



CAT-III

ISO 18436 Category III

Advanced Vibration Analyst Training & Certification

Public Courses and Online Training

Learn vibration analysis from the world's leading provider of training & certification. At Mobius Institute, we offer the most understandable and interesting training available. Our Crystal Clear™ training methodology is unique, using hundreds of 3D animations and software simulations that make complex concepts easier to understand. We offer ISO 18436 Category I to IV training via public venue courses as well as online through the Mobius Institute website.

Mobius Institute is ISO/IEC 17024 and ISO 18436-1 accredited, meaning that you are assured that your certification meets the highest global standards, and our training teaches you everything you need to know according to the ISO 18436 standard for vibration analyst training. There is no more highly regarded training & certification available.



CAT-III Course Overview



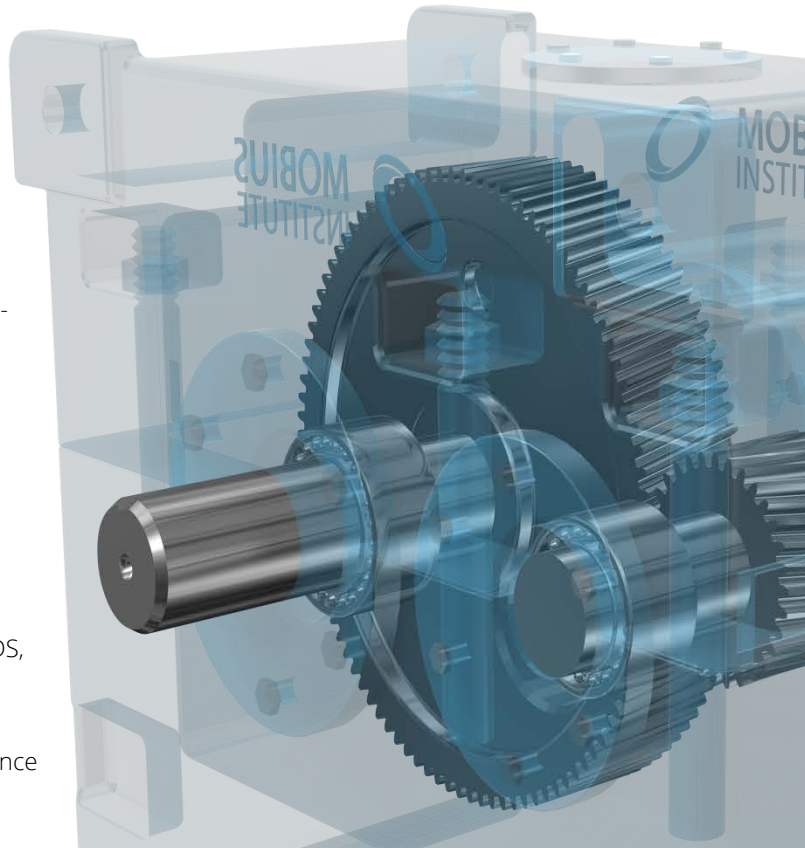
The Category-III course covers four days, with an additional day for review and the exam, is intended for people who are confident with spectrum analysis but who wish to push on and learn more about signal processing, time waveform and phase analysis, cross-channel testing, machine dynamics, and fault correction. If you wish to truly advance in vibration analysis and be able to run a successful condition monitoring team, then you are ready for this course. The course exceeds the ISO 18436-2 Category III standard and meets the ASNT Level III Recommended Practice.

You will learn to diagnose all of the common faults conditions with rolling element and sleeve bearing machines, by utilizing time waveforms, phase readings and other techniques to diagnose faults. You will also learn machine dynamics (natural frequencies, resonance, etc.) and how to perform resonance testing and correct resonance problems. The course also covers single and cross-channel measurement capabilities of your analyzer. And after completing the CAT-III course, you will be able to set and run a successful vibration program, and mentor the junior analysts.

Mobius vibration analysis training is unique. We use 3D animations, Flash simulations, and numerous software simulators that completely demystify vibration analysis. While vibration training courses have traditionally been very theoretical, difficult to understand, (and boring), you will be captivated by the Mobius training methods, and you will enjoy our practical approach. You will take away skills that you can immediately apply to your job, and you will truly understand what you are doing.

You will leave the course with a solid understanding of:

- How a well-designed program and the RCM approach will improve the OEE and the bottom line
- The condition monitoring technologies – via supplementary training
- How to select the correct measurement location and axis, and collect good, repeatable measurements
- What the Fmax, resolution, averaging and other single-channel and cross-channel analyzer settings mean, and how to select the optimum settings
- How to analyze vibration spectra, time waveform, envelope, and phase measurements
- How to diagnose a wide range of fault conditions
- How mass, stiffness and damping affects the natural frequency of a structure
- How to use phase readings, bump tests, impact tests, negative averaging, peak-hold averaging, transient, ODS, modal analysis to determine natural frequencies and visualize machine movement
- How to balance and align a machine, correct a resonance conditions, and employ isolation.



Our public courses are conducted by an experienced, certified Mobius Institute instructor at Mobius Institute authorized training centers in 50 countries throughout the world. See the Mobius institute website at www.mobiusinstitute.com to see the courses scheduled in your area. All of our training courses are also offered at your site, so if you have several people to train, we can come to your location.

CAT-III Course **Description**

Duration: 4 days Cat III / Level III

Format: Live public course or online learning via the web

Optional: 1 day review & 4-hour certification examination, 70% passing grade

Compliance: ISO 18436 Category III – Vibration Analyst, ASNT SNT-TC-1A Recommended Practice

Public Course Pre-Study: Registered students are given access to the online version of the course via the Mobius Institute Learning Zone before the class and for six months after course completion to assist them with converting the course information into practice

Online Learning: Registered students are given access to the Mobius Institute Learning Management System for a period of 6 months to provide ample time to learn the material and prepare for the optional certification examination

Certification Prerequisite: Prior experience is not required to attend training, but certification requires 36 months experience and ISO Category II certification, or a minimum of 60 months experience in lieu of Category II certification

Outcome: You will leave this course with a complete understanding of vibration and phase analysis, dynamic balancing and shaft alignment, and a developing knowledge of machine dynamics and all condition monitoring technologies

Category III - Candidate Profile:

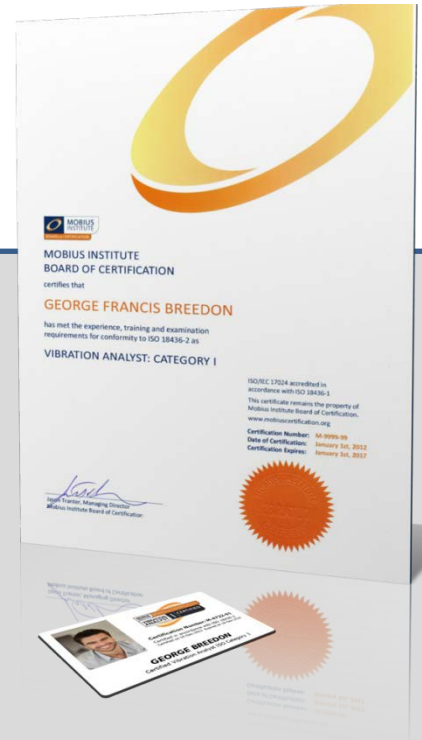
- You have at least two years of vibration analysis experience
- You want to be a leader of the vibration team, or take a leading role in diagnosing faults and making repair recommendations
- You want to understand all data collector options, special test capabilities, all analysis tools and understand the widest range of fault conditions
- You are seeking to become certified to international standards (ISO-18436) by an accredited certification body
- You want to understand all condition monitoring technologies, how and when to apply them
- You want to understand machine dynamics (natural frequencies, resonance, ODS), how to perform resonance testing and how to correct resonance problems

Topics covered:

- Review of condition monitoring technologies and the ISO standards
- Signal processing and data acquisition
- Time waveform analysis
- Phase analysis
- Dynamics (natural frequencies and resonance)
- Testing for natural frequencies
- Operating Deflection Shape (ODS) analysis
- Modal analysis and intro to FEA
- Correcting resonances
- Rolling element bearing fault detection
- Journal bearing fault detection
- Electric motor testing
- Pumps, fans and compressors
- Gearbox fault detection
- Corrective action
- Running a successful condition monitoring program
- Acceptance testing
- Review of ISO standards

The purchase of the **public course** includes six months of access to the Mobius Learning Zone (an excellent web resource) to prepare for the course, and to follow up after the course), a course manual, quick-reference guide, Mobius mouse pad with fault diagnostic reminders and pen. Examinations for certification are offered as an option at the end of the course.

The purchase of the **online learning course** includes six months access to the Mobius Learning Management System (LMS) where you are provided the complete course content, carefully explained and demonstrated on-screen. Optionally, you can order a hard copy training manual, and become certified by taking the optional certification examination through invigilation.



CAT-III Certification

All Mobius certified analysts receive personalized logos with their certification number and name for their own professional use. Mobius Institute also maintains a listing of all certified analysts on our website and provides each analyst with a certification confirmation webpage.

For more information about Mobius Institute's accreditation, and the recognition of your certification by the ISO 18436 standard, please visit www.mobiusinstitute.com/certification.

Get started today

Go to our website to learn more about our public and online learning courses, view the public course schedule for your area. Don't hesitate to mail your questions to learn@mobiusinstitute.com or contact an authorized training center in your region.

MOBIUS INSTITUTE
AUSTRALIA – BELGIUM – COSTA RICA – UNITED STATES
and authorized training centers in 50 countries.
CONTACT: learn@mobiusinstitute.com



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Online Learning & Classroom Course

The Vibration Specialist Advanced course is intended for personnel who have at least two years vibration analysis experience and Category II certification by a recognized certification body. The course provides an in-depth study of diagnostic measurement techniques and the associated applications of the techniques. It is expected that the attendee is either the leader of the vibration team, or takes a leading role in diagnosing faults and making the final recommendation. This person must fully understand all data collector options, special test capabilities, all analysis tools and must understand the widest range of fault conditions.

Detailed topic list:

Review of condition monitoring technologies and the ISO standards

Signal processing and data acquisition

- Filters: Low pass, band pass, high pass, band stop
- Signal to noise ratio
- Analog and digital integration
- Testing low speed machines
- Sampling, aliasing, dynamic range
- Resolution, Fmax, data collection time
- Averaging: linear, overlap, peak hold, negative averaging, time synchronous
- Windowing and leakage
- Order tracking
- Cross channel testing
- Correlation and coherence

Time waveform analysis

- Collecting data - ensuring you have the correct setup
- When should you use time waveform analysis
- Diagnosing unbalance, misalignment, bent shaft, eccentricity, cocked bearing, resonance, looseness and other conditions

Phase analysis

- Collecting data
- Bubble diagrams
- Diagnosing unbalance, misalignment, bent shaft, eccentricity, cocked bearing, resonance, looseness and other conditions

Dynamics (natural frequencies and resonance)

- Natural frequencies and resonances
- Mass, stiffness and damping
- SDOF and MDOF

Testing for natural frequencies

- Run-up coast down tests
- Bode plots and Nyquist (polar) plots
- Impact and bump tests
- Analysis of induction motors

Operating Deflection Shape (ODS) analysis

- Can we prove the existing of a natural frequency?
- Visualizing vibration
- Setting up the job
- Collecting phase readings correctly
- Interpreting the deflection shape

Modal analysis and intro to FEA

- How does modal analysis differ from ODS?
- How does Finite Element Analysis (FEA) differ from modal analysis
- A quick review of the modal testing process

Correcting resonances

- The effect of mass and stiffness
- Beware of nodal points
- Adding damping
- A 'trial and error' approach
- A 'scientific' approach
- Isolation
- Tuned absorbers and tuned mass dampers

Rolling element bearing fault detection

- Why do bearings fail?
 - Cocked bearing, sliding on shaft or inside housing, looseness
 - EDM and DC motors and VFDS
 - Bearing frequencies and what to do when you don't have all the details
 - The four stages of bearing degradation
 - Ultrasound
- (continued on next page)

- High frequency detection techniques
- Shock Pulse, Spike Energy, Peak Vue, and other techniques
- Demodulation/enveloping
- Selecting the correct filter settings
- Spectrum analysis
- Time waveform analysis
- Low speed bearings

Journal bearing fault detection

- What are journal bearings
- Measuring displacement
- Introduction to orbit plots
- Using your analyzer to acquire orbit plots
- Introduction to centerline diagrams
- Eccentricity ratio
- Glitch removal
- How the orbit changes with pre-load, unbalance, misalignment, instabilities, oil whirl and whip

Electric motor testing

- How do motors work?
- Diagnosing a range of fault conditions: eccentric rotor, eccentric stator, soft foot, phasing, broken rotor bars, rotor bar and stator slot pass frequencies
- Motor current analysis

Pumps, fans and compressors

- Unique fault conditions
- Flow turbulence, recirculation, cavitation

Gearbox fault detection

- Spectrum analysis versus time waveform analysis
- Wear particle analysis
- Gearmesh, gear assembly phase frequency (and common factors)
- Tooth load, broken teeth, gear eccentricity and misalignment, backlash and more

Corrective action

- General maintenance repair activities
- Review of the balancing process and ISO balance grades
- Review of shaft alignment procedures

Running a successful condition monitoring program

- Setting baselines
- Setting alarms: band, envelope/mask, statistical
- Setting goals and expectations (avoiding common problems)
- Report generation
- Reporting success stories

Acceptance testing

Review of ISO standards