

Study of Total Productive Maintenance & Its Implementing Approach in Spinning Industries

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Abstract:-This paper presents the study and overview for the implementing approach of Total Productive Maintenance in Indian spinning industries. The study is carried out in medium scale cotton spinning industry using the observations coupled with documents collection. The TPM implementation methodology is suggested for improvement in the availability, performance efficiency and the quality rate, results in improvement of the overall equipment effectiveness of the equipment. The aim of this paper is to suggest and study the implementation of the TPM program in the spinning industry. Using a See through, JH-Check sheet, PM-Check sheet, One Point Lessons, empirical and comprehensive approach toward the methodology results proper implementation of TPM. After implementation of TPM on model machine, both direct and indirect benefits are shown to be obtained for equipment and employees respectively.

I. INTRODUCTION

The concept of Total Productive Maintenance (TPM) has been introduced and developed by Japanese in 1971. This came in response to the maintenance and support problems in commercial factory. It is team-based preventive and productive maintenance and involves every level, from top executive to the floor operator. TPM has been proven to be successful for helping to increase the productivity and overall equipment effectiveness. TPM can be defined as a program for fundamental improvement of the maintenance functions in an organization, which involves its entire human resources. TPM philosophy requires the development of a preventative maintenance program for the life-cycle of the equipment and the involvement of operators in maintaining the equipment in order to maximize its overall efficiency and effectiveness.

TPM is all about Total Plant Maintenance. The underlying concept is, if you properly maintain plant machinery there will see a sharp decline in machine breakdowns, safety and quality problems. There is emerging need for TPM implementation in the Indian Industry and need to develop TPM implementation practice and procedures.

Under TPM, machine operators carry out routine maintenance such as checking water, oil, coolant, and air levels. This may involve some training of machine operators. Through operator training to do simple maintenance on machines will promote ownership and more attention to detail. The actual maintenance teams should as a result of spending less time doing routine maintenance is in a position to concentrate on more urgent machine breakdowns.

II. THEORETICAL OVERVIEW

In this topic, the overall structure of TPM is discussed with its practical approach. All the techniques which are responsible for the efficient and effective operation of machines are discussed below.

A. Steps of TPM implementation

STAGE 1 - PREPARATORY STAGE

STEP 1 - Announcement by Management to all about TPM introduction in the organization.

STEP 2 - Initial education and propaganda for TPM.

STEP 3 - Setting up TPM and departmental committees.

STEP 4 - Establishing the TPM working system and target

STEP 5 - A master plan for institutionalizing

STAGE 2 - INTRODUCTION STAGE

This is a ceremony and we should invite all Suppliers as they should know that we want quality supply from them. Related companies and affiliated companies who

can be our customers, sisters concerns etc. Some may learn from us and some can help us and customers will get the communication from us that we care for quality output.

STAGE 3 – IMPLEMENTATION

In this stage eight activities are carried which are called eight pillars in the development of TPM activity. Of these four activities are for establishing the system for production efficiency, one for initial control system of new products and equipment, one for improving the efficiency of administration and are for control of safety, sanitation as working environment.

STAGE 4 - INSTITUTIONALISING STAGE

By all their activities one would have reached maturity stage. Now is the time for applying for PM award. Also think of challenging level to which you can take this movement.

B. PILLARS OF TPM

1. PILLAR 1- 5S

TPM starts with **5S**. Problems cannot be clearly seen when the work place is unorganized. Cleaning and organizing the workplace helps the team to uncover problems. Making problems visible is the first step of improvement.

TABLE I
5S

Japanese Term	English Translation	Equivalent 'S' term
Seiri	Organization	Sort
Seiton	Tidiness	Systematize
Seiso	Cleaning	Sweep
Seiketsu	Standardization	Standardize
Shitsuke	Discipline	Self – Discipline

2. PILLAR 2 - JISHU HOZEN (Autonomous maintenance)

This pillar is geared towards developing operators to be able to take care of small maintenance tasks, thus freeing up the skilled maintenance people to spend time on more value added activity and technical repairs. The operators are responsible for upkeep of their equipment to prevent it from deteriorating.

Policy:

1. Uninterrupted operation of equipments.
2. Flexible operators to operate and maintain other equipments.
3. Eliminating the defects at source through active employee participation.
4. Stepwise implementation of JH activities.

3. PILLAR 3 - KAIZEN

"Kai" means change, and "Zen" means good (for the better). Basically kaizen is for small improvements, but carried out on a continual basis and involve all people in the organization. The principle behind is that "a very large number of small improvements are more effective in an organizational environment than a few improvements of large value. This pillar is aimed at reducing losses in the workplace that affect our efficiencies. By using a detailed and thorough procedure we eliminate losses in a systematic method using various Kaizen tools.

Its target is to achieve and sustain zero loses with respect to minor stops, measurement and adjustments, defects and unavoidable downtimes. It also aims to achieve 30% manufacturing cost reduction.

4. PILLAR 4 - Planned Maintenance

It is aimed to have trouble free machines and equipments producing defect free products for total customer satisfaction. This breaks maintenance down into 4 "families" or groups which were defined earlier.

1. Preventive Maintenance
2. Breakdown Maintenance
3. Corrective Maintenance
4. Maintenance Prevention

With Planned Maintenance we evolve our efforts from a reactive to a proactive method and use trained maintenance staff to help train the operators to better maintain their equipment.

5. PILLAR 5 - Quality Maintenance

It is aimed towards customer delight through highest quality through defect free manufacturing. Focus is on eliminating non-conformances in a systematic manner, much like Focused Improvement. We gain understanding of what parts of the equipment affect product quality and begin to eliminate current quality concerns, and then move to potential quality concerns. Transition is from reactive to proactive (Quality Control to Quality Assurance).

6. PILLAR 6 - Training

It is aimed to have multi-skilled revitalized employees whose morale is high and who has eager to come to work and perform all required functions effectively and independently. Education is given to operators to upgrade their skill. It is not sufficient know only "Know-How" by they should also learn "Know-why". By experience they gain, "Know-How" to overcome a problem what to be done. This they do without knowing the root cause of the problem and why they are doing so. Hence it become necessary to train them on knowing "Know-why". The employees should be trained to achieve the four phases of skill. The goal is to create a factory full of experts. The different phases of skills are
Phase 1: Do not know.
Phase 2: Know the theory but cannot do.
Phase 3: Can do but cannot teach
Phase 4: Can do and also teach.

7. PILLAR 7- Office TPM

TPM Organization Structure:

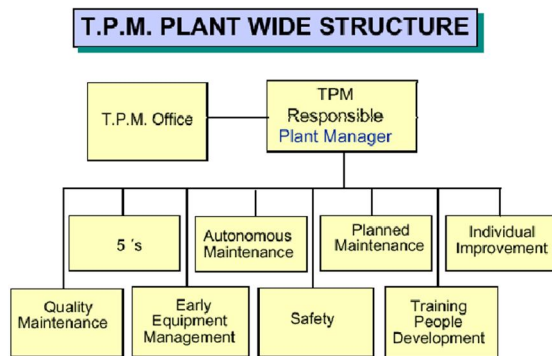


Figure1: - Office TPM Structure

Office TPM should be started after activating four other pillars of TPM (JH, KK, QM, and PM). Office TPM must be followed to improve productivity, efficiency in the administrative functions and identify and eliminate losses. This includes analyzing processes and procedures towards increased office automation. Office TPM addresses twelve major losses.

8. PILLAR 8 - Safety, Health and Environment

Target

1. Zero accident,
2. Zero health damage
3. Zero fires.

In this area focus is on to create a safe workplace and a surrounding area that is not damaged by our process or procedures. This pillar will play an active role in each of the other pillars on a regular basis.

A committee is constituted for this pillar which comprises representative of officers as well as workers. The committee is headed by senior vice President (Technical). Utmost importance to Safety is given in the plant. Manager (Safety) is looking after functions related to safety. To create awareness among employees various competitions like safety slogans, Quiz, Drama, Posters, etc. related to safety can be organized at regular intervals.

III. REAL LIFE IMPLEMENTATION OF TPM

The actual implementation of TPM in spinning industry is discussed in this topic. Where the various difficulties are solved by using different techniques like see through, one point lessons, CLITA, KK, PM, Poke yoke etc. In this paper only first thee pillar i.e. JISHU HOZEN (Autonomous maintenance), KAIZEN, and Planned Maintenance are highlighted for the implementation practice. A Carding Machine Study is considered for the describing all the aspect and changes are observed after implementation.

A. Pillar 2- JISHU HOZEN (Autonomous maintenance):-

What is JH? JH is the Japanese word for autonomous maintenance. It means that we have to do our machine maintenance; no PM man will come on the machine to do the maintenance. This pillar is geared towards developing operators to be able to take care of small maintenance tasks, thus freeing up the skilled maintenance people to spend time on more value added activity and technical repairs. The operators are responsible for upkeep of their equipment to prevent it from deteriorating. Its basic is that "I operate I maintain".

1. Abnormality sheet

For the selected Machine which are the various abnormalities to cause machine failure are observed and enlisted so that the solution and reasons for the failure is search out to run machine efficiently. While making the sheet which are the frequently observed problems likewise type of nature is also noted, which will help the problem solving.

2. CLITA

It means the symbolic representation for the operation cleaning, inspection, retightening & lubrication, if it is done regularly with proper time interval then breakdown will minimized. Initial stage to implement CLITA technique is to all the components must be label with serial number. It helps the operator to do the proper operation at the right time without missing, as the visualization is the one of the easiest way to convey message, CLITA uses the pictorial representation of the operation with the component number. Time interval is also represented over operation symbol. All symbols are stick on the blank place over a machine, also care should be taken that operator must easily visualize the symbol. Following are some CLITA symbols given used in the general practice.

CLITA SYMBOLS		ALPHABETIC CODE FOR CLITA	
SYMBOLS	DESCRIPTION	NOTATION	DESCRIPTION
○	OK CONDITION	C	CLING
⊗	CORRECTED AFTER NOT OK	L	LUBRICATION
⊕	LUBRICATION / REFILL NEW LUBRICATING OIL	R	RETIGHTENING
☞	WEEKLY CLEANING	I	INSPECTION
👁️	WEEKLY VISUAL INSPECTION	Y	YEARLY
🔧	MONTHLY RETIGHTENING	H	HALF YEARLY
✘	NOT OK	M	MONTHLY
		W	WEEKLY
		D	DAILY





Figure2: Examples of CLITA

3. One Point Lesson (OPL)

Sometimes we are so busy that we think we don't make time to develop the people around us. Instead we

fight fires or give direct instructions. This might be effective in the short-term but inevitably small problems are missed. The greatest cost is being unable to teach others how to solve and prevent the problems that we are encountering. A simple countermeasure to this is the focused education and development method known as the one-point lesson (OPL). Originating as part of TPM, the one-point lesson is intended to develop the knowledge and skills of the machine operators in Autonomous Maintenance. The basics of Autonomous Maintenance are daily checking and lubricating of machines. With increased knowledge and familiarity of their equipment the machine operators can detect abnormalities and early signs of failure. This leads naturally to problem solving skill development in collaboration with maintenance and engineering staff.

Following is the OPL sheet in which the safety at time of cleaning can changer is shown.

TPM ONE POINT LESSONS				
Theme	How To Clean Can Changer Safely?	OPL No.	OPL-2	
		Date :-		
Classification	Basic Knowledge	Module Manager	Checked by	Prepared by
	Improvement Case			
	Trouble Case			
Situation Before/ Incorrect Situation		Situation After / Do like this		
ILLUSTRATION		pressurize Air Tube		
				
1. For Cleaning The Can Changer Don't Go inside the Can Changer. It may Cause you Harm. 2. Dont try to clean Can Changer by bending inside .		1. For Cleaning the Can Changer use Pressurised Air tube and Stand outside of can changer. 2. By holding the Pressurised air tube you can Clean the Can Changer Safely.		
Actual Result	Date			
	Trainer			
	Trainee			



B. KOBETSU KAIZEN

Kobetsu Kaizen aims to specifically eliminate breakdown and defect losses through thorough analysis of operating conditions. Ideal conditions for equipment are researched and maintenance and inspection standards are set. These ideal conditions are maintained with great commitment in order to reduce and eliminate losses. Kaizen is the Japanese word for continuous improvement or striving for perfection. Kaizen strives toward perfection by eliminating waste. It defines a project that works through a problem-solving process.

Methods of Kaizen- Kaizen eliminates waste by allowing workers to uncover improvement opportunities and either suggest or make changes. In common usage, the term Kaizen may refer to different kinds of improvement activities. In some cases term use to refer to a process that gathers suggestions for improvements from employees. Others use the term to refer to periodic meetings of employees who brainstorm improvement ideas and immediately select and make an improvement. Still others add to the activities of

Kaizen observation and measurement of the work process and of the results the Kaizen activity produces.

Following is the Kaizen for the better performance and More availability of Carding machine.

Kaizen Theme : Safety		Idea
See Through and Removing of Unnecessary and non-urgent item		Transparent acrylic sheet window to be provided on spindle head electrical motor electrical panel.
		Problem Definition
		Inside condition of spindle head electrical motor not visible and unwanted part on and inside the panel.
Present Status :	Countermeasure :	
 <p>Inside condition not visible and unwanted plug on cover</p>	 <p>Inside condition easily visible an unwanted plug removed from cover.</p>	
Analysis :	Results :	
1. Panel door cover not transparent -why- 2. Three locking screw required more time to open -why- 3. Unwanted plug on cover	1. Due to transparent cover it is very easy to visually inspect condition 2. Also awareness of operator about panel condition increases. 3. Due to removal of unwanted part clean & proper looking	
		Benefits :
		1. Easy visual inspection of condition of panel. 2. No need to open panel door while visual inspection

IV. IMPACT FACTOR FOR IMPLEMENTATION OF TPM

1. Leadership qualities, management improvement participation.
2. Organizational infrastructure.
3. Culture of collaboration and co-operation.
4. Linking TPM to business strategy & Linking TPM to Quality.
5. Project prioritization and selection Employee Training & Understanding of TPM methodology.
6. Linking TPM to Customers & employees & to create empowerment and authority at all levels. .

V. DIRECT BENEFITS OF TPM

1. Overall Equipment Efficiency is improved.
2. Customer complaints reduced.
3. Reduction in the manufacturing cost by 30%.
4. Satisfying the customer's needs by 100 % & reduced accidents.

VI. INDIRECT BENEFITS OF TPM

1. Employees confidence level increases.
2. A clean, neat and attractive work place.
3. Favorable change in the attitude of the operators.

VII. CONCLUSION

Total productive maintenance successfully gives the improvement in the availability, performance efficiency and the quality rate, results in improvement of the overall equipment effectiveness of the equipment. TPM is the effective tool to increase the productivity of Indian industries. We can compete with the other countries in this increased globalization. Spinning

industries can also have the benefit of TPM for the improvement in all aspects. While implementing TPM we found some barriers for effective implementation of TPM, such as Lack of Management Exposure, difficulty in understanding TPM methodology and philosophy by middle management, long time taken for implementation so people shows strong resistant to it. But it is the only thing between the success and failure for many companies as far as the maintenance is concern. TPM works on major 8 pillars which are (JH, KK, PM, QM, E&T, OT, 5s and SHE). It works on methodologies like CLITA, OPL, P-M Analysis for achieving its goal of success.

The aim of this paper is to spread awareness about TPM methodology in modern technocrats and industries in India. We are trying to understand the TPM concepts for the Indian scenario. Objective of this paper is to clear the concept of adoption of TPM in spinning industries.

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