



## Maintenance Prevention--The Neglected Pillar of TPM

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Total productive maintenance (TPM) is *productive maintenance implemented by all employees*. TPM has the focus of eliminating all equipment losses such as breakdowns, changeover delays, slowdowns, capacity losses, and idling. The goal of TPM is to maximize equipment capacity during its entire life cycle.

### TPM's Five Pillars

There are five pillars or interlinked goals for TPM:

1. Maximize equipment effectiveness.
2. Improve maintenance efficiency and effectiveness.
3. Train to improve the skills of all people involved in TPM.
4. Involve operations personnel in daily maintenance of equipment.
5. Manage equipment in order to prevent maintenance.

The fifth of these goals is often omitted from a TPM program, and that is the concern here. For brief descriptions of the first four, which interlink to the fifth, see the accompanying box, "The practiced pillars of TPM."

### The Practiced Pillars of TPM

While many companies do not include maintenance prevention among the goals (or pillars) of their TPM programs--often because they lack the data to pursue that goal--many (to varying degrees) do strive to put the other four pillars in place. Here, for reference, are brief descriptions of those four:

Maximizing equipment effectiveness attempts to ensure that no competitor has the same equipment or assets as your company and obtains higher throughput or capacity from those assets than your company does.

Improving maintenance efficiency and effectiveness focuses on maintenance activities. The goal is to ensure that the mean time to repair (MTTR) on the equipment is as short as possible. This allows for maximum uptime and throughput from the asset. One of the major components of this pillar is maintenance planning and scheduling.

Training to improve the skills of the people involved in TPM has two major components. One is "soft skills" training, such as how to work as teams, diversity training, and communication skills. The second is technical training, which insures that the employees have the technical knowledge to make improvements to the equipment.



Involving operations personnel in the daily maintenance of equipment can vary dramatically from company to company. In some companies, operations personnel may perform pre-startup inspections of their equipment. In other companies, they may do minor maintenance, such as lubrication or adjustments. Some factors determining the level of activity include the type of equipment, the skills of the employees, and the benefits derived from having the tasks performed by operations personnel. The goal of the involvement is to free up some of the maintenance resources so that they can be deployed in activities requiring higher levels of technical skills, such as predictive maintenance, reliability-centered maintenance, or root-cause analysis.

The fifth pillar, *early equipment management and maintenance prevention*, focuses on the initial design of equipment to reduce the amount of maintenance required. However, since many companies are concerned about their existing equipment or assets, the focus can also be on redesign or retrofits to reduce maintenance requirements. An example of maintenance prevention as a design activity can be found in automobiles. In the early 1970s, automobiles required a “tune-up” every 30,000 to 40,000 miles. By contrast, today’s models require tune-ups only every 100,000 miles. This change in the amount of maintenance required did not occur accidentally. Detailed studies of components, materials, and quality led to the improvements. These studies included examination of historical data, engineering data, and the operational habits of drivers.

The same strategy may be applied to equipment or assets in plants or facilities. Companies are looking for methods of reducing maintenance costs, and part of the answer is found in the type of equipment they purchase or design. If the maintenance requirements can be minimized during the design phase of the life cycle, then the overall maintenance costs for the equipment’s life cycle will be lowered. However, as previously mentioned, many companies are concerned about their existing assets. The principle of designing for maintenance prevention can still be applied to these assets. The historical records for the equipment can be analyzed for trends of types of failures, frequency of component failures, or root causes of failures. This information can then be examined further to determine how to eliminate the problem and reduce maintenance through an equipment design change or by changing a process.

## **Maintenance and Maintainability**

Maintenance is defined as a series of actions necessary to restore or maintain an asset or equipment item in an efficient operational state. Maintainability is the designed ability of the equipment item or asset to be maintained. Maintainability is, therefore, closely related to maintenance prevention. Maintainability addresses issues such as accessibility, component standardization, interchangeability, serviceability, safety, and modularization. When these issues are addressed during the design of equipment, the overall maintenance cost during the operational phase of the equipment’s life cycle is reduced dramatically. As mentioned previously, addressing these same issues on existing equipment or assets can also reduce the maintenance costs during the operational phase of the life cycle.

Since maintenance activities are expense items in most companies, reducing the amount of money spent on maintenance contributes to overall profitability. In other words, money not spent on maintenance is



transferred to the company's bottom line. Reducing maintenance expenditures by \$1 million in some companies has the same impact as a \$20 million increase in sales.

Since this goal or pillar of TPM has such a dramatic impact on overall costs and profits, why don't more companies focus on it? The answer is that they don't have the equipment data necessary to drive maintenance prevention activities. For example, two common measures are MTTR (mean time to repair) and MTBF (mean time between failures). These terms are calculated respectively by dividing the total repair time for a piece of equipment and the total run time for a piece of equipment by the number of repair incidents.

Where does a typical company obtain this information? It gets it from the records kept in a computerized maintenance management system (CMMS) or enterprise asset management (EAM) system. However, most companies do not fully use the capabilities of their CMMSs (EAM systems). So, their data are not accurate enough to calculate MTTR or MTBF. Many companies only record a portion of their work activities, either by duration of the work or by the type of work done. Since the accuracy of the data is compromised, the company gives up the ability to use maintenance prevention activities. This loss of ability to do maintenance prevention prevents a company from realizing the full benefits of implementing TPM.

While many companies focus on the operator involvement aspects of TPM, they should not neglect its other pillars or goals. Unless the impact of all five pillars or goals is clearly understood, a company cannot have total productive maintenance. It may not even achieve productive maintenance. In fact, it may have trouble doing maintenance at all.

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