



## **Non-Invasive Inspections**

by Jeff Shiver, CMRP, CPMM

There are Standard Operating Procedures (SOP), Preventive Maintenance (PM) procedures, and Predictive Maintenance (PdM) procedures that both Maintenance and Operations engage in. The most basic is Condition Monitoring or Operator Care and involves both groups. The equipment owners/ maintainers (both Maintenance and Operations) clean to inspect, inspect to detect issues, and on detection, correct those issues. Consider that condition monitoring/ operator care should be a daily procedure (SOP) from the standpoint of listening, feeling, and smelling the equipment operating. The primary distinction for PM procedures over SOPs is they are time-based and occur on a given frequency. Some PMs are invasive but we want to use other PMs as a non-invasive inspection tools along with Operator Care to feed our Computerized Maintenance Management System (CMMS) with work orders that allow us to properly plan, schedule and execute corrective invasive actions when the right parts/materials are available.

So with that said, you can see that there is an overlap between the Standard Operations Procedures (SOP) and the Preventive Maintenance (PM) procedures. This overlap gives us the opportunity to clean and inspect the equipment. During the inspection, we get the opportunity to detect issues that can be addressed immediately. For some items especially the more invasive items, properly create planned work orders to correct later utilizing the planning and scheduling process.

With any of the above procedures (SOP, PM, or PdM), each must be written to a detailed specification. With the attrition and retirement of the baby boomer generation and the increasing lack of skilled labor availability, it's more important than ever that we write our procedures with step by step details. These procedures become training tools for those who may attempt to fill your shoes at a later date and are invaluable for certification programs. What does that mean, "a specification"? No, you don't have to write a line to a procedure that says "Turn the wrench counterclockwise to loosen the bolt" but the opposite extreme such as writing a line "Adjust machine as necessary" doesn't cut it either. Our goal is to set ourselves up for high equipment reliability by taking away some of the failure modes that lead to significant downtime in connected drive trains or other parts. For example, belt tension that is too tight creates excessive bearing or shaft wear, or wears down the pulleys as does misalignment. It also can create issues with gearboxes in the drive train as well.

For each component, the procedure should list the correct components based on the initial installation or approved modification. Another reason to list the parts is things sometimes change in the heat of the moment i.e. the storeroom was out of #60 chain so we modified it with #40 chain to get us by, and someone forgets to put a work order in to change it back to the correctly engineered parts. The #40 chain can snap later causing downtime. Most like they changed it to #80 (bigger is always better!) and instead of being the weakest link, the oversized chain wrings the shaft off an 80 inch wide conveyor drive roller and causes much greater losses. The procedure should have space on the form to note deviations from the norm such as chain

pops while rotating over the sprocket or chain is loose, dragging on safety guard. It's nice when the form has a checkbox for each item so if the person is called away, they know where they left off in the process or if they have forgotten an item. It is a tool within the tool. The challenge is to educate your people so they don't simply pencil-whip the form without doing the procedures.

Let's look at some examples below that are typically non-invasive:

**Safety First!** Any procedure SOP, PM, or PdM should start with the appropriate safety procedures to de-energize and lockout the equipment to ensure personnel safety and prevent unexpected equipment operation. This may not apply to the PdM procedure for items such as vibration analysis or infrared imaging.

**V-Belt or timing belt drive trains**– Instead of a line such as “Inspect belt”  
Are the belts frayed on the edges? Is the belt material cracked or is the webbing broken? Measure the belt tension using a spring scale or the amount of deflection. Depending on the method and the manufacturer, the correct measurement parameters should be listed on the procedure since it varies based on the distance between the sheaves, etc. Each belt manufacturer provides this information on their website or in their technical documentation. Do the pulley grooves match the measuring gauge tool for the belt size or are they worn and in need of replacement? You specify/ picture the tool and what the tool should measure in the procedure. Is the shaft key in place (if one exists) and is the pulley tight on the shaft? If using set screw collars, are the set screws at the proper torque. Is the belt properly aligned with the pulleys? A simple straight edge can be used for an inspection but the proper belt alignment tools should be utilized on installing new or replacement pulleys. Remember our goal of precision maintenance is to ensure equipment reliability, to prevent damage to other components, and reduce or eliminate equipment downtime.

**Chain drives** – Instead of “Inspect chain”

Does the chain pop or jump as it rotates on the sprocket? Is the sprocket worn? Again, manufacturers have gauges that allow one to quickly verify the proper dimensions but you must indicate the correct measurement on the procedure. Is the chain worn? Is it too loose or too tight? ...

Don't forget items like lubrication, filling the bearing lubrication container (specify the right fluid), conveyor belt tensions, cleaning electronic enclosure cooling fan filters, and inspecting polycord belts where at the joint and so on.

I'll ask a good question along the same lines. How many of you have your grease guns calibrated to know how many pumps it takes to equal one ounce of grease? And the grease guns are visually color coded for each type of grease used in your facility? Are the grease points color coded to match the appropriate grease guns and tagged with the greasing frequency and grease amounts required? A grease gun is a deadly weapon in the wrong hands, capable of generating 15,000 psi and blowing out seals. Recognize PMs such as lubrication PMs should be separate from other PMs so that you can adjust the frequency independently.

What we didn't talk about is the environment and culture that is required to make this a reality in most companies, the invasive PM, or PdM. If you would like more information on these, please email Jeff Shiver at [jshiver@peopleandprocesses.com](mailto:jshiver@peopleandprocesses.com).

About the author:

Jeff Shiver is a Certified Maintenance and Reliability Professional, and Certified Plant Maintenance Manager. He held operations and technical roles across 20 years for a global manufacturer, a leader in confectionary snacks, food processing and pet care. Jeff worked in 4 different manufacturing sites and on 2 U.S. and Canadian regional assignments. Prior to his last manufacturing role as an Operations Area Manager, he was the site Maintenance Manager where he led a change effort towards a proactive reliability-based culture. His passion for maintenance and operations best practices led him to People and Processes, Inc. where he is a Managing Principal. Jeff can be contacted at [jshiver@peopleandprocesses.com](mailto:jshiver@peopleandprocesses.com). Jeff is an active member in the Society of Maintenance and Reliability Professionals (SMRP) and is on the SMRP Maintenance and Reliability Knowledge Committee currently rewriting the Book of Knowledge for the Society.



People and Processes, Inc.  
PO Box 460  
Yulee, FL 32041-0460  
(800) 930-4276 Office  
(866) 637-9437 Fascimile