Preventive and Predictive Maintenance for TPM Workshop
Two-day Workshop Content

Overview

In Total Productive Maintenance (TPM) overlapping teams work together to ensure plant and equipment reach its highest reliability. Managers, engineers, technicians and equipment operators combine to undertake the care of machinery and improve reliability through the use of effective Preventive, Predictive and Corrective Maintenance.

This 2-day workshop takes attendees through the investigation, analysis, selection, document development and implementation of Preventive and Predictive Maintenance for use in a TPM program.

A Preventive Maintenance program (PM program) is a series of routines, procedures and steps taken (including tests, measurements, adjustments, and parts replacement) to identify and resolve potential equipment problems before they happen. The purpose is to ensure that machines last longer, that production quality is maintained and that delivery schedules are met. A preventive maintenance program requires systematic replacement of aged parts, plus the inspection, detection, and correction of embryonic failures either before they occur or before they develop into major problems.

Predictive Maintenance (PdM), or Condition Monitoring (CM) is the process of monitoring the trend in a measured condition of a machine or a component to gauge the condition under observation. When the condition changes unacceptable corrective measures are done. Vibration, noise, wear, thickness and temperature measurements are often used as key indicators of the state of a machine and technologies such as vibration analysis, tribology and thermography are examples of Condition Monitoring techniques. Condition based maintenance (CBM) is a maintenance strategy that involves monitoring and testing vital machine and equipment parameters for their state. This is done in order to predict machine failures and to do restoration to avoid hazards which could otherwise occur if minimum requirements are surpassed.

The training is done over two days, starting at 8am and concluding at 4pm each day. Workshop content is focused at the shopfloor level of manufacturing, operations and production. It is of great value to maintenance managers, maintenance engineers, maintenance leading hands, maintainers in TPM teams, operations managers, production engineers, operating leading hands, and operators in companies that apply TPM or will do so in future. It takes attendees through the key concepts of PM and PdM selection, definition, implementation and monitoring for operations starting or doing TPM programs. The training provides opportunity to understand PM and PdM task selection and application with correct knowledge, examples, case studies and practice sessions presented throughout the course.

You need to ensure your TPM strategy is focused on discovering and using the right principles and the appropriate practices for successful PM and PdM program development by:

- Reviewing basic equipment design to discover what is necessary for its proper operation.
- Looking at equipment in a production environment to understand the operating impact.
- Investigating expectations for the performance of plant and equipment.
• Determining maintenance requirements and the equipment operating environment.
• Setting the necessary maintenance and operating quality standards to be met.
• Developing the necessary skills and competencies in the workforce.
• Identifying necessary documentation, content and its arrangement for PM and PdM tasks.
• Establishing frequencies and a program for PM and PdM.
• Identify processes, information, physical resources, safety required for PM and PdM jobs.
• Recognising other business processes and information which link to PM and PdM.
• Imbedding good practice PM and PdM into your organisation’s TPM program.
• Tracking and trending PM and PdM performance, outcomes and savings.
• Initiating the continuous improvement of PM and PdM systems and processes.

Day 1 Workshop Topic Details

1 Purpose of Maintenance

• 6 Big Losses from Machines
• Life Cycle Equipment Management
• Equipment Design Limitations
  o Design envelope
  o Operating specifications
• Physics of Failure
  o Materials of construction limitations
  o Design requirements and conditions
• Activity: Identify Physics of Failure Mechanisms

2 Maintenance Management

• Maintenance Strategy Selection
  o Operating risk management
  o Statutory compliance
  o Hidden failures
• Maintenance Types
  o Preventive (PM)
  o Predictive (PdM)
  o Corrective (CM)
  o Run to Failure (RTF)
  o Failure Finding Tasks (FFT)
• Failure History Collection
  o Which information to collect
  o Understanding history data

3 Reliability Management

• Equipment Reliability
  o Basic reliability concepts
  o Improving equipment reliability
• Failure Mode Effects Analysis
  o Functional loss
  o Failure modes
• Reliability Creation
  o Degradation management
  o Reliability Centred Maintenance
• Activity: Do an FMEA

4 Total Productive Maintenance

• Overall Equipment Effectiveness (OEE)
  o Equipment availability
  o Production rate
  o Quality rate
• 7 Steps of Autonomous Maintenance
• TPM Team
Day 2 Workshop Topic Details

5 Preventive Maintenance

- **Definition of PM**
- **Mechanical Equipment PM**
  - Wearing Parts
  - Consumable Parts
  - Lubrication Cleanliness
  - Looseness
  - Alignment
- **Electrical Equipment PM**
  - Wearing parts
  - Cleanliness
  - Moisture ingress
  - Temperature
  - Looseness
- **Instruments and Control Equipment PM**
  - Cleanliness
  - Calibration
  - Looseness
- **Selecting PM Frequency**
  - Mechanical
  - Electrical
  - Instruments and Controls
- **Developing a PM Program**
  - Analysis
  - Necessary documentation
  - Implementation
- Activity: Selecting PM Tasks

6 Predictive Maintenance

- **Definition of PdM**
- **Equipment Degradation Cycle**
  - Evidence of Failure Modes
- **Equipment Condition Monitoring**
  - Condition monitoring techniques
  - Vibration Analysis
  - Tribology
- Visual Management Methods
  - For Equipment
  - For Processes
- Operator Watch Keeping
- Activity: Write Accuracy Controlled Procedures for TPM Tasks

7 Supporting Practices

- Failure Prediction
  - Decide predictive data to collect
  - Leading and lagging indicators
- Maintenance Prevention (MP)
  - Reengineer processes
  - Redesign equipment
  - Equipment Selection
- Precision Maintenance
  - Requirements of precision maintenance

- Thermography
- Non-Destructive Testing
  - Mechanical
  - Electrical
  - Process performance monitoring
- **Mechanical Equipment PdM**
  - Inspection
  - Vibration
  - Temperature
  - Physical condition
- **Electrical Equipment PdM**
  - Electrical signatures
  - Physical condition
- **Instruments & Control Equipment PdM**
  - Process trends
  - Physical condition
  - Failure finding tasks
- Selecting PdM Frequency
  - Mechanical
  - Electrical
  - Instruments and Controls
- Developing a PdM Program
  - Analysis
  - Necessary documentation
  - Implementation
- Activity: Selecting PdM Tasks
Creative disassembly
Jobs Library by Equipment
One-Point Lessons
Continuous Improvement Process
  Reliability
  Processes
  Precision skills
Root Cause Failure Analysis
  Physical, human, and management system (latent) failure roots
  Shopfloor Team
  Problem solving process
  5-Why must have evidence

Activity: Conduct a Root Cause Analysis

8 Implementing PM and PdM in TPM

NOTE: This workshop is not about developing and conducting a complete TPM program. It only covers the selection of the maintenance tasks to be done in a TPM program. It includes the improvement of plant and equipment reliability through the use of effective maintenance strategy and the application of better maintenance practices and skills.