Education & Training	There are no technical training on injection machine operator and maintenance technician	2	Added technical knowledge and competency matrix machine maintenance injection for operators and technicians.
6	Safety, Health & Environment	Job safety & environment analysis available, but still hot in production area Safety awareness still poor of employees	2 2	Redesign air circulation in production area Safety health& environment training to all employees on reguler basis.
7	Office TPM	TPM has not been trained to all employees of administration	1	Socialization TPM to all office administration (purchasing, GA, HRD, PPIC, production).
8	Development Management	Preparation resources before the new machines /equipment arrive	3	Created preparation check list of resources before the machine arrived.. The preparation until the operator has been given the Operational Training and TPM
C	Participation of Top Managemnet	No timetable role of top management in TPM	1	Make a schedule for the participation of top management in the implementation of TPM



Graph 1: The value of the measurement parameter TPM program implementation

From the results of the implementation of TPM parameter measurements obtained above, agrades of 1 for the role of top management in the TPM, autonomous maintenance, and office TPM. With a value of 1 is then immediate action must be taken immediately to be done as the first priority in table 1.1 above. For the next action is a grade 2 obtained by seiri, seyton, Seiketsu, Shitsuke, education & training, and safety health & environment. Further action for grades 3 that Seiso, focus on maintenance, planned maintenance, quality maintenance, and development management. With these guidelines created schedule implementation of TPM implementation of corrective actions in order of priority 1, 2, and 3 above. Once that is done by taking the value of control once every 3 months to do restoration for continuous improvement (continuous improvement). If the TPM implementation of corrective actions above is done continuously and constantly monitored the results for every 3 months, it will automatically bring down the value of downtime that occurs on the Injection Molding. Interval time monitoring of results in the first year of implementation of TPM is done every 3 months. After the results of the first year to meet the target with the whole assessment parameters to get the value of 5, in the second year to do with interval 6 months. If at the time of taking the value back, determined to be impaired, the interval of time monitoring the implementation of TPM back to 3 months.

Conclusions and Suggestions

The conclusion from this research are: (i) the successful implementation of TPM involves the active involvement of all parties or all employees of the company, (ii) conduct training and education about the operations and maintenance of injection molding machines to operators and technicians in accordance matrix 'competencies, which raised awareness to implement TPM correctly and independently. (iii) the role of top management is crucial in the successful implementation of TPM in the company. Top management must have a strong commitment to get involved, because it will lead to a culture and a strong motivation to all employees.

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