The Role of Total Productive Maintenance in Group Technology to Achieve World-Class Status

Hassan Farsijani, Department of Industrial Management, Shahid Beheshti University, Tehran, Iran

Mohsen Shafiei Nikabadi, Department of Industrial Management, Semnan University, Semnan, Iran

Fatemeh Mojibian, Department of Industrial Management, Shahid Beheshti University, Tehran, Iran

ABSTRACT

The purpose of this paper is to illustrate how the World Class Manufacturing (WCM) techniques influence in implementation of Total Productive Maintenance (TPM) in cellular manufacturing. The paper presents an investigation of TPM which can be defined in terms of Overall Equipment Effectiveness (OEE). Then, using a case study in Cement Industry, OEE index that is related with TPM implementation in a cell with performance standards of world class Manufacturing is compared. Implementation of TPM in cellular manufacturing brings competitive advantages such as increasing efficiency and improving maintenance quality in cellular manufacturing systems. The first step to World-Class Manufacturing is to implement TPM successfully and to create a very active organization. When TPM has been a common practice in daily production, it can be said that company has just commenced a journey to world-class manufacturing. So, the originality of this paper is to assessing The Role of Total Productive Maintenance in Group Technology to achieve world-class status.

Keywords: Cellular Manufacturing, Efficiency, Overall Equipment Effectiveness (OEE), Total Productive Maintenance (TPM), World Class Manufacturing (WCM)

INTRODUCTION

Until the 1970, there was a widely accepted view of best practices in manufacturing. Firms which had grown on the back of post-war reconstruction, sold into stable and relatively undemanding markets. The term “World Class” was introduced by Hayes and Wheelwright in 1984. Since, then various researchers have embraced and expanded this concept. World Class Manufacturing (WCM) determines which set of activities needs to be undertaken by identifying
what is needed by the companies to compete globally, that TPM has provided an excellent means to improve the overall efficiency and helped organization in the move toward WCM through achievement of distinctive benefits. WCM is a different set of concepts, principles, policies and techniques for managing and operating a manufacturing company. It is driven by the results achieved by the Japanese manufacturing resurgence following World War II, and adapts many of the ideas used by the Japanese in automotive, electronics and steel companies to gain a competitive Advantage. It primarily focuses on continual improvement in quality, cost, lead time, flexibility and customer service. Competitive forces in both domestic and global markets are challenging batch processing firms to become more efficient and at the same time to become more flexible. Cellular Manufacturing (CM) is a layout organization that has been used to meet this challenge.

Cellular manufacturing (CM) is a manufacturing process that produces families of parts within a single line or cell of machines. Total Productive Maintenance (TPM) plan in a cellular manufacturing system can be implementing in different way, for example, TPM can implement on each machine cell by minimizing the total maintenance cost and overall probability of machine failure. Likewise, implementation of maintenance program based on AM (Autonomous Maintenance), and OEE improvement in cell production are the major points of implementation TPM in Cellular manufacturing System (CMS). Kumar Sharma et al., (2006), attempted to provide an in-depth and case-based approach to implement TPM in a semi-automated cell of a company, that helps maintenance managers to understand the reality of failures, their nature and to reduce their effect by adopting suitable repair strategies (Kumar Sharma et al., 2006).

The typical failures in a cell can be classified in 6 items as indicated in Table 1 (Hammer & Kennedy, 1987).

The first step to World-Class Manufacturing is to implement TPM successfully and to create a very active organization, when TPM has

### Table 1. Six big losses and failures classification

<table>
<thead>
<tr>
<th>Failure Classification</th>
<th>Definition and Concept</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human failure</td>
<td>Mainly occurs because of errors of omission and improper actions</td>
<td>Pushing the wrong button or lever, using the wrong weight of oil</td>
</tr>
<tr>
<td>Mechanical failure</td>
<td>Include failures of traditional components</td>
<td>Gears, bearings, fixture and tooling</td>
</tr>
<tr>
<td>Electronic failure</td>
<td>Consisted of failure of the solid-state component, these types of failure require less time to repair</td>
<td>Servo drives, power supplies and logic buses</td>
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<tr>
<td>Hydraulic failure</td>
<td>Can be avoided by performing regular maintenance intervention, it takes long time to repair such failure because when a failure occurs it requires machine to be shutdown for the entire maintenance activity.</td>
<td>Hoses, pumps, solenoids</td>
</tr>
<tr>
<td>Software failure</td>
<td>Include improper logic or coding, depends upon part and system program changes</td>
<td>Programmer errors or omissions</td>
</tr>
<tr>
<td>Electrical failure</td>
<td>Include failure of electro-mechanical devices</td>
<td>Motors, relays, starters, transformers and wiring</td>
</tr>
</tbody>
</table>
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