

Preventive Maintenance Strategy: What It Is, What It Does, and Why You Should Have One

by Terry Harris, CMRP

In the years I've spent travelling across the US and the world teaching people and companies how to make their equipment last longer, there's one thing I notice time after time: every plant has some type of preventive maintenance (PM) program. I've also frequently noticed that in many cases, there is no clear understanding of how the program was developed or the rationale behind it. As a result, I've seen many instances where seemingly comprehensive PM programs have no real value. Before we consider the reasons for this, let's look at the different types of PM programs:

- Time based (two shots of lubricant per week)
- Condition based (if a belt is squeaking, then tighten it)
- Failure finding (verify function of a high level probe)
- OEM directed (the procedure is recommended in the equipment manual)
- Hand me down experience ("we've always done it that way")
- Regulatory (required for compliance with EPA, OSHA, etc.)
- Risk ("this is really expensive equipment, so let's do this task more often")

Normally, one of these methods will determine whether a PM task will be assigned and completed. But frequently these methods are unscientific or purely subjective, such as "We grease a bearing based on time, two shots per week," or "We've done this every week for the last 15 years and haven't had a failure so it must be effective." We need to ask: How do we justify what we are doing daily, weekly, and monthly? We should also consider whether OEM-recommended tasks are always the right thing to do.

For example, let's look at a very common preventive maintenance recommendation: "Grease the bearing with two shots of grease every week." In this case, several obvious questions might arise, such as "Does the speed of the bearing require grease every week? What are the operational parameters the bearing is exposed to, such as speed, load, and temperature? Is the correct grease being used?" On many occasions I have performed maintenance audits and found that companies were using cheap, off the shelf grease purchased from automotive supply stores to lubricate machines with six figure price tags. These automotive-grade greases have the incorrect viscosity or additives for industrial applications. In this situation, performing the PM task is

actually reducing the life of the bearing and hastening a major equipment failure.

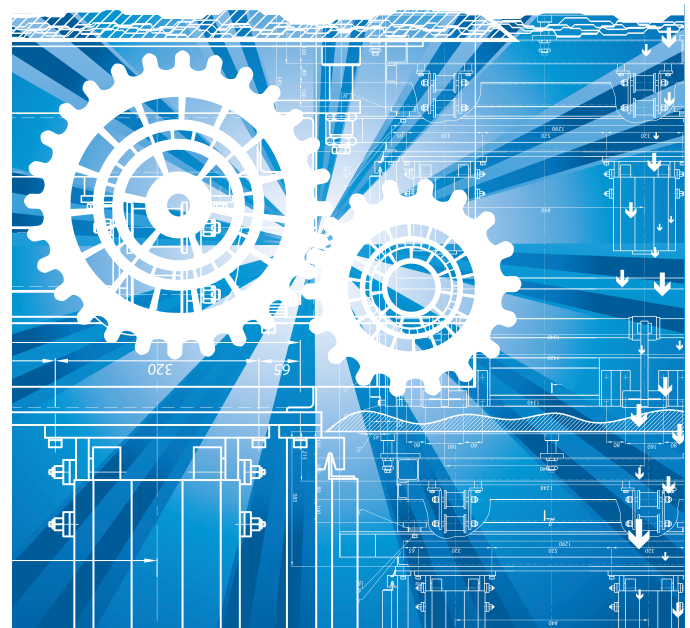
Preventive maintenance programs are designed to do the following:

- Reduce equipment failures;
- Reduce the magnitude of equipment failure or repair costs;
- Reduce product loss or production downtime due to equipment failure or repair; and
- Reduce deterioration in the productive capacity of equipment.

A PM task is justified only if we can say that it accomplishes at least one of the objectives on this list.

There are a variety of processes that can be used to justify a PM program. The first and most effective is reliability centered maintenance (RCM). RCM was developed by F.S. Nowlan and Howard F. Heap at United Airlines' San Francisco Maintenance Center in the late 60s and early 70s. RCM looks at every component in the production process and asks how can or has this component failed. Once we have answers to these questions, we can then ask how can we predict, prevent, or eliminate the failure. This process requires considerable training and a thorough understanding of predictive technologies and the RCM process. The result is a strategic PM program in which all PM tasks add life and value to each component.

Another process which is less costly but effective is PM optimization. PM optimization evaluates each PM task and asks a series of questions to determine if the task adds value or life



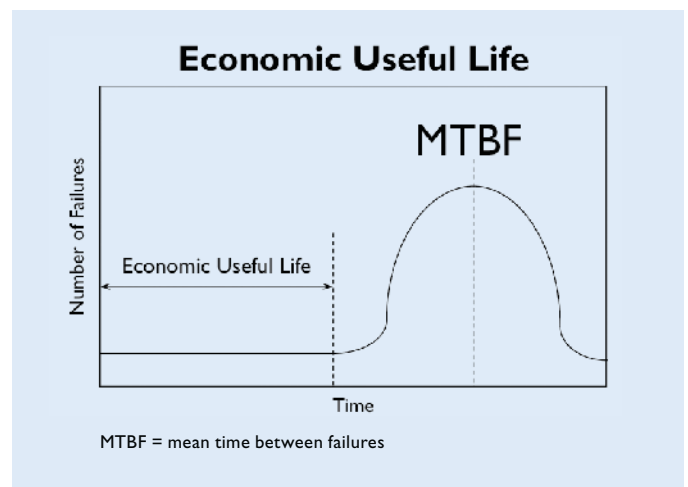
to the component. If it does not, the task is either eliminated or modified. With proper training and execution, PM optimization can be very effective.

A third process is equipment criticality or asset criticality. This process assigns a numerical rating to each piece of equipment based on its criticality or value to the overall production process. It looks not only at the maintenance perspective but also at how critical the equipment is in areas such as safety, product quality, customer issues, environmental issues, and production efficiency. Each piece of equipment has a criticality rating, for example, a numeric value ranging from 0 to 1,000. A larger number indicates equipment with high criticality or higher repair or replacement cost should it fail. Maintenance resources and time (PM tasks) are then assigned based on the equipment's criticality value.

A process used in many plants is mean time between failure (MTBF). This is frequently used in facilities that have a robust computerized maintenance management system (CMMS) system and have collected failure data that is accurate and comprehensive. For example, if we have MTBF data that says a particular belt has failed repeatedly after approximately 6 months of service, we would change the belt before 6 months, on a scheduled basis, and thus eliminate unexpected (and costly) emergency downtime. This is very effective for some equipment and reduces emergency downtime. However, the biggest mistake made in most plants that use the MTBF method is failing to determine how to make the equipment last longer on the next cycle. Knowing why a component failed is crucial in modifying a PM plan to extend the life of the component.

Predictive maintenance (PdM) adds value. My training indicates that 90% of all rotating equipment failures can be predicted months before the failure occurs. Use of predictive technologies can improve PM programs and add life to the equipment. Here's an example of an OEM-directed PM task. A centrifuge OEM states in the manual: "Change the oil in the gearbox every 30 days" or "Rebuild the gearbox every year or a specified number of hours of operation." Using the predictive maintenance approach, we would change the oil after an oil analysis indicates a problem. This keeps the machine operating and producing until the oil needs to be changed. We would also ask why the oil needs to be changed: Can we filter it while the equipment is operating? For the manufacturer's recommended yearly gearbox rebuild, we would use vibration analysis, mechanical ultrasound, or wear particle analysis to tell us when we need to have the gearbox rebuilt. This is a great strategy for critical equipment and improving operating time.

The two areas of training that have been lacking in all the operations that I have visited are lubrication excellence and predictive maintenance. Understanding how to purchase, store, and transport lubricants and keep them clean is a key element in lubrication training. The simple act of lubricating a bearing can cause failures and shorten a bearing's useful life if abrasive foreign particles are pumped in along with the grease. Understanding how



predictive technologies can predict rotating equipment failure months before failure occurs is the key to reducing unplanned downtime.

There are several strategies that can be used to make preventive maintenance more effective. The crucial point I want to make is that we must think of preventive maintenance as a *process* rather than a program. What's the difference? A program is something that is defined and done the same way every time. A process is continually evolving to optimize production and maximize the useful life of equipment.

The key is to invest in training to improve knowledge at all levels of the company. It has been proven that for every dollar spent to improve equipment reliability, there is a \$5-10 return to the bottom line. It is no secret that we are living in

a time when only the most efficient operations will survive. Competition is fierce in every industry, and oilseed processing is no exception. Companies that shift production facilities to Third World countries in an effort to remain competitive are just fooling themselves and are taking the easy way out. Most have found that, in the long run, the initial savings are offset by other issues such as lower product quality.

Improving processes, maximizing uptime, increasing quality, and reducing costs associated with environmental, health, and safety issues is where the true savings are to be found. This can only be accomplished by moving away from the traditional thought processes that have been dominant for the past 50 years and embracing the effective scientific strategies of the 21st century.

The author is a Certified Maintenance & Reliability Professional, certified through the Society of Maintenance & Reliability Professionals. Based in Sydney, Ohio, Mr. Harris has 26 years of experience in the manufacturing/processing industry and, as the owner of Reliable Process Solutions, has facilitated PM training programs worldwide. He can be reached at tkharris10@woh.rr.com.

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