

Whitepaper — PREVENTATIVE & PREDICTIVE MAINTENANCE



How can we define the difference in preventative maintenance versus predictive maintenance? How we ensure we are in compliance with the standard?

What Does the Standard Say?

7.5.1.4 Preventive and predictive maintenance

The organization shall identify key process equipment and provide resources for machine/equipment maintenance and develop an effective planned total preventive maintenance system.

As a minimum, this system shall include the following:

- > Planned maintenance activities
- > Packaging and preservation of equipment, tooling, and gauging
- > Availability of replacement parts for key manufacturing equipment
- > Documenting, evaluating, and improving maintenance objectives

The organization shall utilize predictive maintenance methods to continually improve the effectiveness and the efficiency of production equipment.

What Does This Mean?

The standard requires that your facility use a preventative maintenance **system** using predictive **methods**. Predictive may be better titled “condition monitoring”. It is a system of applying condition-based monitoring technologies, statistical process control or equipment performance with the goal of early detection, and elimination, of equipment defects that could lead to unplanned downtime or unnecessary expenditures. It is **very** cost-effective when properly done.

The preventative **system** is the framework for all maintenance activities (the set of engineered actions required to optimize the equipment). The system includes regular examinations, planned work orders, lubrication, adjustments, wear part replacement, testing, etc. and uses predictive methods as tools within the system. The goal is to replace the “fix it when it breaks” method with a “minimize total maintenance cost” method.

Predictive **methods** include vibration monitoring, infrared thermography, motor circuit analysis, and oil analysis.

The purpose of these tools is to detect problems that are difficult to find by simply looking at the equipment, even by skilled personnel. The methods should be included in your PM system, usually as tasks or planned work orders.

One study concluded that preventative maintenance costs \$13/hour, but adding predictive methods can drive the cost to \$9/hour. Another study concluded that predictive methods show an ROI of 10 times the cost.

Key Equipment

Use risk analysis tools to define Key Equipment for your facility. What equipment is crucial to produce **what** you need, **when** you need it and in the correct quantities required by your customer? What equipment is vital to your stakeholder satisfaction?

Many facilities define key by categorizing their equipment into groups based on risk. One example that has worked very well is:

- > **Key:** Equipment that could cause a major plant or process shutdown (such as a generator or main plant air supply) where no backup is readily available. Equipment that could cause a process shutdown of greater than X hours.
- > **Important, but not key:** Equipment that, while it could affect a main process, has a backup that can be readily put into operation or can be repaired within X hours.
- > **All other equipment.**

This type of categorization allows your facility to prioritize your maintenance resources.

Maintenance Goals

Goals are long term aims for which you then set objectives. Goals include items such as:

- > Ensure environmental, safety and health compliance
- > Optimize equipment performance (energy use, life, productivity, capability, etc.)
- > Reduce the rate of equipment deterioration

Maintenance Objectives

Objectives are concrete measurements designed to ensure your goals are met. The objectives must include measurements for both effectiveness and efficiency.

Examples of common objectives include:

- > OEE (optimal equipment effectiveness) for key equipment is xx, YY for important equipment and not measured for all other equipment. OEE has many definitions, but a common one is: the sum of material and labor cost necessary to repair equipment, the cost of preventative maintenance to avoid repairs, the cost of lost production, and the cost of outsourcing due to maintenance failures.
- > X% of key equipment will have X% PM performed on time
- > X% of key equipment will have SMED implemented by DATE (SMED are techniques for quick changeover usually measured in minutes)



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