

# Machinery Health Training and Certification

- *Defined skill paths guide you to expertise across multiple technologies*
- *Lab work provides hands-on opportunity in each course*
- *Certification testing available for most technologies*
- *Additional instruction available through books, charts, pocket guides, and eLearning courses*
- *ISO-compliant Vibration Analysis training classes available*



*Personalized instruction and hands-on lab work with other trainees at your skill level creates the ideal learning environment.*

## Overview

Companies today rely on fewer people to do more work. That's why the need for training is more critical than ever to achieve and maintain cost-effective maintenance programs.

Emerson helps maximize the return on your investment in technology and people. Every year, more than 1,500 individuals receive training from Machinery Health Management classes across the country.

Our instructors share their own real-world experiences and guide classes through hands-on exercises that reinforce the lesson.

Emerson's Machinery Health Management strategy includes training courses designed to help you start up and maintain your mechanical equipment. Our goal is to provide you with the knowledge to keep your plant running smoothly.

## Path to Success

Pick the curriculum of your choice or let us help guide your technicians on a path to certification. All training uses the latest equipment.

Choose and Complete Your Machinery Health Training Path to Success					
Level I Vibration Analyst Path	Level II Vibration Analyst Path	Advanced Vibration Analyst Path	Online Monitoring Path	Lubrication Analyst Path	Complementary PdM Technology
1. Fundamentals of Vibration	Recommended Prerequisite: Level I Vibration Analyst Path	Recommended Prerequisite: Level II Vibration Analyst Path	1. CSI 9210 Machinery Health Transmitter	1. Level I Lubrication with Certification Exam	1. Electric Motor Diagnostic and MotorView
2. Basic Vibration Analysis	1. Advanced Vibration Analysis	1. Root Cause Failure Analysis	2. CSI 4500 Machinery Health Monitor	2. Level II Lubrication with Certification Exam	2. Balancing Theory & Techniques
3. Intermediate Vibration Analysis	2. Intermediate AMS Machinery Manager	2. Introduction to Windows-Based ODS/Modal	3. Turbomachinery Diagnostics using CSI 4500 with Transient	3. OilView for AMS Machinery Manager	3. Laser Alignment with Vertical for the CSI 2130
4. Fundamentals of the CSI 2130	3. Advanced CSI 2130 with PeakVue	3. Advanced AMS Machinery Manager	4. CSI 6000 Machinery Health Monitor	4. Wear Debris Analysis Workshop	4. IR Thermography & Level I Certification Exam
5. Introduction to AMS Machinery Manager	4. Level II Vibration Analyst Certification Exam	4. Taking the Mystery Out of PeakVue Technology			5. Infrared Analysis for AMS Machinery Manager
6. Level I Vibration Analyst Certification Exam		5. Autocorrelation as an Advanced Diagnostic Tool			6. Basic Ultrasonic Theory & Techniques

- Level I Vibration Analyst Path introduces students with no prior experience in vibration monitoring and analysis to the theories of vibration data and basic operation of the CSI 2130 Machinery Health® Analyzer and AMS® Suite: Machinery Health Manager.
- Level II Vibration Analyst Path is for experienced students who are familiar with vibration data collection and want to advance their knowledge and ability to diagnose machinery issues. Learn the advantages of AMS Machinery Manager's PeakVue® features for a more simplified and complete analysis.

- Advanced Vibration Analyst Path teaches students the advanced power of PeakVue, root causes of machine problems, and the use of CSI technologies for ODS and modal analyses.
- Online Monitoring Path is for students with the CSI 6500 or CSI 6000 Machinery Health Monitor, CSI 4500 Machinery Health Monitor or the CSI 9210 Machinery Health Transmitter. Explore the benefits of continuous monitoring of critical machinery and how to integrate with operational plant control architecture.

- Lubrication Analyst Path explores lubrication analysis and its importance to a complete reliability program. Lubrication analysis is often the easiest way to diagnose common machine problems.
- Complementary PdM Technology instruction rounds out a full reliability program with Infrared Thermography, Ultrasonics, Balancing, and Alignment courses.

## Vibration Courses

### Fundamentals of Vibration Course 2069

2 days

This vibration training course is for those with no prior experience in vibration analysis. The class prepares participants for the Basic Vibration Analysis course. Students learn about causes of vibration and methods of measurement. Although the training course does not provide instruction on Emerson's CSI technologies, the course will use them to demonstrate vibration principles.

Topics covered include:

- Introduction to vibration
- Components of a predictive maintenance program
- Basic fault identification
- Vibratory fault characteristics and patterns
- Information to help start a vibration program

### Basic Vibration Analysis Course 2031

4 days

This class is intended for students who desire an integrated, hands-on approach to vibration analysis. Students will use CSI technologies for lab exercises. The course combines basic vibration analysis and basic machinery analyzer operations into a comprehensive approach to vibration problem-solving.

Prerequisites: Fundamentals of Vibration or up to six months of vibration experience is recommended.

Topics covered include:

- Basic CSI 2130 / 2120 Analyzer functions
- Machined defect recognition
- Computer software operations

Participants will receive a complimentary copy of the *Pocket Vibration Analysis Troubleshooter Guide*.

### Intermediate Vibration Analysis Course 2032

4 days

This course introduces waveform data as a powerful additional analysis method and stresses phase analysis in all appropriate applications. It also discusses case histories on machinery faults – the next step in the progression of data collection and analysis abilities. The course features CSI brand machinery analyzers to support these advanced machinery analysis techniques.

Prerequisites: Basic Vibration Analysis and six months to two years vibration experience is recommended.

Topics covered include:

- Analyzer averaging techniques
- Slow speed applications using SST
- Sensor selection guidelines
- Introduction to demodulation and PeakVue methods
- Advanced waveform analysis
- Sideband analysis
- Rolling element bearing failure modes
- Advanced electrical analysis techniques
- Phase analysis using single- and dual-channel

Students will receive a complimentary copy of the *Simplified Handbook of Vibration Analysis, Volume I*, by Art Crawford.

## **Advanced Vibration Analysis Course 2033**

4 days

This course interactively teaches single- and dual-channel vibration measurement and analysis techniques, as well as how to take measurements and evaluate data. Resonance testing, phase analysis and operational deflection shape testing are key components. The course also introduces digital signal processing concepts and use of AMS Machinery Manager to set up dual-channel and split-channel route collection.

**Prerequisites:** Intermediate Vibration Analysis and one to three years vibration experience is recommended.

Topics covered include:

- Digital signal processing
- PeakVue technology
- Slow Speed Technology (SST)
- Zoom analysis
- Waveform parameters
- Dual-channel machinery analyzer features
- Triggered data capture
- Resonance detection
- Vibration analysis problems

Students will receive a complimentary copy of the *Simplified Handbook of Vibration Analysis, Volume II*, by Art Crawford.

## **Introduction to Windows-Based ODS/Modal Course 2039**

4 days

This course is designed to teach Operating Deflection Shape (ODS) and Modal Analysis software. This course uses the CSI 2130 or 2120 single- and dual-channel machinery health analyzers to teach the practical concepts of ODS/modal measurement techniques and display options. The modal course is introductory and will not cover theory or mathematical background.

**Prerequisites:** Knowledge of dual-channel analyzers and at least one year of full-time vibration analysis experience is recommended.

Topics covered include:

- Building of the wireframe model
- Measurement considerations
- Collecting ODS data with and without a tachometer reference
- Using an impact hammer with the CSI 2130/2120 Advanced Dual-Channel DLP
- Interpretation of results

## **Electric Motor Diagnostics and MotorView Course 2081**

4 days

The MotorView course is intended for students who are experienced in vibration analysis and diagnostics and focuses on the theoretical concepts of motor diagnostics. This course uses labs and case histories to demonstrate the functionality of the MotorView software in determining rotor bar defects using current and flux data. This course was designed for mechanical- and electrical-skilled personnel who may not have a background in motor theory, operation, and construction.

Topics covered include:

- Basic electrical principles
- AC/DC motor theory and design
- Variable frequency drives
- Data collection methods
- Current spectra and waveform analysis
- Flux spectra analysis and data evaluation
- Temperature data
- Shaft current
- Analysis of case histories
- Windows configuration for MotorView operation

## Vibration Analysis Certification

Testing can be scheduled to coincide with your course attendance. Please arrange for testing when you call to register for your course.

### Level I Vibration Analyst Certification Course 2054

½ day

Prerequisites: Basic and Intermediate Vibration Analysis

Test Format: Written exam only

Passing Grade: 70

Must show proficiency in:

- Understanding and interpreting basic vibration data, spectrum, waveform, and phase
- Understanding common vibration terminology
- Identifying common machinery faults
- Identifying fault severity using vibration data



### Level II Vibration Analyst Certification Course 2055

1 day

Prerequisites: Vibration Analysis Level I Certification and Advanced Vibration Analysis are recommended.

Test Format: Written and hands-on exam

Passing Grade: 70 in each format

Must show proficiency in:

- Analyzing advanced machinery faults found in rotating equipment, including:
  - Airflow disturbances
  - Cavitation
  - Anti-friction bearings
  - Sleeve bearings
  - Resonance
  - Electrical
  - Phase analysis
- Identifying and performing advanced diagnostic measurement techniques with a single-channel analyzer
- Evaluating fault severity and making appropriate repair recommendations
- Understanding basic uses of multi-channel analysis techniques including orbits and cross-channel phase

## ISO Courses

### ISO Category I Vibration Analyst Course 2021

4 days

This course complies with ISO standard 18436-2: Vibration condition monitoring and diagnostics. It is intended to enable students to operate single-channel machinery analyzers, dump and load routes, recognize the difference between good and bad data, and compare vibration measurements against pre-established alert settings. The recommended level of cumulative field experience is six months.

Topics covered include:

- Principles of vibration
- Data acquisition
- Signal processing
- Condition monitoring
- Fault analysis
- Corrective action
- Equipment knowledge
- Acceptance testing

### Category I Certification for ISO Complaint Training Course 2021EX

Test Format: Written exam

Duration: 4 hours

Passing Grade: 75

## **ISO Category II Vibration Analyst Course 2022**

5 days

This course complies with ISO standard 18436-2: Vibration condition monitoring and diagnostics. Category II vibration analysts are expected to be able to select appropriate vibration measurement techniques, set up instruments for basic resolution of amplitude, frequency, and time, perform basic spectrum analysis, maintain a database of results and trends, perform single-channel impact tests, classify, interpret, and evaluate test results in accordance with applicable specifications and standards, recommend minor corrective actions, and understand basic single plane field balancing concepts. The recommended level of cumulative field experience is 18 months.

Topics covered include:

- Subjects along with those in Category I course
- Equipment testing and diagnostics
- Reference standards
- Reporting and documentation
- Fault severity determination

### **Category II Certification Exam for ISO Compliant Training Course 2022EX**

Test Format: Written exam

Duration: 4 hours

Passing Grade: 75

## **ISO Category III Vibration Analyst Course 2023**

5 days

Complies with ISO standard 18436-2: Vibration condition monitoring and diagnostics. This course expands on the subjects covered in the Category II course, especially in the areas of fault analysis and corrective actions. The recommended level of cumulative field experience is 36 months.

Category III vibration analysts are expected to be able to:

- Specify appropriate vibration instrumentation hardware and software for both portable and permanently installed systems
- Perform spectrum and time waveform analysis under both steady-state and unsteady operating conditions
- Establish vibration monitoring programs
- Establish specifications for vibration levels and acceptance criteria for new machinery
- Measure and analyze basic operational deflection shapes (ODS)
- Understand and direct use of other condition monitoring technologies such as ultrasonics, infrared thermography, and oil analysis
- Measure and analyze PeakVue measurements
- Perform basic single-plane field balancing

- Prepare and submit machinery condition reports
- Provide instruction and technical direction to vibration trainees

Category III certification exam for ISO compliant training available at the end of the course

### **Category III Certification Exam for ISO Compliant Training Course 2023EX**

Test Format: Written exam

Duration: 4 hours

Passing Grade: 75

## CSI 2130 Machinery Health Analyzer Courses

### Fundamentals of CSI 2130 Course 2072

*(Also available: Fundamentals of CSI 2120, Course 2071)*

2 days

This hands-on course focuses on the basic operation of the CSI 2130 Machinery Health Analyzer. Students will collect data from machines similar to those found in plants. The course was designed for students with little or no experience with CSI analyzers, but who are experienced in the field of vibration data collection and analysis. If you also need to learn vibration analysis skills, we recommend taking the Basic Vibration Analysis course.

Prerequisites: Understanding of vibration analysis.

Topics covered include:

- Analyzer/computer communication
- Predefined route data collection
- Off-route data collection and set up
- Monitor mode measurements
- Peak and phase measurements

Note: You may take this course with Fundamentals of Vibration as a four-day course.

### eLearning: Fundamentals of CSI 2130 Course e2130

3 months (unlimited access)

Students can now participate in an online training course for Fundamentals of CSI 2130.

Learn how to load a pre-defined route into the CSI 2130, gather general data and specialized data, and then interface the data with a computer for further diagnostic analysis.

Topics covered include:

- Analyzer-computer communication
- Predefined route data collection
- Off-route data collection and setup
- Monitor mode measurements
- Peak and phase measurements

Online training puts the information in your hands at your convenience.

- Access the eLearning course anytime within 3 months after registration
- Available at your home, office, or anywhere you can access the Internet

To register for the eLearning course, call 1-800-675-4726 or email [Nancy.Goettsch@Emerson.com](mailto:Nancy.Goettsch@Emerson.com).

### Advanced CSI 2130 with PeakVue Course 2091

*(Also available: CSI 2120 with PeakVue, Course 2034)*

3 days

This course is intended for students with single-channel vibration analysis experience and little or no multi-channel experience. It covers advanced signal processing using Emerson's patented PeakVue technology for slow-speed analysis, transient capabilities, coherence and cross-channel phase, Operating Deflection Shapes (ODS), modal analysis, and other advanced techniques.

Prerequisites: Single-channel vibration analysis experience is required.

Topics covered include:

- PeakVue
- Advanced Transient Downloadable Program (DLP)
- System vs signal analysis
- Dual-channel data collection
- Fundamentals of cross-channel data collection
- Introduction to coherence and cross-channel phase
- Orbit data collection
- Introduction to ODS testing methods
- Introduction to modal analysis testing methods
- Advanced two-channel DLP

**Taking the Mystery Out of  
PeakVue Technology  
Course 2035**

2 days

This course is taught by expert vibration consultants who provide training on the advanced functionality of Emerson's PeakVue technology. Learn how the autocorrelation coefficient function works and become familiar with the properties of microscopic vibration stress waves.

This course uses case studies from real-life examples of common faults and live demonstrations, illustrating specific mounting procedures to reliably detect certain faults. The difference between PeakVue techniques and demodulation is also demonstrated.

**Prerequisites:** Students should be familiar with vibration data collection and analysis techniques and have used AMS Machinery Manager.

Topics covered include:

- Proper PeakVue setups for all speeds (as low as 1 rpm)
- Sensor selection and sensor mounting
- Setting alarm levels
- Choosing trend parameters
- Analyzing PeakVue spectra and waveforms
- Using and understanding the autocorrelation coefficient function
- Uses of the circular waveform plot

**Autocorrelation as an Advanced  
Diagnostic Tool  
Course 2075**

1 day

This course will teach the power of the autocorrelation coefficient function for the analysis of vibration-induced time waveform data. The autocorrelation function is generally computed from the same time waveform data used to compute the spectrum. The strengths of the autocorrelation data are complimentary to the strengths of the spectral data.

This class will be instructed by Dr. Jim Robinson and Jim Crowe, both experts in PeakVue and vibration analysis.

This class will:

- Introduce the autocorrelation coefficient
- Demonstrate the computation of the autocorrelation coefficient data from the time wave form data
- Highlight the strengths of the autocorrelation coefficient function data relative to spectra data
- Demonstrate the use of the autocorrelation coefficient data as a diagnostic tool to support the spectra data for vibration analysis through several case studies.
- Identify unique patterns of the autocorrelation function data for certain classes of bearing faults, gearing faults, etc.

## AMS Suite: Machinery Health Manager Courses

### Introduction to AMS Machinery Manager Course 2068

4 days

This course is designed for the new users of AMS Machinery Manager. Students learn methods of database creation and vital features of route creation, such as collecting reference data, analyzer/computer communication, and the basic concepts of Analysis Parameter Sets, Alarm Limit Sets, and Fault Frequency Sets. A CSI 2130 Analyzer will be used to load routes and collect data on lab machinery for basic vibration analysis using Export and Diagnostic Plotting.

Prerequisites: Computer experience with the Windows operating system and the Basic Vibration Analysis course are recommended.

Topics covered include:

- Equipment configuration using RBMwizard®
- Machine duplication
- Route creation
- Basic diagnostic plot options
- Introduction to reporting techniques
- Problem reporting

### Intermediate AMS Machinery Manager Course 2074

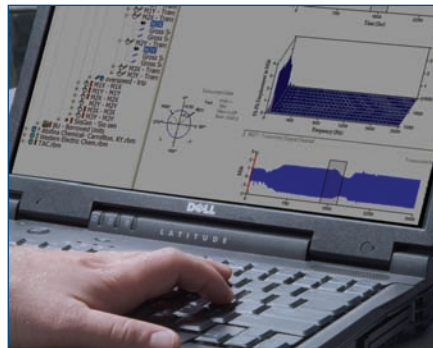
4 days

This course is designed for students who have a basic understanding of AMS Machinery Manager. Students expand their knowledge of machinery analysis techniques, focusing on analysis and reporting using PlotData, Diagnostic Analysis, Export, PeakVue, and the full version of RBMview.

Prerequisites: Introduction to AMS Machinery Manager course.

Topics covered include:

- PlotData
- Diagnostic analysis
- Exporting
- PeakVue technology
- RBMview



### Advanced AMS Machinery Manager Course 2070

4 days

This course expands students' understanding of AMS Machinery Manager. Gain hands-on experience through the creation of a class database with example machines and collecting vibration data for problem analysis and reporting. Students will learn to use the advanced analysis and reporting functions of AMS Machinery Manager.

Prerequisites: Intermediate AMS Machinery Manager course. Intermediate Vibration Analysis course or one year vibration analysis experience. Experience with the Windows operating systems is recommended.

Topics covered include:

- Advanced analysis features in Diagnostic Plots
- Problem reporting
- Status-at-a-Glance operation and reporting
- Nspectr® reporting techniques and modification/addition of setup information
- RBMwizard reporting techniques and modification/addition of setup information

## CSI Online Technologies Courses

### CSI 4500 Machinery Health Monitor

*(This class also applies to the CSI 6500)*

#### Course 2088

4 days

This course is best suited for those who have a CSI 4500 system installed and operational prior to attending the course.

Topics covered include:

- Vibration basics and terminology related to the CSI 4500
- System overview: functionality and system components
- Online Watch — used to monitor the system daily
- Online Config — adding a new machine to an existing database
- Plotdata — spectrums, waveforms and trend data
- PeakVue processing
- Review of customer databases

Prerequisites: Knowledge of vibration and industrial machinery is helpful, but not necessary.

The course is designed for:

- System operators or analysts
- Operations personnel using the CSI 4500 daily
- Those responsible for configuring databases and analyzing data

*For training for the CSI 9420 Wireless Vibration Transmitter and other Emerson Smart Wireless products, call: 641-754-3011*

### Turbomachinery Diagnostics using the CSI 4500 or the CSI 6500 with Transient Course 2089

5 days

This class details the operation, maintenance, management, diagnostics, and design of rotating machinery using vibration information. Emphasis is placed on interpreting startup/shutdown and steady state vibration data plots, understanding the sources of rotating machinery vibration, and recognizing common machinery malfunctions.

This seminar makes extensive use of full-featured field diagnostic equipment to reinforce lecture topics. The class is designed for engineers, supervisors, managers, and rotating equipment support professionals responsible for design, operation, and maintenance of rotating equipment.

Students will receive a complimentary copy of *Fundamentals of Rotating Machinery Diagnostics*, by Donald E. Bently.



### CSI 9210 Machinery Health Transmitter Course 2090

2 days

This class is available at our Austin Training Center and is meant for companies with FOUNDATION™ fieldbus and installed CSI 9210 systems. The CSI 9210 monitors any plant asset by providing overall and PeakVue vibration values along with temperature back to AMS Machinery Manager and/or your control system.

Topics covered include:

- Introduction to the CSI 9210 and vibration analysis
- Commissioning
- Configuring within DeltaV™
- Parameter trending

### CSI 6000 Machinery Health Monitor Course 2080

2 days

This hands-on training course is for students who operate and maintain a CSI 6000 online machinery monitoring system. Workshop includes practice with “live” monitors and racks.

Topics covered include:

- Overview of hardware components
- Rack configuration
- Operator display software
- Data acquisition software
- Interface with CSI 4500 / CSI 4500 Transient
- System troubleshooting and maintenance

## Lubrication Courses

*(Level I and II Lubrication courses can be taken together)*

### Level I Lubrication with Certification Course 2082A

2 days

This course is designed for individuals who have limited or no oil analysis experience. Guidelines and instruction for starting an oil analysis program are provided. The course focuses on the basic properties of lubricants and lubricant specifications, including additive packages, and gives an overview of laboratory testing methods and interpretation of test data.

In addition, instruction will be provided on proper storage and handling of unused lubricants, sample point identification, and best practices for collecting samples from machinery. Basic contamination control, wear debris analysis, and identification will be covered.

Topics covered include:

- Starting a productive lubricant analysis program
- Analyzing oil data
- Identifying common types of wear debris, their origins, and corrective actions
- Importance of contamination control
- Designing sampling, storage and handling procedures

Optional Level I Lubrication Certification is available at no additional charge.

### Level II Lubrication with Certification Course 2082B

2 days

Learn the use of oil analysis with other predictive technologies to enhance your machinery health program. Machine life extension and reduction of unscheduled downtime will be covered in depth.

Training includes introduction to lubricant engineering, failure concepts, and failure prevention. Information will be provided on greases and synthetic lubricants, including advantages and applications.

Guidelines and step-by-step procedures will be offered for consolidating lubricants, setting alarm limits, and managing and enhancing existing lubrication programs.

**Prerequisites:** Basic understanding of lubrication.

Topics covered include:

- Components of RBM lubrication program
- Methods for extending machine life
- Importance of wear debris analysis and contamination control
- Lubricant consolidation
- Establishing alarms

Optional Level II Lubrication Certification is available at no additional charge.

### OilView® for AMS Machinery Manager Course 2083

4 days

The course is designed for those who are new to CSI onsite oil analysis instruments and experienced users who wish to use advanced OilView features in AMS Machinery Manager.

Students learn database creation and modification, Analysis Parameter, and Alarm Limit Sets.

The course demonstrates how to set up and configure the OilView software module, discusses calibration and use of OilView instruments (including the CSI 5200 Trivector Analyzer) for analyzing oil samples onsite, and explains data interpretation and basic reporting.

Topics covered include:

- Introduction to Oil Analysis
- Onsite Analysis
- Reference Oil Database Management
- Database Construction and Modification
- Analysis Parameter Sets
- Alarm Limit Sets
- Best Practices for Onsite Analysis Using OilView
- Importing Laboratory Data
- Basic Wear Debris Analysis
- Data Analysis and Reporting

## **Wear Debris Analysis Course 2084**

2 days

Wear debris analysis (WDA) is often referred to as the most important form of oil analysis. This course teaches how to apply environmental conditions and other outside factors to make an accurate root cause analysis. Attendees will gain a basic understanding of wear particle generation, sample preparation techniques, and identification of wear particles.

Topics covered include:

- Theory presentation
- Wear particle generation
- Tribology, friction, and wear
- Lubrication fundamentals
- Sample screening: Using preliminary data and equipment type to select WDA candidates and sample preparation techniques
- Interpretation of oil analysis results related to WDA, such as OilView indices and commercial oil laboratory data
- Sample preparation techniques: grease, oil, hydraulic fluid, and synthetics
- Disciplined and systematic approach to WDA: overview of the OilView WDA module
- Particle identification and characterization exercise
- Identification and characterization using photographs and/or live samples

## **eLearning OilView for AMS Machinery Manager Course E2083**

The course is designed for those who are new to CSI onsite oil analysis instruments and experienced users who wish to use advanced OilView features in AMS Machinery Manager. Students learn database creation and modification, Analysis Parameter, and Alarm Limit Sets.

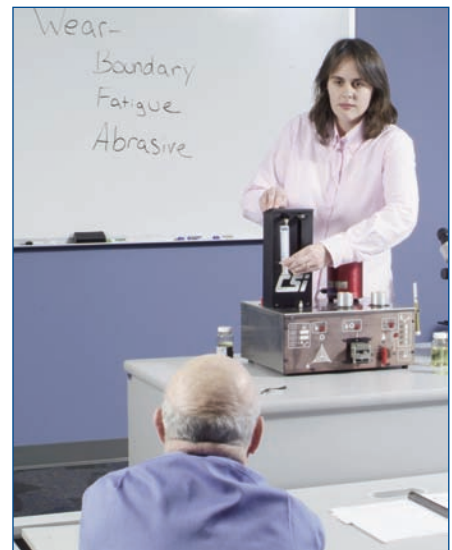
The course demonstrates how to set up and configure the OilView software module, discusses calibration and use of OilView instruments (including the CSI 5200 Machinery Health Oil Analyzer) for analyzing oil samples onsite, and explains data interpretation and basic reporting.

Topics covered include:

- Introduction to Oil Analysis
- Onsite Analysis
- Reference Oil Database Management
- Database Construction and Modification
- Analysis Parameter Sets
- Alarm Limit Sets
- Best Practices for Onsite Analysis Using OilView
- Importing Laboratory Data
- Basic Wear Debris Analysis
- Data Analysis and Reporting

The eLearning OilView class is also available with the Training Manual used in regular scheduled classes.

- Access the eLearning course anytime within 3-months after registration
- Available at your home, office, or anywhere you can access the Internet



## Thermography Courses

### Infrared Analysis for AMS Machinery Manager Course 2018

3 days

This course is designed for maintenance personnel who want to learn how to incorporate infrared-related data into AMS Machinery Manager. Infrared (IR) Analysis establishes the foundation and provides the tools required for a sound thermography inspection program. It identifies the equipment to be scanned, the monitoring schedule, and other information needed to construct a database that defines the monitoring procedures for your program.

**Prerequisites:** Computer experience with Windows operating system is recommended.

Topics covered include:

- Overview of AMS Machinery Manager
- Thermographic database setup management
- Thermographic route management
- File transfer to/from IR imager
- IR event collection
- Image viewing and event reporting
- IR analysis tools
- IR reporting
- Case history compilation

### IR Thermography Level I with Certification Course 2019

4 days

This class is intended for students who have limited or no experience in infrared thermography analysis and diagnostics. Emerson thermography courses meet or exceed Level 1 ASNTTC- 1A recommended practices.

Successful completion of the courses and passing of optional examinations can lead to Level I certification.

Topics covered include:

- Physics of infrared energy
- Components of infrared light
- System components and data collection
- Setting acceptance criteria for electrical and mechanical components
- Data storage, trending, and reports
- System coordination with other PDM technologies
- Built-up roofs



## Ultrasonics Courses

### Basic Ultrasonic Theory and Techniques Course 2067

3 days

This Level I course is a comprehensive course for students with little or no experience in ultrasonic testing. Although introductory, the course offers in-depth coverage of ultrasonic theory and instrument operation. Through lecture and lab exercises, students gain an understanding of technical principles and test procedures.

Topics covered include:

- Introduction to ultrasonics
- Basic principles of acoustics
- Measurement techniques
- Testing methods

Ultrasonics Level I Certification Exam is also available.



## Balancing Courses

### Balancing Theory and Techniques Course 2015

4 days

*(May be taken as two 2-day classes)*

This class teaches how to perform single- and dual-plane balancing using both graphical and analyzer-based balancing methods. The class uses the CSI 2130 Machinery Health Analyzer.

Topics covered include:

- Imbalance identification
- Use of vectors
- Calculate influence coefficients
- Use of the auxiliary analyzer balance functions
- Use of UltraMgr module
- Calculate a system lag
- Estimate trial weights
- Balance flexible rotor systems
- Balance overhung rotors
- Apply balancing techniques in an industrial setting

Training for CSI 2120 and UltraSpec products is also available.

## Alignment Courses

### Laser Alignment for CSI 2130 Course 2092

2½ days

*(Also available: Laser Alignment for CSI 2120 and UltraSpec Users, Course 2043)*

This class is intended for students who have limited or no alignment experience. It provides training on shaft alignment using CSI technologies, focusing on the CSI 2130 Machinery Health Analyzer. This course includes hands-on training with horizontal alignment demonstrators and covers management of an alignment program using AMS Machinery Manager.

Topics covered include:

- Alignment
- Required pre-shutdown checks
- Pre-alignment checks and corrections
- Science and art of alignment
- Tools and techniques for moving equipment
- Time-savers
- Alignment information management
- Management systems: methods and advantages

## **Vertical Alignment (for UltraSpec users) Course 2061**

1 day

This class is intended for students who have alignment experience. It provides training on shaft alignment using technology from the Emerson laser alignment product line. The course includes hands-on training with vertical alignment demonstrators.

**Prerequisites:** Alignment experience is recommended.

Topics covered include:

- Science and art of alignment
- Tools and techniques for moving equipment
- Time-savers
- Use of Emerson laser alignment product



## **Maintenance Strategy Courses**

### **Maintenance Best Practices Course 2093**

2 days

In today's industrial environment proper installation and maintenance of equipment is essential. This 2-day course will give you the knowledge to correctly identify various types of components, proper installation, and their location on various machines. The course will also discuss safe work practices and safe lock out and tag out. Onsite classes can be adapted for the issues at your plant.

Topics covered include:

- Bearing identification and installation
- Component lubrication
- Mechanical seal identification and installation
- Couplings
- Thread pitch
- Pumps (centrifugal, positive displacement), compressors and turbines
- Gear boxes
- Belt and chain drives (sprockets, sheaves)
- Conveyors
- Lubrication

## **Tools for Optimizing Maintenance Performance Course 2085**

3 days

This course is designed for managers, engineers, and technicians looking to develop the future stages of their maintenance management strategy. It provides students with an incisive understanding of maintenance best practice and the role of organizational and technological policies.

During the course, students gain a new vision of asset management and maintenance performance and knowledge of essential elements of a proactive maintenance and inspection program. Students also acquire the knowledge and skills to align asset management for dramatic effect on the capabilities of the maintenance function.

Topics covered include:

- Defining maintenance objectives and introduction to key tools
- Developing a proactive maintenance plan
- Asset reliability process and program implementation
- Managing and measuring the impact of maintenance optimization

**Root Cause Failure Analysis  
Course 2053**

3 days

This course provides participants with the tools they need to begin the process of identifying Root Cause Failure Analysis (RCFA). The course was designed for managers, engineers and technicians who are looking to establish a RCFA program to enhance an existing predictive/preventive maintenance program. The course introduces the various facets of benchmark RCFA programs.

**Prerequisites:** One to two years of experiences with a predictive maintenance program is recommended. No specific knowledge of predictive technologies is required.

Topics covered include:

- Failure definitions and types of failure
- Establishing a RCFA program
- When to initiate investigation
- Investigation methodology
- Cost/benefit evaluation and performance metrics
- Review of machinery and component failure modes
- Case histories



**Onsite Training**

Training is vital for getting the most out of your reliability program, but traveling to an offsite class can sometimes be an issue for you or your staff. Today we have a solution.

Emerson instructors can bring the benefits of classroom training to your plant. Most Emerson reliability training classes can be held in your facility where more of your reliability staff can learn the most effective techniques using the equipment you have available now. Training can be tailored to your needs and to deal with the issues which affect your operations every day.

Call now to inquire about the onsite classes and improve your bottom line: 800-675-4726

## Continue Your Education With Emerson Training

Emerson training is a proven way to acquire confidence and experience in the technologies associated with industrial maintenance. Our alumni are considered valuable assets to their organizations and are proud of the recognition and job promotions they've received from plant management. Attending Emerson training is an investment in your career and in the efficient and competitive operation of your facility.

More than simply a catalog of courses, Emerson training provides an educational path that leads to full mastery of the knowledge and skills necessary in a Machinery Health program. These "Paths to Success" are outlined for you here. They include theory/application classes that are required for certification and product-specific classes for getting the most out of your existing hardware/software tools.

The same hands-on, application-intensive courses offered in our own classroom environment can also be taught in your facility. For a calendar schedule of courses, course descriptions, and registration information, go to [www.assetweb.com/mhm](http://www.assetweb.com/mhm).

## Level I Vibration Analyst Path to Success

- Fundamentals of Vibration Analysis\*
- Fundamentals of the CSI 2130
  - Taken same week as Fundamentals of Vibration Analysis
- Basic Vibration Analysis\*
- Intermediate Vibration Analysis\*
- Introduction to AMS Machinery Manager
- Level I Vibration Analysis Certification Exam\*

## Level II Vibration Analyst Path to Success

- Advanced Vibration Analysis\*
- Intermediate AMS Machinery Manager
- Advanced CSI 2130 with PeakVue
- Level II Vibration Analysis Certification Exam\*

## Advanced Vibration Analyst Path to Success

- Root Cause Failure Analysis
- Introduction to Windows Based ODS/Modal Analysis
- Advanced AMS Machinery Manager
- Taking the Mystery Out of PeakVue Technology
- Auto correlation as an Advanced Diagnostic Tool

\* Indicates course is required for certification testing.

## Lubrication Analyst Path to Success

- Lubrication Level I with Certification Exam\*
- Lubrication Level II with Certification Exam\*
- OilView for AMS Machinery Manager
- Wear Debris Analysis
  - Taken after Lubrication Level I and II

## Online Monitoring Path to Success

- CSI 9210 Machinery Health Transmitter
- CSI 4500 Machinery Health Monitor
- Turbomachinery Diagnostics using CSI 4500 with Transient
- CSI 6000 Machinery Health Monitor

## Adding other technologies to your credentials

- Electric Motor Diagnostic and MotorView
- Laser Alignment with Vertical for the CSI 2130
- Basic Ultrasonic Theory & Techniques
- Infrared Analysis for AMS Machinery Manager
- IR Thermography & Level I Certification Exam
- Balancing Theory & Techniques

# REGISTRATION FORM

Complete a separate registration form for each class you attend. Deadline for registration is one week prior to start of class.

Name to appear on class certificate

\_\_\_\_\_  
Name to appear on name tag

\_\_\_\_\_  
Country of Citizenship

\_\_\_\_\_  
Company

\_\_\_\_\_  
Physical or Shipping Address

\_\_\_\_\_  
City/State/Zip

\_\_\_\_\_  
Billing Address

\_\_\_\_\_  
City/State/Zip

\_\_\_\_\_  
Phone

\_\_\_\_\_  
Fax

\_\_\_\_\_  
Email

\_\_\_\_\_  
Course or Certification

\_\_\_\_\_  
Dates of Course or Certification

Course location  Knoxville  Austin  
 San Diego  
 \_\_\_\_\_

Today's Date   -   -

FORM OF PAYMENT (MUST BE COMPLETED)

Credit Card # \_\_\_\_\_

\_\_\_\_\_  
Expiration Date

\_\_\_\_\_  
Please print cardholder's name

Visa  Mastercard  AMEX

\_\_\_\_\_  
Authorized signature

\_\_\_\_\_  
Phone

\_\_\_\_\_  
Fax receipt to

Check # \_\_\_\_\_

Purchase Order # \_\_\_\_\_

\_\_\_\_\_  
Total amount of purchase order

Please make purchase order out to Emerson (to the address below) and **please send a copy with your registration**

Does this P.O. cover more than one registration?

YES  NO

Training Certificate: ACERT #:

\_\_\_\_\_  
A copy of your certificate for training must accompany your registration. Please bring the certificate with you to class.

**Note: A confirmation will be sent to you to confirm your place in the class within 72 hours of receiving your registration. If you do not receive a confirmation, your space in class is not guaranteed, so please call.**

I have the prerequisites for this course. I know the date, starting time and directions to the training facility. I understand the cancellation policies.

Date   -   -   Signature \_\_\_\_\_

## RETURN TO

Emerson • Attn: Education Services  
835 Innovation Drive  
Knoxville, Tennessee 37932  
Phone: 800-675-4726  
Fax: 865-218-1411

## Registration Information

### Tips for Easy Registration

1. For a list of current class schedules, go to [www.assetweb.com/mhm](http://www.assetweb.com/mhm).
2. Make one copy of the registration form for each student.
3. Carefully and legibly complete the registration form(s), including purchase order/check number, credit card information, or certificate. Your registration cannot be processed without this information.
4. Fax the registration form to Emerson Education Services at 1-865-218-1411. If paying with a PURCHASE ORDER, a faxed copy is required. If paying with a CERTIFICATE, include copy of it with your faxed registration form and bring the original to class.
5. Watch for a confirmation within 72 hours of faxing your registration. If you do not receive a confirmation, please call 1-800-675-4726.
6. Register as early as possible to get into your preferred classes. Payment must be received prior to class.
7. Do not purchase non-refundable airline tickets. If for some reason a class is cancelled, Emerson is not responsible for non-refundable tickets.

8. Take advantage of our money-saving discounts. We offer a 10% discount if you do any of the three things listed below:

- Attend two classes in one week
- Attend two full consecutive weeks of classes
- Submit your complete registration at least four weeks in advance of the class

NOTE: Only one discount per registration.

## Education Certificates with Product Purchases

Certificates of attendance are provided with some product purchases. The certificates is included with your product. If you qualify for a certificate and did not receive one, contact your sales coordinator. When you mail or fax your registration form, be sure to include a copy of the certificate and bring the original with you to class.

## Cancellation Policy

The cancellation deadline is one week before the start of the course. If you cancel before the deadline, we will either refund the cost of the course or reschedule at your convenience. If you cancel after the deadline but before the course begins, we will refund 75% of the cost or reschedule at your convenience. If you cancel after the course begins or do not show up, you forfeit the entire cost of the course.

In case of a sudden, serious illness or a death in your immediate family, you or your company must notify us within 24 hours that you cannot attend. If you do not notify us within 24 hours after the emergency arises, you must pay a 25% penalty for late cancellation. We will reschedule any late cancellation upon request after payment of the late cancellation penalty.

If you register for a course with a certificate, you may cancel before the deadline and reschedule. If you cancel after the deadline but before the course begins, you will owe the 25% cancellation fee. If you cancel after the course begins, you forfeit the course attendance. To reschedule a course, you must pay full price.

**Emerson Process Management**

**Asset Optimization Division**

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