Preventive, Predictive and Corrective Maintenance

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General Overview

Basic Introduction to Maintenance

- Three types of maintenance
- Why do it?
- Benefits
Types of Maintenance

- Preventive (PM) - greasing, oil, filters
- Predictive (PdM) - Inspections
- Corrective - Repairs
Definition of Preventive Maintenance (PM)

“Schedule of planned maintenance actions aimed at the prevention of breakdowns and failures”

Primary goal- Preserve and enhance equipment reliability
Examples of PM

- Oil changes
- Greasing
- Changing filters
- Belt tightening

Anything that increases life of equipment, and helps it runs more efficiently
Preventive Maintenance Quiz

Quiz time...

TRUE or FALSE

1) Preventive maintenance is only necessary on large equipment, such as 100 HP blowers, large gearboxes, etc.
Quiz

FALSE!

- Preventive maintenance should be performed on most equipment as recommended by the Manufacturer

Note: Determine if time spent to perform PM is greater than the replacement cost
TRUE or FALSE

2) Equipment manufacturers outline preventive maintenance procedures in the OEM manuals
QUIZ

TRUE!

- Oil and/or grease types, quantities
- Time periods (weekly, monthly, quarterly)
- V-belt inspections
- General visual inspections
- Torque settings

Use these guidelines when creating program
QUIZ

3) Every 10 minutes an average furnace runs, it unleashes the equivalent energy of 3.5 sticks of dynamite
Department of Energy (DOE) reported this very fact in a recent study, in an effort to raise awareness of the importance of regular PM of a common household furnace.

Point made: Not performing PM wastes energy AND costs money
Benefits of PM

- Increases life of equipment
- Reduces failures and breakdowns
- Reduces costly down time
- Decreases cost of replacement
Who Does PM?

- Only trained, qualified maintenance personnel should perform PM’s
Why do I need training?

➢ *To ensure proper techniques and procedures are followed*

• Over greasing is often worse than not greasing enough

• Improper tightening of packing increases shaft wear and shortens packing life

• Using improper lubricants can shorten equipment life
Training

- Often available from vendors
- Local schools
- Seminars

- Develop a training program outlining your needs
- Establish an on-the-job training program if possible
Predictive Maintenance (PdM)

• Definition - “Techniques that help determine the condition of in-service equipment in order to predict when maintenance should be performed”

• Primary goal - Minimize disruption of normal system operations, while allowing for budgeted, scheduled repairs
Examples of Predictive Maintenance

- Vibration Analysis
- Infrared Thermography
- Oil Analysis
- Visual Inspections
Predictive Maintenance Quiz

TRUE or FALSE

1) Predictive maintenance identifies trends and provides historical data
TRUE!

Predictive Maintenance, such as oil analysis, may show increasing metals in oil sample, indicating breakdown of internal parts.
2) Predictive maintenance includes partial rebuild of equipment to keep it running until a complete rebuild can take place.
FALSE

Predictive Maintenance shows condition of in-service equipment, and predicts when corrective maintenance should be performed.
3) Predictive Maintenance can be performed by almost anyone

PdM should only be performed by trained personnel using proper equipment!
Benefits of PdM

- Provides increased operational life
- Results in decrease of downtime
- Allows for scheduled downtime
- Allows for money to be budgeted for repairs
- Lowers need for extensive parts inventory
- DOE reports an estimated 8-12% cost savings by having a PdM program
Benefits (continued)

DOE also estimates:

- Reduction in maintenance costs - 25-30%
- Elimination of breakdowns - 70-75%
- Reduction of downtime - 35-45%
- Increase in production - 20-25%
Who does PdM?

Often done by a contracted, specialized technician

Reasons:
1) Qualified and trained on latest technology
2) Possess the proper equipment
3) Provide trending and historical data in report form
Oil Analysis

• Long term program that may take years before its benefits are seen

1) Oil analysis determines:
   ✓ Condition of oil
   ✓ Quality of the lubricant
   ✓ Suitability for continued use

2) Wear particle analysis determines:
   ✓ Mechanical condition of machine components
   ✓ Identifies particle size, type, etc.
Oil Analysis Report

Oil Analysis results may:

- Detail the types of metal fragments in the sample
- Show a continued increase in particle size
- Recommend increasing sampling intervals
- Recommend shutting down machine
Thermography

Used for Electrical Infrared Inspections

- Detects hot spots, load imbalances and corrosion at a *safe distance*
- Detect failures due to excessive heat

1) Indoor equipment such as MCC’s, disconnect switches and transformers
2) Outdoor equipment such as substations, transformers and outdoor circuit breakers
Vibration Analysis

• Usually done on large equipment, such as blowers, pumps, etc.
  ➢ Determines if bearings or components are loose, moving or wearing
  ➢ Allows for scheduled repair of equipment
  ➢ Can provide trending that enables shutdown of equipment BEFORE failure and major damage
Equipment Inspections - PdM

- Visual inspection of equipment such as:
  - Clarifiers and associated equipment
  - Mechanical bar screens
- Allows for equipment to be coated, such as bar screens
What else?

- Concrete-Deteriorating concrete can indicate several things

Presence of $H_2S$
Corrosion Attack on Rebar!
Don’t forget

• Chemical Tanks
• Roofs
• Portable equipment (generators, diesel pumps)
• Safety equipment
Corrective Maintenance

Definition - Repair of equipment/machinery in order to bring it back to original operating condition.
Important Facts

• Use original OEM parts
• Install per manufacturer’s specs
• Don’t take shortcuts
• Do it right
Summary

- Proper maintenance programs have huge returns
- Keeps equipment running longer
- Allows for scheduled, budgeted repairs
- Reduces unscheduled down time
- Makes life less stressful
Questions?

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