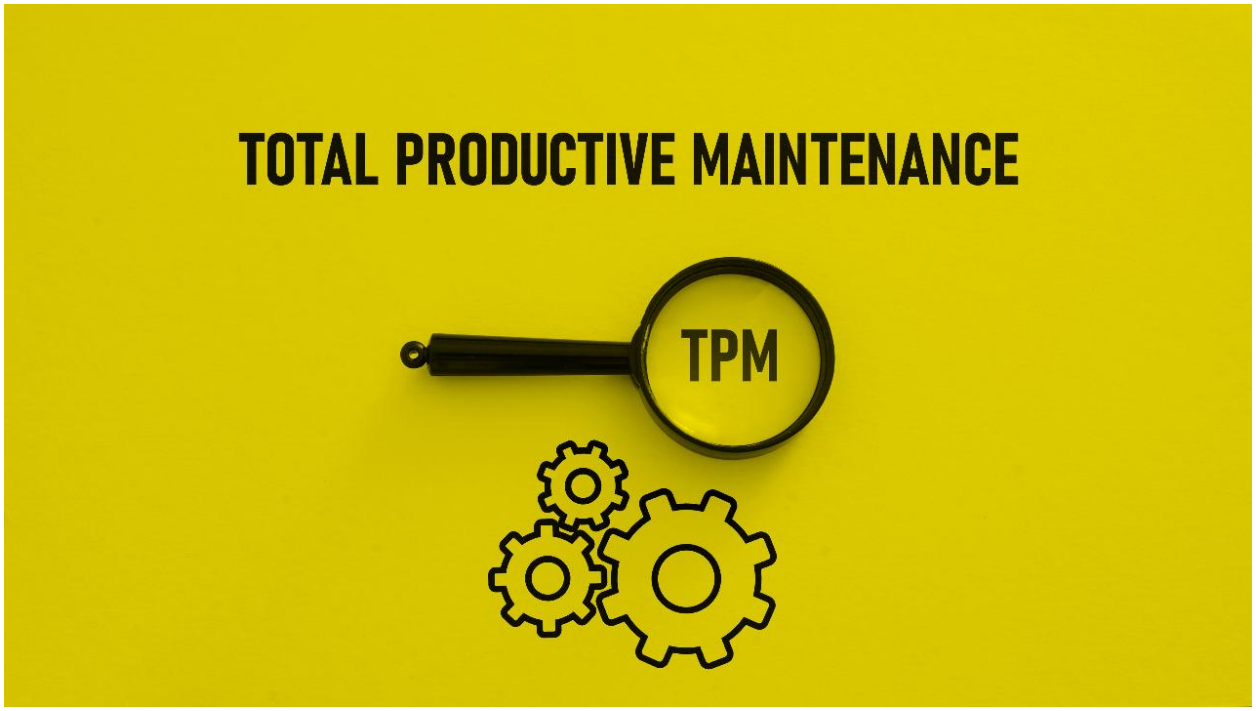
Study Guide: Total Productive Maintenance



What is Total Productive Maintenance and where did it originate?

The purpose of TPM is to have ZERO unscheduled downtime by having only Planned Downtime i.e. Preventive Maintenance

Total Productive Management (TPM) is a comprehensive approach to improving manufacturing processes, equipment reliability, and overall operational efficiency. It originated in Japan and is closely associated with the development of the Toyota Production System (TPS) and lean manufacturing principles.

After WWII the Japanese economy was devastated and the industrial leaders, to start again, started adopting the American Principles of Quality Management and Quality Control. Dr. Deming made many trips to Japan to teach Total Quality Management (TQM).

In those years, the Japanese industry started to build and use automatic equipment. The use of automatic equipment created the belief that only specialized personnel could work on the machines, which in turn created a distance between the line operators and the machines they were working. This mentality led to a loss of production capacity and unplanned and prolonged downtime.

- Quality and delivery targets cannot be met when equipment is always breaking down
- 1950s There is a new focus on preventive maintenance
- Preventive Maintenance focuses on daily maintenance to keep the machine in good operating condition to avoid breakdowns
- In 1960 the Denso Company introduced the concept of Autonomous Maintenance. The frontline operator had to perform routine maintenance on the machine he was working on. Thanks to this approach, the specialized Maintenance personnel could focus on Preventative Maintenance and Improvement of the equipment.
- The first definition of TPM was made in 1971 and later revised in 1989

The 6 Big Losses

In Total Productive Maintenance (TPM), the "Six Big Losses" represent the major sources of inefficiency and waste in manufacturing processes. Identifying and addressing these losses is a fundamental part of TPM to improve overall equipment effectiveness (OEE) and operational efficiency.

The Six Big Losses are:

1. **Equipment Downtime or Equipment Failure (Availability Loss):**

This loss occurs when equipment or machinery is not operating during planned production time due to breakdowns, changeovers, or setup time. Availability loss is a significant factor in reducing overall equipment effectiveness.

2. **Setup and Adjustment Time (Setup Loss):**

Setup loss refers to the time spent on preparing equipment for a changeover, adjustments, or tool changes. Reducing setup times through techniques like SMED (Single-Minute Exchange of Die) is essential to minimize this loss.

3. **Reduced Speed (Performance Loss):**

Performance loss happens when equipment does not run at its maximum designed speed or optimal operating rate. Factors contributing to performance loss include suboptimal operating conditions, wear and tear, and minor stoppages.

4. **Defects and Rework (Quality Loss):**

Quality loss encompasses all issues related to product defects, rework, and scrap. When defective products are produced, it results in additional work and resources to correct the defects, leading to decreased efficiency.

5. **Minor Stops and Idling (Idling Loss):**

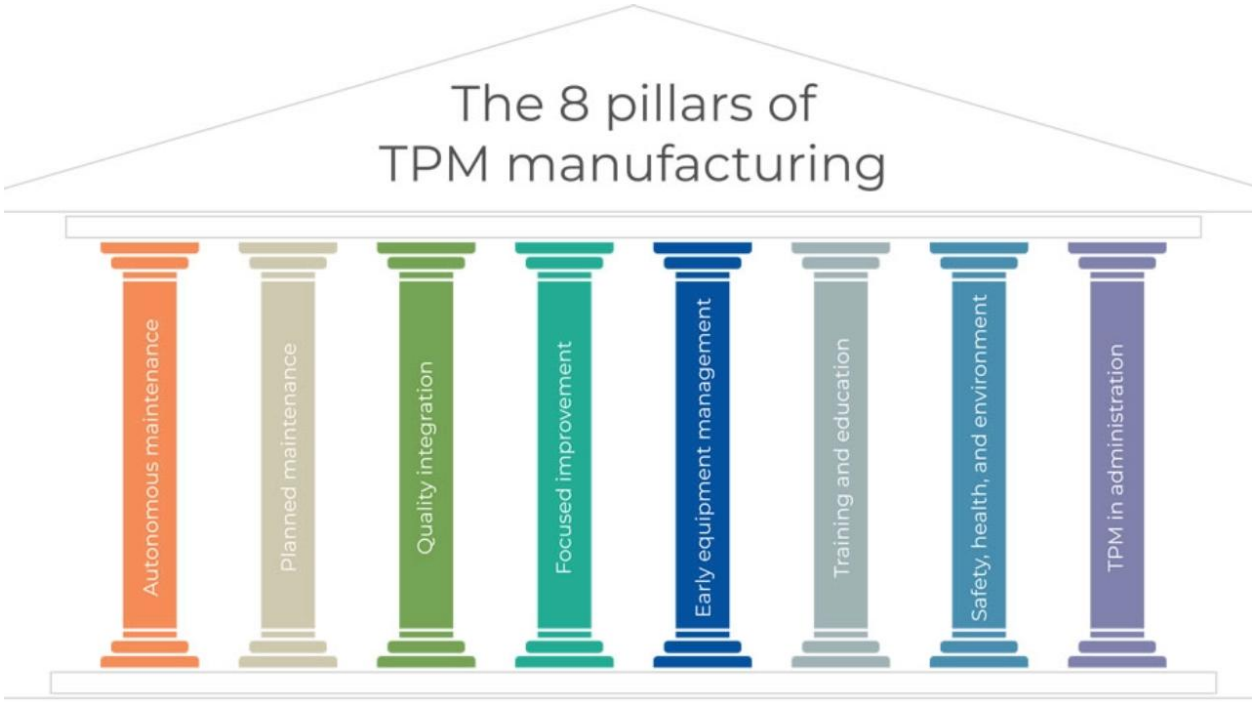
Minor stops and idling refer to short interruptions or pauses in equipment operations that are not part of the planned cycle. These brief stoppages, even if they seem insignificant individually, can accumulate to a significant loss of production time.

6. **Reduced Yield or Startup Losses (Yield Loss):**

Yield loss is related to the production of less-than-optimal quantities of good-quality products. It includes factors like startup losses, yield losses due to process variations, and raw material defects.

To address these Six Big Losses, TPM focuses on improving equipment reliability, reducing changeover times, optimizing equipment performance, ensuring product quality, eliminating minor stoppages, and maximizing yield. By systematically addressing these losses, organizations can increase their overall equipment effectiveness and operational efficiency, leading to reduced waste and improved productivity.

The 8 Pillars of the TPM



Total Productive Maintenance (TPM) as defined by the Japan Institute of Plant Maintenance (JIPM) consists of the following eight pillars. These pillars serve as the fundamental principles and components of TPM, guiding organizations in implementing TPM effectively:

1. **Autonomous Maintenance (Jishu Hozen):**

Autonomous Maintenance empowers operators and front-line maintenance personnel to take ownership of equipment care. It involves performing routine maintenance tasks, inspections, and small repairs to prevent breakdowns and maintain equipment in optimal condition.

2. **Focused Improvement (Kobetsu Kaizen):**

Focused Improvement involves continuous and systematic efforts to identify and eliminate losses or waste in the production process. It encourages cross-functional teams to work together to address and resolve issues that reduce equipment efficiency and overall productivity.

3. **Planned Maintenance (Keikaku Hozen):**

Planned Maintenance emphasizes the need for systematic and planned maintenance activities, which include scheduled inspections, component replacements, and other maintenance tasks. The goal is to prevent unplanned downtime and breakdowns.

4. **Training and Education (Kenshu Y Kaizen):**

This pillar emphasizes the importance of training and developing the skills and knowledge of employees to effectively carry out TPM activities. It covers both technical and non-technical training to create a knowledgeable and motivated workforce.

5. **Early Equipment Management (Early Equipment Maintenance or Initial Flow Management - Seiketsu):**

Early Equipment Management focuses on incorporating maintenance and reliability considerations during the design and procurement stages of new equipment. This ensures that new machinery is easier to maintain and operate, reducing potential issues down the line.

6. **Quality Maintenance (Hinshitsu Hozen):**

Quality Maintenance aims to prevent defects and deviations in product quality by addressing issues related to equipment and processes. By maintaining equipment to produce consistent quality, this pillar supports the reduction of quality-related losses.

7. **Safety, Health, and Environment (SHE) Maintenance (Anzen Kanketsu Y Boushi Hozen):**

Safety, Health, and Environment Maintenance focuses on ensuring the well-being of employees and minimizing risks associated with equipment and processes. It promotes a safe and environmentally responsible work environment.

8. **Administrative and Office TPM (Seiso Kaizen or TPM in Administration):**

This pillar extends TPM principles and practices beyond the manufacturing floor to administrative and office areas. The goal is to streamline administrative processes, reduce waste, and improve efficiency in non-production functions.

These eight pillars provide a structured framework for organizations to implement TPM comprehensively and systematically, covering all aspects of equipment maintenance, production, and support functions. By addressing these pillars, companies can work toward reducing losses, increasing equipment effectiveness, and achieving greater overall operational efficiency.

TQM vs TPM

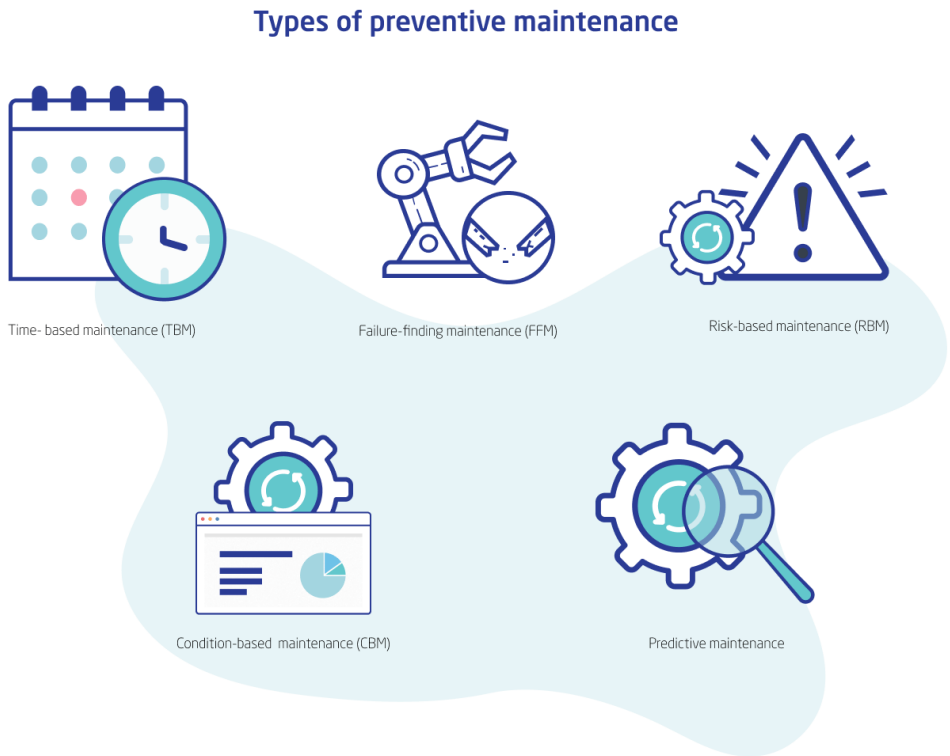
- TQM and TPM are often used interchangeably. Although they have many similarities, they are considered two different approaches
- TQM aims to increase the quality of goods and services by raising awareness of quality control across the organization

TQM is based on 5 cornerstones:

1. Product
2. Process
3. Organization
4. Leadership
5. Commitment

- TPM focuses on the losses that impede the equipment used to produce the products.

Types of Maintenance



- **Corrective Maintenance**

Breakdown Maintenance, also known as corrective maintenance, involves repairing equipment only after a breakdown or failure has occurred. While TPM aims to reduce the reliance on this type of maintenance, it is still necessary in some cases.

This approach can be inexpensive in the short run that is until a catastrophic loss occurs.

- **Preventive Maintenance**

Preventive Maintenance includes scheduled maintenance activities performed on a regular basis, such as lubrication, inspections, and component replacements. The aim is to prevent equipment failures and ensure reliable operation.

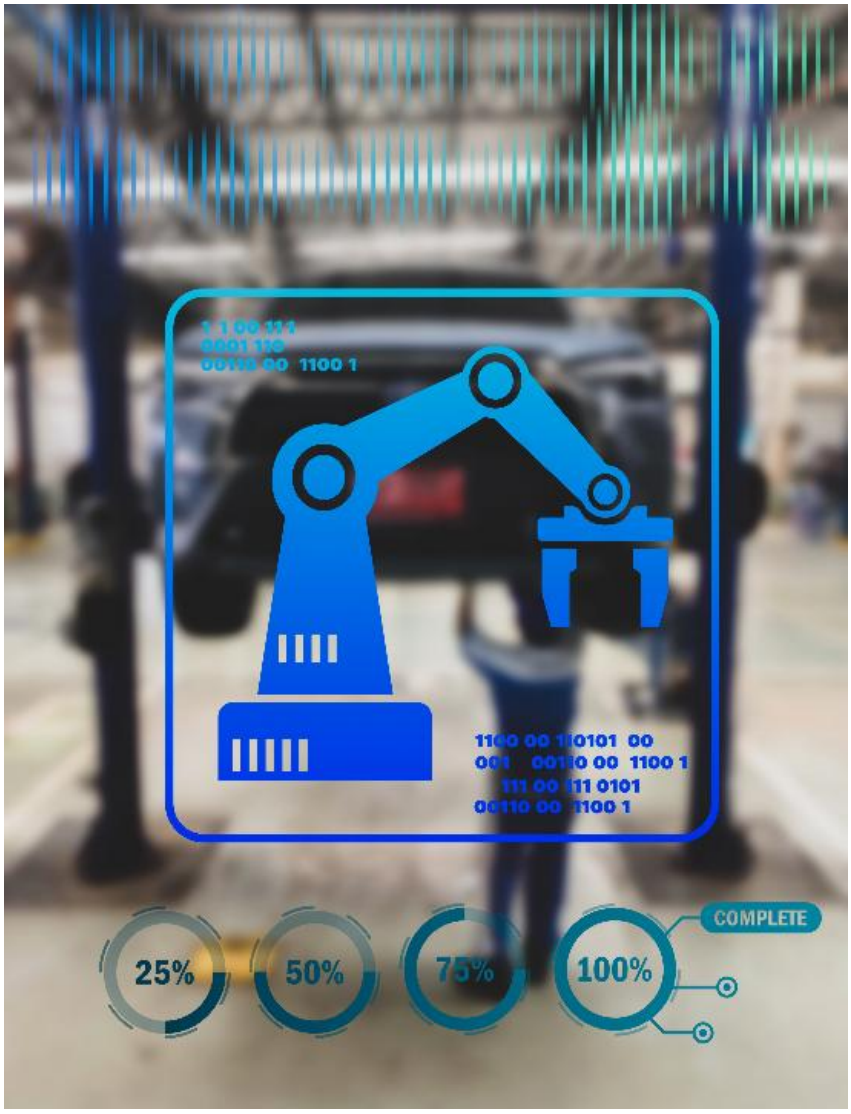
- **Risk-Based Maintenance or Reliability-Centered Maintenance (RCM):**

RCM is a strategic approach to maintenance that identifies the most critical components and equipment and tailors maintenance strategies accordingly. It considers factors such as safety, operational requirements, and environmental impact.

- **Condition Based Maintenance**

Condition-based maintenance relies on continuous monitoring and assessment of the equipment's condition. Sensors and data analysis are used to detect abnormalities, wear and tear, or impending failures. Maintenance is only performed when necessary based on the equipment's actual condition.

The 9 Steps to Implement Autonomous Maintenance



1. Collect Equipment History and Performance Analysis
    - Sets measurement objectives. i.e. Cost, OEE, Material Savings
2. Define and Calculate OEE
    - Clarify OEE meaning and interpretation among team members
    - Display and OEE board in the shopfloor
3. Asses Six Big Losses and Set Priorities
    - Agree and sign off on priorities with management
4. Critical Assessment
    - Produce a list of all the machine components
    - Discuss and understand the role of each component and their interdependency

- Determine the ideal condition for the proper operation of each component, then define the normal operating conditions

5. Initial Clean-up and Condition Appraisal
    - Identify the cleaning areas
    - Source all the necessary cleaning equipment
    - Photograph the current state
    - Systematically inspect every part of the machine in detail
    - Clean and inspect capturing problems found
    - Develop a cleaning and inspection program
    - Identify sources of contamination, internal and external
    - Develop a plan to eliminate, isolate, and prevent contamination
6. Plan Refurbishment
    - Develop a refurbishment schedule covering Item, Labor Hours, Planned Completion, and PDCA cycle stage
    - Look into Poka-Yoke and Quick Changeover, and undertake this where necessary.
7. Develop Asset Care

- Define the role and the tasks of the operator
- Create checklist to follow with the appropriate frequencies
- Create a visual board that covers the daily activities of Maintenance, Safety, Quality, and Operator Checks
- Identify, mark, and color code all gauges, pipework, lubrication points, levels, and sight classes

8. Develop best practice routines and standards

- Assemble a best practice manual
- Develop single-point lessons where necessary
- Review Standard operating procedures and Maintenance Instructions

9. Problem Prevention

- This is an improvement cycle
- Complete the cycle. Use problem-solving approach tools such as 5 Whys and A3

Practical Tips for TPM

1. Be Guided by an expert
2. Don't start with a company-wide TPM program. Start small, maybe with one machine and one OEE component
3. Plan adequate resources for maintenance