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Failure Analysis 1 - Course Description

Failure Analysis Services Level I course runs 36 hours over a 4-day period. The class material is presented via slide presentations, lecture, class exercises, and extensive labs. Class concludes with final exam and case study analysis. Primary course teachings are based upon failure analysis wear and fracture principals pertaining but not limited to heavy industrial components found in heavy duty natural gas and diesel engines, rotating equipment, reciprocating compressors, construction and mining equipment, agricultural equipment, trucks and marine. Failure analysis basics include Failure Management, Metallurgy, Fracture types and Wear types. Course teachings also include a heavy focus on customer service, managing service relationships between End User, Distributor, and OEM. General troubleshooting practices are included as well as many salvage repair techniques, procedures, tips and tricks. Students apply what they learn through extensive "Hands On" labs throughout the week. Student competencies are displayed via student lab findings, case study analysis and presentations, and final exam.

Course Agenda

Day 1

MODULE 1: Management

Review Objectives – Analyst, Customer, Dealer, OEM

- Slide Presentation
- Lesson: 8 Steps Worksheet
    - Class Exercise – Problem Solving, Documentation, Communication
    - General Lab - Photography
    - Class Exercise - Visual Inspection

MODULE 2: Metallurgy

- Review Objectives – Metals, Cast and Wrought
- Slide/Video Presentation
- Lesson: Metallurgy Fact Sheet
    - General lab – Hardness Tooling and Testing
    - General lab – Case Hardness vs. Through Hardness Lab

MODULE 3: Fractures

Review Objectives – Four Fracture Types

- Brittle

    - Ductile
    - Fatigue
    - Shear
- Slide Presentation learning about why and how metal parts break. Cause and effect. Loads that cause different fracture types and how to identify them.
- Lesson: Analyzing Fractures Worksheet
    - General Lab – Loading and Fracture Planes
    - Combined Extensive Hands on Lab - Following Module 4: Wear

MODULE 4: Wear

- Review Objectives – Seven Wear Types + Corrosion. How to recognize the differences and what causes them.
    - Abrasive
    - Adhesive
    - Erosive
    - Fretting
    - Cavitation Erosion
    - Corrosion Types
    - Contact Stress Fatigue
- Slide/Video Presentation
- Lesson: Analyzing Wear Worksheet, Particle Size Worksheet
    - Combined Extensive Lab - Wear and Fractures

Day 2

MODULES 3 and 4 continued: Fractures and Wear

- Review Wear/Fracture Lab Findings
- Slide Presentation
- Lesson: Road signs
    - General Lab – Wear/Fracture Lab Review

MODULE 5: Engine/Compressor Bearings

- Review Objectives
- Slide/Video Presentation
- Lesson: Engine and Compressor Bearings with an extensive focus on the 7 different types of wear and identifying what causes them.
    - Extensive Lab – Engine and Compressor Bearings
    - General Lab – Engine and Compressor Bearing Lab Review

Day 3

MODULE 6: Crankshafts

- Review Objectives
- Slide/Video Presentation
- Lesson: Crankshafts
    - General Lab – fillet radius inspection and measurement
    - Extensive Lab – Crankshaft fractures with focus on recognizing fracture types and their causes
    - General Lab – Crankshaft Lab Review

MODULE 7: Engine Valves

- Review Objectives
- General group discussion with hands on
- Lesson: Engine Valves
    - Extensive Lab - Engine Valves, time permitting
    - General Lab – Valves Lab Review

Day 4

Review –

Class Exercise - Wear/Fracture Terminology

Module 9: Pistons, Rings, and Liners

- Review Objectives
- Slide/Video Presentation
- Lesson One: Pistons
    - Extensive Lab - Pistons, Rings, Liners, Crossheads
    - General Lab – Piston, Rings, Liner Lab Review

Final Exam, Case Studies and Presentations

- Final Exam
- Student Teams Analyze Failure Case Studies
    - Complete analysis report including root cause, timeline sequence of events, determine responsibility, and make recommendations
    - Team Report Presentations
- Review
- Course Evaluations
- Diplomas

Resources and Reference

Participants will receive:

- USB Flash drive with course materials
- Loupe Magnifier
- Spiralbound FA notebook
- Technical Support Contact
- **Contact Details**

If for any reason there is a need to contact Failure Analysis Services, Inc. regarding this learning program, the following personnel should be contacted:

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