Bringing Precision Maintenance, Vibration and CMMS together to identify and eliminate true bad actors in your plant

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My name is Scott Glover…

- A mechanical engineer, I have worked in the Charleston Paper Mill for 20 years as a Paper Machine Process Engineer, Power and Utilities Maintenance Engineer, Machine and Rebuild Shop supervisor providing support to the Mill. For the past 2 ½ years I have been the Precision Maintenance lead at the Charleston Mill.
- More personally and still relevant, I enjoy doing Machine Shop work as a Hobby. I still can not pass a lawnmower in a trash pile with out picking it up to resurrect…
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- Bottom line, I love Machinery and am excited be here today to share some of my experiences…

What is a Bad Actor?

- When I told a machinist this week what I was going to be talking about today he was quick to tell me, “anything on two legs walking around this plant.”
- It is that equipment that you hear “is that thing down again? We just worked on it two weeks ago.”
- Another is “yeah, it lasted six months and that’s what we typically get from it.”
- It is the P.I.T.A. equipment… Pain In the !@#.

Bad Actors $$$…

- Study from Reliability Solutions, Inc. of Maintenance Cost Data from 9 years and 10 paper mills…
- Machines over 500HP typically comprise 2% of machines in a mill and cost $11-13/hp/year to operate.
- Machines 500 to 100 HP typically comprise 13% of machines in a mill and cost $22-26/hp/year to operate.
- Machines 100HP and less typically comprise 80% of machines in a mill and cost $49-63/hp/year to operate.

Precision Maintenance…

- Simply put a process of doing maintenance according to specifications which address primary failure modes.
- We generalize that equipment fails as follows:
- 30% fails due to Misalignment
- 30% fails due to Unbalance
- 30% fails due to Assembly Error
- 10% fails due to Other

Alignment…

- A good alignment program is key to rotating equipment reliability. Commonly missed are:
- Soft foot
- Pipe strain
- Thermal growth
- Angle and short foot
- Belief that couplings will “accept” misalignment

Precision Maintenance: Balance

- Car tire example… Not many in the room would spend $100/tire and then not spend $6-8/tire to have them balanced.
- Specify all rotating assemblies be balanced to the “intent” of G1.

Precision Maintenance: Balance

- I should have know…

Precision Maintenance: Assembly Error…

- This category really captures what I describe as good machine practice.
- Cleanliness, proper tools, checking and correcting fits, doweling, proper lube.
- The “no hammer” rule.
- The shiny metal myth. My experience…10-15% of the stuff you have on the shelve as spares…from parts to complete assemblies are failures on the shelf.

Other…

- The 10% “OTHER” category includes the more difficult mechanical failures…perhaps the word should be more exotic or less frequent…
- Oil swirls
- Motor rotor bar problem
- Electrical air gap problems
- Operators…those two legged bad actors…

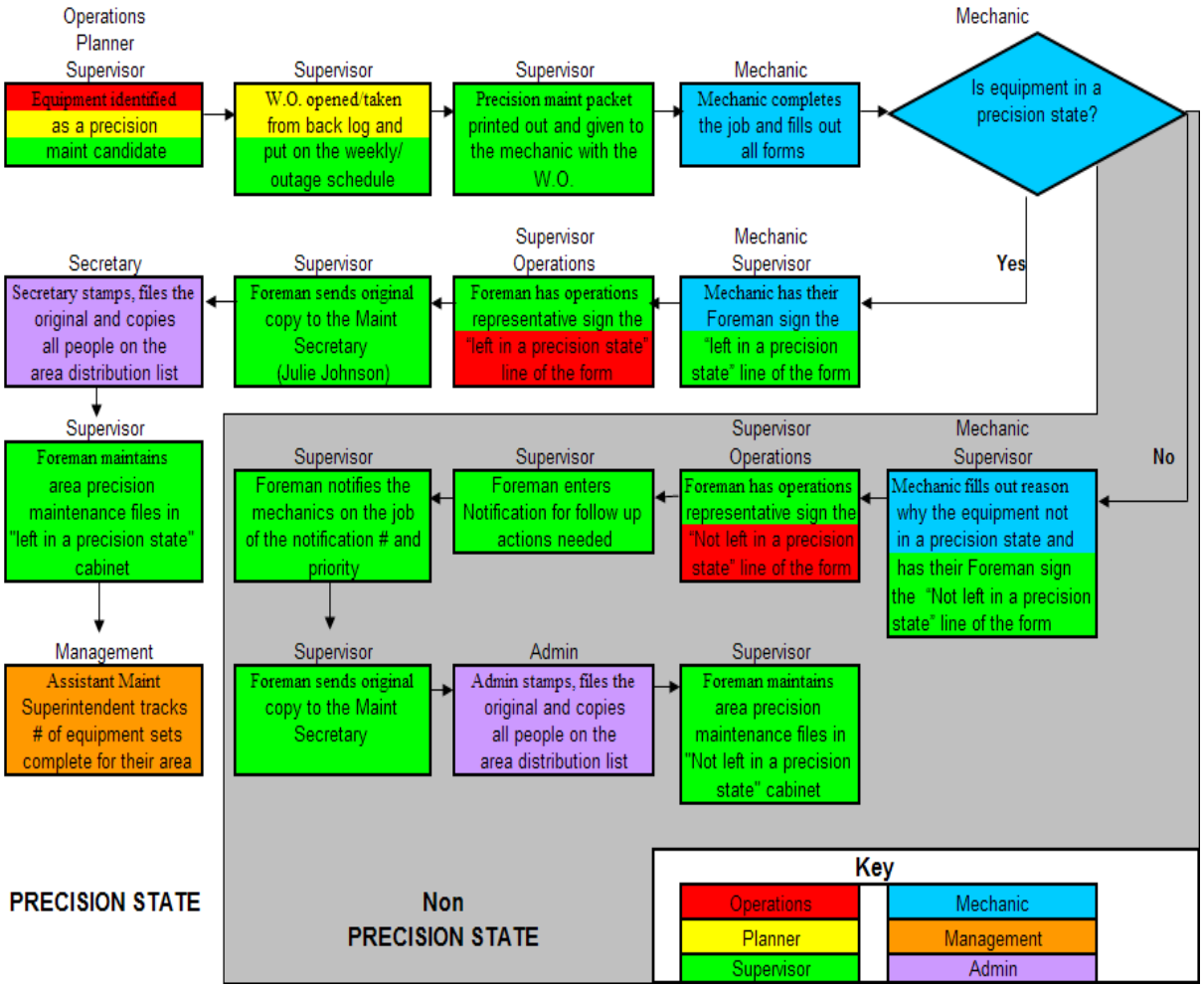
Precision Maintenance Spec's

- Similar to and sync'd with engineering specs and documented. Examples:
- Soft foot checked and no more than 0.002", pipe strain the same.
- No more than 4 shims under a foot
- Jack bolts to be installed on all equipment
- Thermal growth calculated and applied to all equipment
- Keyways turned 180 degrees and keys fitted
- All bearing fits to be mic'd and in tolerance
- G1 balance
- TIR 0.002" or less
- Proper bolt torque
- Proper Lube

Good Vibrations…

- Vibration is one tool used to prioritize “Precision Maintenance work” and provide feedback for the craftsman.
- “Experience suggests that reducing the overall vibration level from 0.2 in/second to 0.1 in/sec can reduce maintenance costs up to 50%” (R.S. Inc)
- 0.1 in/sec overall vibration is consider a “good” level, while 0.075 is considered “world class.”
- Above 0.25 in/sec is to be a suspected bad actor.

Precision Maintenance Process Flow



- Written process flow diagram
- Color coded responsibilities
- Identified path for precision and non-precision work
- Post in the areas
- Hand out and review with everyone who has had training

Computerized Maintenance Management Systems) CMMS:

- During my career I have led/and or participated in the design and implementation of two CMMS (Maximo and SAP).
- I did this not because of my love for computers, but for the love of Tools and Machinery.
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The Perfect CMMS

- You have accurate equipment records in searchable fields.
- hp, rpm, manufacture, model number, seal type, etc. are populated.
- Work Orders are written to the correct functional location.
- Standing orders do not exist…

Fishing for bad actors…

- Surf your vibration database of using the vibration tolerances of 0.1 in/sec and above and then 0.25 in/sec and above.
- Take this list and pull up equipment work order records. You are guaranteed to find some good, easily fundable maintenance work.
- Do not necessarily get hung up on “bad” vibration numbers if the work order history does not show significant $$$. Some machines that would not qualify as “precision,” infact do not need to be prioritized: Ex. Blowers, shaft mounted gearboxes, spring bases.

Fishing for bad actors…cont'd

- If your vibration data and/or experience suggests a piece of equipment is bad actor, but the initial work order review shows few $$$ spent…dig further.
- Sometimes, "Less is More" in data base searches. It is quite possible that the significant repair costs you thought should be on that equipment are being charged to a nearby piece of equipment or at a level above in the work order system.
- Service and Vendor records can be used successfully when W/O's fail. Windshield example…

Fishing for bad actors…cont'd

- The lack of precision maintenance is especially telling in high rpm equipment. A 3600rpm application that exhibits high vibration will likely have a history of high $$$. Review both your vibration and CMMS data bases in this area for opportunities.
- It is particularly important to apply precision vibration standards and repair work on equipment with mechanical seals.

Case History

- First Base, $$$, History

Case History

- Agitator, $$$, History, Base, Pack-ryte

Case History

- Pump, $$$, history, pipe strain

Case History.

- 25hp, 3600rpm high pressure water pumps. 0 to $42,0000 over 2-1/2 years

Case History.

- 800hp, $60,000 year steam savings, disk coupling

Case History.

- 1000hp, FD Boiler fan, $$$, sootblower

Case History.

- Plastic Precision – Poly-Shield

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Case History.

- Lineshaft bearings

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Case History.

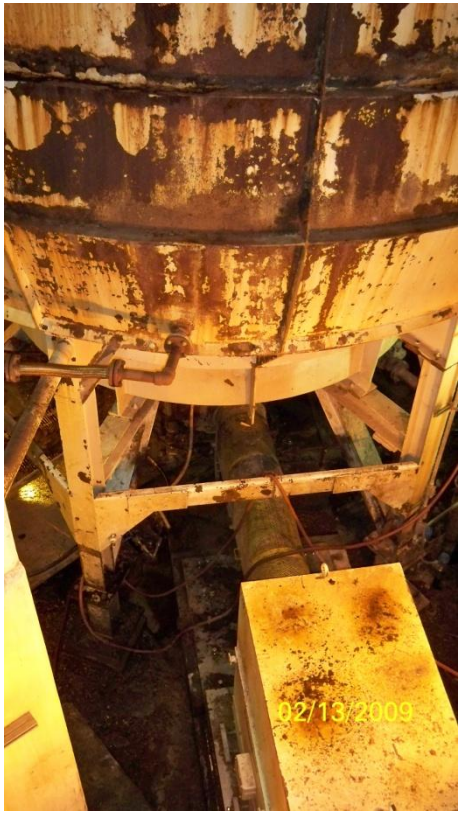
- Lineshaft Temp monitoring, $$$

Case History.

- Hydrapulper Feed

Case History.

- Hydrapulper Tub



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Case History.

- Hydrapulper New base, $$$

Case History.

- Hydrapulper New base & jack bolts

Case History.

- New pump, jack bolts, pipe supports

Case History.

- New base, jack bolts, pipe supports, dog-house, 8 years, 0 $$$

Case History.

- Good transition base…

Case History.

- Another Good transition base…

Case History.

- Another Good transition base…

Case History.

- Full base…

Case History.

- Full base…

Case History.

- Precision Maintenance at its best and worst… 3 years and running great…

A few more good words…

- $$$...It is all about the money
- Learn how much it cost $$$ for you customer to run their process. Process $$$ information and downtime, combined with maintenance cost/vibration levels can be good places to look for opportunities to shine.
- Know how much electrical power costs and use potential savings to drive reliability…especially in 24/7/365 operations.
- Talk to mechanics and operators to find bad actors…then confirm with your vibration data and CMMS.

Discussion…