



KICKING YOUR PM PROGRAM UP A NOTCH

By Preston Ingalls

Let the fear of danger be a spur to prevent it; he that fears not, gives advantage to the danger.

—Francis Quarles, English poet (1592–1644)

A major objective in maintenance operations is to reduce unplanned maintenance by increasing planned maintenance. Unplanned maintenance generally costs four to five times more than planned maintenance. Preventive maintenance (PM) is one of the methods that helps equipment owners migrate away from unplanned maintenance, or emergency maintenance (EM), by doing more PM and resulting corrective maintenance (CM).

As Figure 1 illustrates, failures can be detected in advance if inspection is conducted. The P-F Curve is a common curve that illustrates the actions of equipment as it approaches failure. The curve shows that as a failure starts occurring, the equipment deteriorates to the point at which it can possibly be detected as the potential for failure (P point). If the failure goes undetected and is not corrected, it continues on until the failure occurs (F point). The period of time between P and F, commonly called the P-F interval, is the window of opportunity during which an inspection can possibly detect the pending failure and resolve it through corrective action. This allows equipment owners to inspect to detect, detect to correct, and correct to perfect.

P1, P2, and P3, shown on the curve, are condition-based maintenance and preventive maintenance inspection activities applied by maintenance personnel to detect early changes in condition. P4 and P5, which are closer to the failure event and, therefore, more easily detectable, are activities operations personnel can apply to detect changes in condition before failure occurs. This is the main advantage of having an Operator Care program as part of the PM process.

PREVENTIVE MAINTENANCE

Preventive maintenance, the foundation to a “Best in Class” maintenance program, is designed to improve and extend

equipment life and avoid any unplanned maintenance activity. PM is a time- or interval-based, planned service to detect and prevent potential failures and extend the life of equipment. With PM, owners use metered hours, cycles, rotations, units, or units of time to schedule service.

Its purpose is to minimize breakdowns and excessive depreciation. In its simplest form, PM can be compared to the service schedule for an automobile. It includes activities like lubrication, painting, testing, cleaning, adjusting, and minor component replacement, aimed at extending the life of the

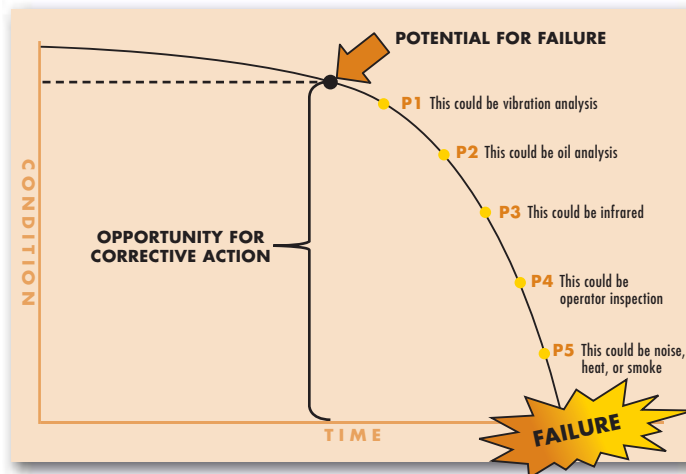
equipment. The costs of operating this type of program are easily justified by the resulting decreased number of equipment breakdowns and delayed degradation of the overall material condition of the equipment.

PM has been around many years: We sharpened our knives, we cleaned our caves and huts, we packed animal fat in the hubs of Conestoga wagons, we cleaned pots after dyeing a fabric lot, and we oiled our rifles. However, the first article on formal PM was published by a United States Army officer in the mid-1930s.

The following list provides some of the specific outcomes expected from an effective PM process:

- Reducing equipment downtime
- Improving conservation and increasing life expectancy of equipment assets, virtually eliminating premature replacement of equipment
- Lowering overtime costs and more efficiently utilizing maintenance staff, a result of working in a more planned and scheduled manner
- Minimizing the need for large-scale, disruptive repairs
- Reducing production losses from equipment failures
- Acquiring meaningful data from the equipment history, which helps owners make more intelligent decisions on repair, overhaul, and replacement to maximize the return on capital employed

Figure 1: Principles of Deterioration: P-F Curve
Window of Opportunity for Planning and Scheduling



ABOUT the AUTHOR



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- Providing tasks for planning and scheduling for minimal production disruption
- Offering timely identification of high-maintenance-cost equipment, allowing for proactive operator training and/or planned replacement of obsolete equipment
- Reducing incidents of secondary failures
- Improving safety and quality of equipment
- Reducing the cost of repairs by reducing secondary failures (collateral damage caused when parts fail in service, damaging other parts)

THE INSPECTION PROCESS

Although PM can include cleaning, lubrication, testing, and scheduled replacements, the most important task in PM is inspection. Inspection helps to detect early signs of changes in condition—a warning of impending failure. The key to this inspection is making sure the equipment is “to spec.” In other words, the equipment and its components should be in a specified state or condition.

To make this effective, PM procedures should clearly state what conditions owners should and should not look for during inspection. It should be stated as the “spec.” For example, it is inadequate to state “Check belt.” That leaves too much to interpretation. A better approach would be to state the conditions the belt should or should not be found in, such as “free of glossing, cracks, and fraying.”

One of the key advantages that PM provides is the ability to plan and schedule it in advance; activities include identifying, planning, scheduling, performing, reviewing, and

improving work.

PM, by its nature, allows owners to identify work up front. They know that, based on so many operating hours, cycles, or units of time, an activity will come due. They can then plan the job by preparing all the necessary documentation, as well as kitting the parts and materials needed. The next opportunity is scheduling the resource (who) and event with operations. They then conduct or do the PM. Afterward, they look at the tasks to see if they need to modify them or change the frequency. They also examine how they might perform it better the next time. Part of the review step is looking at the corrective work that may have been surfaced by the PM. The final step, improving work, means taking the necessary improvement steps from their learnings in the review step and streamlining the process.

In refining a PM program, the key is to start with the most critical equipment first. It also means having good metrics to measure the effectiveness and results of the PM efforts. Example metrics of key performance indicators include the following:

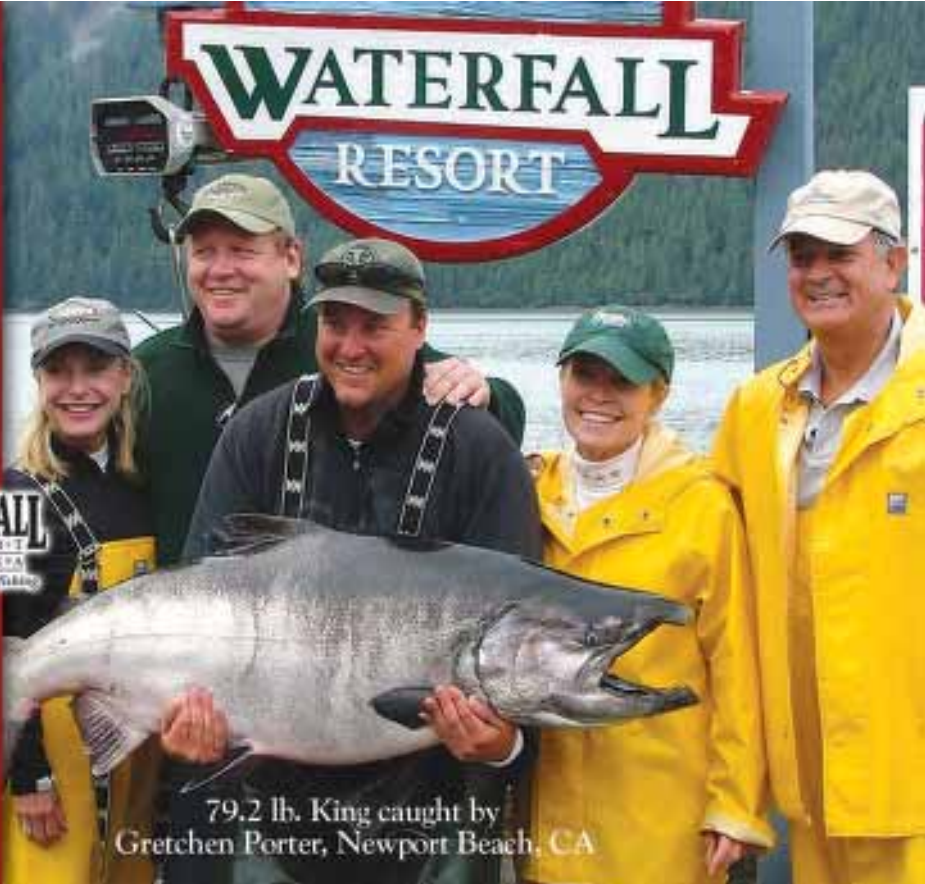
- Percent PM of total maintenance hours
- Percent PM schedule compliance
- Mean time between failures (MTBF) on critical equipment
- Percent PM review (revised PMs)
- Percent corrective maintenance from PM
- PM versus CM ratio

Having reliable equipment is critical to every construction firm. Ensuring that the correct tasks are done well and on time can prevent losses—both in equipment and job delays. ♦

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