

The Fundamentals: How To Write An Effective PM Procedure

Written by Raymond L. Atkins CPMM, CMRP
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Follow these steps in developing the type of world-class document and process that provides real value throughout your operations.

If you want to change your current maintenance reality, you must begin with the basics. One of the cornerstones of a successful maintenance effort is the precise execution of thoughtful, well-written preventive maintenance (PM) procedures. There are several steps that must be followed to ensure that these procedures are as effective as possible.

Step #1: Assessment The first step in the development of an effective PM procedure is to determine the condition of the machine or machine center. You have to know where you are before you can decide where you want to go and how you intend to get there. If the machine is newer equipment, this evaluation should be fairly straightforward. If, however, you are dealing with equipment that has been in service for a period of time or has a history of unreliability, this assessment could be quite a lengthy undertaking. Still, it's time to invest if you want to leave reactive maintenance behind.

The assessment portion of the project should begin with a thorough cleaning of the machine. Having a clean machine will make the remainder of the assessment process easier to complete. Just as importantly, the machine should be evaluated as it is being cleaned to determine if there are any cleanliness issues that may be leading to or masking failures. Examples of these conditions include build-up or residue on electric motors, excess grease on bearings or other moving parts, oil residue on or below components, damp hoses and accumulated residues that might be indicating or hiding deeper problems. Any discoveries of this nature should be noted so they aren't overlooked when the PM is written. Machine maintenance is a field that revolves around surprisingly few basics—one of these is that a clean machine runs better and longer.

The work team for the assessment portion of the project should be made up of both Maintenance and Production personnel. These are the people who operate and maintain the machine. They are your experts, and that fact alone should be motivation enough to involve them in the PM development process. The issue of "ownership" is another important reason to include these people. If your hourly professionals are involved in the development of the PM at every step of the process, they will have a vested interest in the success of the finished product. After the cleaning is completed, the next step of the process is to conduct a comprehensive mechanical and electrical assessment. In this portion of the exercise, you are looking for what is going right, as well as for what is going wrong.

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- Fasteners should be checked for torque.
- Drive belts, chains, sheaves and sprockets should be inspected for wear and alignment.
- Hydraulic components should be observed for signs of leakage.
- Pneumatic components should be assessed with ultrasonic equipment if you have it and for audible air leaks if you do not.
- Bearings should be inspected for signs of lubrication issues.
- Moving parts should be analyzed for wear. Overall machine alignment should be checked to the extent that you are able.

During this mechanical assessment, notations should be made of any condition that is found to be out of spec—whether you intend to repair it or not. This is also the time to update your bill of material for the machine. Think of these variances as messages from the machine about potential trouble areas. The machine is telling you where your maintenance procedures are adequate and where they are not.

Step #2: Documentation and analysis Once the assessment is complete, you will again need both Maintenance and Production personnel to proceed to the next step. You also will need the maintenance records of the machine, including any documentation on breakdowns or failures. If formal documentation of prior reliability issues is not available, you may need to rely on anecdotal evidence or employee memory. Additionally, you will need all owner's manuals, drawings and installation documentation.

Once you have gathered the necessary team members and documentation, the task before you is to make a written list of every known machine failure that has occurred in the past, as well as every possible failure that the team can envision occurring in the future. Do not forget to include the potential failures that you discovered during the mechanical and electrical assessments of the machine. If these conditions had gone undiscovered, would they have eventually caused machine failure? This exercise is the first phase of a Failure Modes and Effects Analysis (FMEA)—and, perhaps, the most crucial part of the PM development process.

Conducting the FMEA can be a daunting task. Don't let it scare you. Just remember that the idea is to try to document what has gone or can go wrong with a machine so that you can put a procedure in place to prevent it from happening again. (A good website to visit on the subject of FMEA development is <http://www.isixsigma.com/tt/fmea/>) There also are some common-sense tips that can help.

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- First, follow the flow of the work that the machine was designed to do. If you are dealing with a hydraulic system, follow the fluid. If you are looking at a widgetmaker, follow the widget.
- Do not try to conduct the FMEA in small installments over time. You will lose your train of thought, as well as the brainstorming continuity that is necessary to successfully complete the task.
- Once you have convened your team, arrange the work schedules so that this group can meet eight hours per day, every day, until the FMEA is finished and the PMs are written.
- Finally, follow the “likelihoods” when you are listing causes. As an example, a bearing failure could have a cracked machine footing as a root cause, but unless you have seen some indication of structural issues during your machine assessment, there is a low likelihood that this condition is causing your machine to fail.

Incidentally, a failure should be defined as any time that a machine: (1) ceases to do whatever it was designed to do; (2) when you want it to do it; (3) at the rate you desire; (4) at the quality specification you require. This is a very important concept. If a machine has been designed to stamp 500 holes per hour and it can only manage 480 holes per hour, the machine is in failure mode—despite the fact that it is still running and producing product. Likewise, if the machine is managing to stamp 500 holes per hour, but 100 of them are in the wrong place, it is exhibiting a sign of failure.

Step #3: Writing your procedures

Once your FMEA is completed, it's time for the PM procedures to be written. A good place to begin is by reviewing the owner's manual and the supporting documents that were provided by the manufacturer when the machine was purchased. You want familiarize yourself with the functions the manufacturer suggests conducting and when. This is especially true if the equipment is a new and just being brought online. If that's the case, following the manufacturer's suggested procedures should keep you out of trouble until you develop some machine history of your own to evaluate. Keep in mind that the PM procedures and intervals suggested by an OEM are not in and of themselves the road to machine reliability. Each machine and machine installation is unique—and, manufacturers typically have not operated their products in real-world plant environments before supplying them to you. Most importantly, they have not operated them in your plant, with your personnel, at your rates of production. Thus, your reality will differ greatly from the manual. Through your evaluations and research, you have identified many potential failures that must be guarded against and many repetitive tasks that must be performed. Now you must decide the most effective schedule to complete the tasks.

In most cases, there will be a daily perfunctory or runtime inspection, a weekly mid-level inspection, a monthly major PM, as well as a series of regularly-scheduled procedures that will

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deal with overhauls, major replacements of wear parts, mandated inspections and the like. Regardless of the CMMS system that you have—or even if you do not have one—remember the following points when writing your PM procedures:

- **Keep it simple and short.** You do not want to cut-and-paste your entire FMEA into your PM and print it out once a week with “Perform These Tasks” written across the top. Your millwright will be overwhelmed, and nothing will get done. Rather, the work should be divided into a series of shorter operations, optimally of no more than two hours in length. The millwright will experience a sense of accomplishment and an accompanying morale boost every time he completes one of these shorter pieces of work.
- **Keep it safe.** The first language that the millwright encounters as he reads his PM document must refer to the safe performance of the task. Lockout/ tagout and PPE should be specified at this point.
- **Keep it logical.** If you are checking bearings, check all of them. If you are checking drive belts, check all of them. Give the millwright the benefit of intuition by grouping similar functions and objects.
- **Solicit input.** Construct your PM document so the information that must be recorded on it could only be derived by the actual completion of the PM. If your PM contains a series of check boxes, you will get a series of checks. How, though, would you know if the work were actually performed? If you ask for readings, temperatures and measurements, it will be much more likely that the work you have requested will be performed.
- **Build accountability into the document.** To put it simply, when the millwright signs the document, he is signing that the work actually was done...that it was done correctly...that it was done according to specification. A good way to ensure conformity is to randomly assign a supervisor to view the work as it is performed or immediately thereafter. This is the standard you must hold, and your millwrights must understand that this is the level of accountability to which they are being held.

Getting where you want to go If you follow these steps detailed here, you will be on your way to a betterperforming and less-reactive process. Remember, however, that a written PM procedure is a living document. It will change over time based on the machine’s performance and the millwright’s inputs. While you may not get it exactly right the on the first cut, over time, a well-written PM procedure can evolve into a world-class document and process—one that will have transferability and application to the other machines in your operations.

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