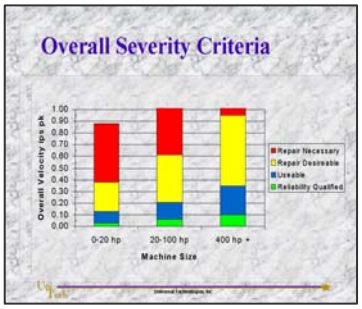
MEP-301:
Managing Machinery Reliability

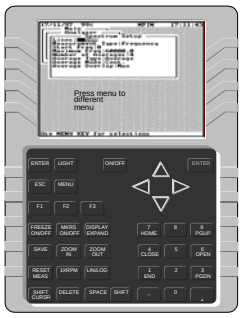
Abstract



Designed specifically for those who manage the purse strings and the organization, this seminar increases management personnel awareness of the need for a "precision" approach through use of extensive case histories and success stories. It also provides information on proven methods for justifying the investment in tools, time and training, as well as setting up the organization and implementing machinery reliability programs.

This course begins with a discussion of different maintenance philosophies and methods, including examples of how and where each is appropriately applied. Case histories and practical examples drive home key points and reduce confusion often created by use of the many buzzwords surrounding machinery reliability.

Each of the primary condition monitoring/PdM technologies in use today is discussed, including the benefits of each:



- Visual Inspection and Monitoring
- Vibration Detection and Analysis
- Oil Analysis
- Infrared Thermography
- Ultrasonics
- Performance Monitoring
- Motor Analysis Techniques

Understanding and even using each of these technologies has proven over and over again NOT to be enough! If maximizing machinery reliability is the goal, processes must be in place not only to detect problems, but also to analyze them, determine the root cause of the problem, correct the problem, and verify the problem has indeed been corrected. Key elements of successful machinery reliability programs are discussed.

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Throughout this seminar, instructor demonstrations reveal the impact of course content on machinery reliability, vibration levels, bearing life, etc. Attendees will leave this seminar with *a refreshed understanding* of maintenance principles and procedures they had forgotten, never used, or never learned. This seminar provides practical, easy-to-implement techniques and processes for ensuring maintenance tasks are performed *confidently right the first time.*

Seminar Duration

The duration of this seminar is 16 hours. Seminar can be customized to meet specific client needs.

Who should attend?

This seminar is designed primarily for maintenance, engineering, technical support and management personnel whose job functions involve rotating machinery repair. The scope of content is appropriate for management personnel, as well as for technicians or other employees who will benefit from an overview of machinery reliability processes and requirements.

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Associated Task(s)

Manage plant personnel involved with implementation of a Machinery Reliability program and demonstrate technical understanding sufficient to provide program leadership and assess the program's effectiveness.

Seminar Objectives

Upon successful completion of the seminar, the student will be able to:

1. Explain the following maintenance philosophies, including the role each plays in an overall machinery reliability improvement process:
   - Breakdown/Repair
   - Preventive Maintenance (PM)
   - Predictive Maintenance (PdM)
   - Precision Maintenance/Corrective

2. Explain six primary patterns of component failures, including the general percentages of age-related vs. random failures and the impact of these failure patterns on maintenance strategies.

3. Explain how “risk management” processes are used to select the appropriate maintenance philosophy for given machines, components or systems.

4. Briefly explain the following condition monitoring/PdM technologies, including examples of the capabilities and limitations of each:
   - Visual Inspection and Monitoring
   - Vibration Detection and Analysis
   - Oil Analysis
   - Infrared Thermography
   - Ultrasonics
   - Performance Monitoring
   - Motor Analysis Techniques

5. Explain the following elements of an effective condition monitoring program:
   - Detection
   - Analysis
   - Correction
   - Verification

6. Explain the meaning and application of the following vibration terms:
   - Displacement
   - Velocity

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- Acceleration
- Frequency
- Phase/Relative Motion

7. Briefly explain how to determine vibration severity, including the limitations of using overall vibration levels.

8. Explain the root cause failure analysis process, including the importance of the following steps:
   - History
   - Machine Details
   - Amplitude /Hand Feel
   - Spectrum
   - Phase/Relative Motion
   - Time Waveform

9. Explain the following sources of machinery vibration and identify their typical spectral symptoms:
   - Misalignment
   - Unbalance
   - Resonance
   - Bearings
   - Looseness
   - Flow-related problems
   - Electrical
   - Bent Shaft

10. Explain the major causes of unbalance and how to prevent them, including:
    - Standards, Methods and Tolerances
    - Assembly Errors
    - Operational Factors

11. Explain the major causes of misalignment and how to prevent them, including:
    - Tolerances
    - Precision Alignment Processes
    - Prealignment Considerations
    - Dealing with Dynamic Movement
    - Base and Foot-related Problems

12. Explain the major components of a “precision repair,” including management and supervisory concerns that should be addressed.

13. Explain methods for verifying the effectiveness of condition monitoring, including:
    - Establishing and tracking Key Performance Indicators (KPI’s)
    - Cost and Benefit Analysis

14. Briefly explain 12 key steps for implementing a plan for improving machinery reliability.

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Seminar Outline

1.0 Introduction

2.0 Machinery Reliability Concepts
- 2.1 Maintenance Philosophies
  - A. Breakdown
  - B. Preventive
  - C. Failure Patterns
  - D. Condition Based
  - E. Precision/Reliability Improvement
- 2.2 Risk Management
- 2.3 Examples of Where Each is Appropriate—Case Histories
- 2.4 Relationship to RCM
- 2.5 How these philosophies are currently applied

3.0 Maximizing Machinery Reliability…the improvement cycle
- 3.1 Overview of the steps to achieving reliability Improvement
  - A. Detection…Condition Monitoring Program
  - B. Analysis… Root Cause Failure Analysis
  - C. Correction/improvement…Assembly, Tolerances, Alignment, PM Tasks, Attention to Detail
  - D. Verification….Standards, QC Check

- 3.2 Detection…Overview of Condition Monitoring Techniques
  - A. Touch-Fell…Overview, Capabilities and Limitations
  - B. Vibration…Overview, Capabilities and Limitations
  - C. Oil Analysis…Overview, Capabilities and Limitations
  - D. Infra Red…Overview, Capabilities and Limitations
  - E. Performance Monitoring…Overview, Capabilities and Limitations

- 3.3 Analysis…Integrating All The Technologies
  - A. The Analysis Process
  - B. The Importance of History/Machine Details
  - C. Hand Feel
  - D. Vibration
  - E. Phase
  - F. Use all the tools at your disposal for effective analysis
  - G. Bearing Failure Example…demonstration

- 3.4 Correction/ Improvement…Maintaining for Reliability
  - A. Tolerances…Balance, Alignment, Vibration
  - B. Maintenance Practices…Assembly, Alignment

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4.0 Overview of Main Sources of Premature Machinery Failure

4.1 Unbalance Prevention

A. Key length
B. Accumulation of tolerances
C. Run out
D. Installation of pulleys
E. Cocked Bearings / spacers
F. Greasing couplings
G. Pulled Threads

4.2 Misalignment Prevention

A. Overview of Precision alignment processes
B. Pre-alignment, Rough alignment, Precision alignment
C. Soft foot
D. Thermal growth

4.3 Resonance prevention

A. Resonance overview
B. Resonance analysis
C. Resonance prevention techniques

4.4 Precision Repair Overview

5.0 Verification and Implementation of Reliability Improvement

5.1 Establishing Key Performance Indicators
5.2 Precision Maintenance & Energy Consumption
5.3 Precision Maintenance & Bearing Life
5.4 Case Histories
5.5 12-steps for Machinery Reliability

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