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Whether initiating a new preventive maintenance (PM) program for your plant, or upgrading the return on investment from your existing PM resources, you need to answer two basic questions: "What PM tasks should be performed?", and "When should these tasks be done?"

I would submit that the application of the Reliability-Centered Maintenance (RCM) process, if done properly, will provide the best possible answers to the "what" question. However, contrary to a perception held by some maintenance engineers, RCM does not directly answer the "when" question.

In fact, my experiences over the past 20 years in working with clients on PM optimization using RCM have shown the "when" question (referred to as interval frequency or periodicity) is by far the more difficult issue to solve. So just how can we accurately specify PM task frequency? The answer is ... not easily.

We have three ways to approach the assignment of a task interval. Here is a brief synopsis of each:

Option 1
Ideally, we would like to have a statistically accurate picture of the time-failure distribution of each failure mode of concern for each component in our plant. With such information in hand, we can pinpoint parameters such as mean time to failure (or MTBF if the failure pattern is random) and can precisely define end-of-file characteristics. Then, we can specify the level of risk that we wish to take vs dollars involved, and accurately define the desired frequency in an appropriate measurement (hours, cycles, days, etc.). The problem here, of course, is that we almost never have enough data to use this approach.

Option 2
The most commonly accepted approach is to use our collective "best judgment," and essentially guess at the frequency. Obviously, if we cannot do Option 1, there is little other choice.

While the "best judgment" approach is universally employed, my experience says that it usually selects frequencies that are very conservative, e.g., overhauls are done long before they are

really necessary. Thus, we waste resources and especially expose ourselves to the risk of human errors if the maintenance action is intrusive in nature.

Option 3

There is a third option, and it works. It is called age exploration (AE), and is simply an empirical approach wherein we meticulously determine the as-found condition of equipment whenever a PM task occurs. If the condition is OK, we open up (or conversely, close down, if necessary) the current frequency before the next scheduled PM is conducted.

Here is how it works. Say our initial overhaul interval for a fan motor is 3 years. When we do the first overhaul, we meticulously inspect and record the condition of the motor and all of its parts and assemblies where aging and wearout are thought to be possible. If our inspection reveals no such wearout or aging signs, when the next fan motor comes due for overhaul, we automatically increase the interval by 10 percent (or more).

We repeat the process, continuing until, on one of the overhauls, we see the incipient signs of wearout or aging. At this point, we stop the age exploration process, perhaps back off by 10 percent, and define this as our final task interval.

United Airlines used this process for one of its hydraulic pumps. The overhaul interval started at about 6000 hours. The AE process was used over 4 years to extend the interval to 14,000 hours. It was also discovered that on the same population of pumps, the premature removate rate (the rate at which corrective maintenance actions were required) decreased over the same 4-yr period. This suggests that as the amount of human handling and intrusive overhaul maintenance actions decreased, so did the human error resulting from these actions with the net effect that corrective maintenance actions also decreased.

The problem is that this can take a long time before the correct frequency is finally established, but if we never start the AE process, then we are destined to live forever with the wrong frequency. (See Reliability-Centered Maintenance, pgs 186 to 189 for more details on AE.)

In summary, we are usually stuck with Option 2 for starters, but considerable savings can accumulate if we also invoke an AE process in those areas where the PM task cost is significant. **MT**

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