

Vibration Analyst CERTIFICATION GUIDE

MIBOC Certification according
to ISO 18436-1 and 18436-2
CATEGORY I - IV



ISO 9001 CERTIFIED
ISO/IEC & ISO 18436 ACCREDITED



MOBIUS INSTITUTE Board of Certification

www.mobiusinstitute.com/certification



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Welcome

Thank you for your interest in Mobius Institute Board of Certification (MIBoC), an ISO/IEC accredited certification body having certified vibration analysts from over 100 countries. MIBoC certification is delivered through MIBoC authorized examination centers in over 50 countries. See the MIBoC website at www.mobiuscertification.org to locate an authorized examination center near you.

In addition to receiving your certification through a MIBoC examination center, you also have the convenient option to sit your certification examination at a time and location of your choice using our secure online examination software.

When considering your vibration analysis certification provider, you must be assured that the certification does meet the ISO 18436 specification that all vibration analysts are measured to. Many vibration vendors, consultants and training organizations offer vibration analysis training and certification. Many will advertise that they their training and certification “follows the ISO 18436 standard”, but those not accredited may or may not actually provide you the competency intended by the ISO 18436 standard. Only accredited organizations can and do provide the highest level of recognition associated with the certifying body’s accreditation. Mobius Institute Board of Certification is accredited to ISO/IEC 17024 and ISO 18436-1 by an accredited IAF member organization, to ensure the certification program minimally meet the ISO 18436 specification. IAF organizations include Joint Accreditation System of Australia and New Zealand (JAS-ANZ), American National Standards Institute (ANSI) and the United Kingdom Accreditation Services (UKAS). In addition we are ISO 9001 certified.

Getting Started

MIBoC is here to help you. We have friendly and knowledgeable staff that will guide you along your way through your vibration analyst certification. Never hesitate to contact us with your questions. Because we serve customers through all world time zones, it is best to contact us by email at certification@mobiuscertification.org and we will respond promptly with email.

Thank you

We hope that this Certification Guide provides you a good understanding of what vibration analysis certification is all about. If you have any further questions please don’t hesitate to contact us.

We wish you the greatest success as you educate yourself and become a certified vibration analyst.

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Introduction

This Certification Guide has been written to provide the reader with the essential information, in layman's terms, about the certification scheme of the Mobius Institute Board of Certification.

It contains information about MIBoC's certification scheme, which is accredited by the Joint Accreditation System of Australia and New Zealand (JAS-ANZ). It is therefore internationally recognized and accredited at the same level as organizations which are accredited by the American National Standards Institute (ANSI) and the United Kingdom Accreditation Services (UKAS).

This guide also outlines a roadmap of MIBoC Vibration Analysis certification, as well as the benefits which certification brings, and the requirements that need to be fulfilled to become certified.

This guide should be read in conjunction with the scheme documents, particularly the General Scheme Requirements (ED002) and the Vibration Analysis Scheme Requirements (ED003). These documents can be downloaded from the MIBoC website at www.mobiuscertification.org.

MIBoC's Vibration Analysis Roadmap

MIBoC's scheme covers vibration analysis certification from Category I right through to Category IV, the highest category. Our classification of the Vibration Analyst categories is based on those outlined in standard ISO 18436-2.

Vibration Analysts who are certified through MIBoC should be justifiably proud of their achievements.

Category I Vibration Analysts

Vibration Analysts certified to Category I will have a good understanding of the fundamentals. They will understand how to take good single-channel measurements and the importance of repeatability. They are able to compare vibration measurements against pre-established alert settings, identify errors in data and transfer data to a computer-based system. They will also be able to report on visual observations of equipment condition.



Category II Vibration Analysts

In addition to having the knowledge and capability of a Category I analyst, a Category II Vibration Analyst is able to define routine data collection measurement activities, and use the basic principles of signal analysis to define acquisition and analysis settings to collect data. The analyst can also perform single-channel impact tests to determine natural frequencies, evaluate test results from routine analysis and acceptance tests, diagnose common fault indications, and recommend basic corrective actions.



Category III Vibration Analysts

Vibration Analysts certified to Category III are expected to have all the knowledge and capabilities of a Category I and II analyst and be able to provide technical guidance and instruction to analysts certified to the lower categories. Additionally they will use their in-depth knowledge of the principles and techniques of vibration analysis to make initial diagnoses of faults which are beyond the range of commonly encountered issues. Such knowledge includes the use of spectra, time waveforms and orbits, transfer functions, basic operating deflection shapes and acceleration enveloping.



Category III analysts are qualified to design, establish and manage routine condition monitoring programs, evaluate alarm sets, write work procedures, specify vibration acceptance testing procedures.

They are also able to initiate and validate corrective actions, recommend restrictions to machine operations and direct, when necessary, alternative condition monitoring technologies to verify or investigate issues raised.

Category IV Vibration Analysts

Vibration Analysts certified to Category IV shall have all the knowledge and capabilities of the lower level categories. They will have a broad technical knowledge and experience of a range of machines, and an in-depth knowledge of a selection of them.

They are able to perform signal analysis, including frequency and time domain processing, and they can determine natural frequencies, mode shapes and damping of systems, operating deflection shapes of machines and recommend means for correction.



Category IV analysts can apply vibration theory and techniques (including measurement and interpretation of multi-channel spectral results), basic principles of rotor-bearing dynamics and advanced two-plane balancing.

For further details of the specific topics required at each category, please refer to the Body of Knowledge in Appendix A.

About MIBoC

Mobius Institute began certifying Vibration Analysts in 2005.

The Mobius Institute Board of Certification (MIBoC) was formed in 2011 to provide independent and impartial certification for personnel involved in condition monitoring and diagnostics of machines.

MIBoC's aim is to provide access to vibration analysis certification around the world, and in as many languages as possible. We believe that if an analyst wants to become certified, he or she should not be impeded by location, language or socio-economic situation.

In 2012 MIBoC was formally accredited by the Joint Accreditation System of Australia and New Zealand (JAS-ANZ) to the international standard ISO/IEC 17024 to provide personnel certification in the condition monitoring field.

JAS-ANZ has formal arrangements with a number of international accreditation organizations including the International Accreditation Forum (IAF), the Pacific Accreditation Cooperation (PAC), the Asia Pacific Laboratory Accreditation Cooperation, and the European cooperation for Accreditation (EA).



www.jas-anz.org/register

Other IAF member organizations include ANSI in the United States, SAS in Switzerland and UK AS in the United Kingdom.

This means that certification through MIBoC is recognized internationally.

Committees

The activities and strategic direction of the Mobius Institute Board of Certification are governed by a management team and a number of committees which collectively represent the scheme's stakeholders.

Advisory Board and Governing Body

The remit of the Advisory Board is to ensure that the activities of the MIBoC Board, management team and committees meet the needs of the condition monitoring community, including employers, clients, vendors and training companies.

The Governing Body is responsible for safeguarding the independence and impartiality of MIBoC at all levels, including its organizational structure, policies and procedures.

Scheme Committee

MIBoC's scheme committee is responsible for the development, review and approval of the organization's policies and procedures.

Members of the scheme committee represent stakeholders at a number of different levels, including condition monitoring functionality, industry and geographical region.

Technical Committee

Members of MIBoC's Technical Committee provide expertise on the technical aspects of the certification scheme, including

- the development, review and approval of the examination questions,
- the review and approval of training courses and certifications from other organizations,

- providing an escalation point for technical decisions relating to certification, appeals and complaints.

MIBoC's Certification Scheme

The certification program of the Mobius Institute Board of Certification is accredited to and based on the requirements of international standards ISO/IEC 17024, ISO 18426-1 and ISO 18436-2:

- ISO/IEC 17024 is the ISO standard which outlines how personnel certification programs should be conducted in general.
- ISO 18436-1 is the ISO standard which outlines how personnel certification should be conducted specifically for personnel engaged in Condition Monitoring and Diagnostics of Machines.
- ISO 18436-2 is the ISO standard which outlines the technical requirements that are specific to certification of Vibration Analysis personnel.

MIBoC's policies, processes and procedures are reviewed and approved by its committees to ensure that they are impartial and meet the needs of the various stakeholder groups. The certification program is reviewed regularly and updated when necessary to reflect changes in the ISO standards or requirements of industry.

Benefits of MIBoC Certification

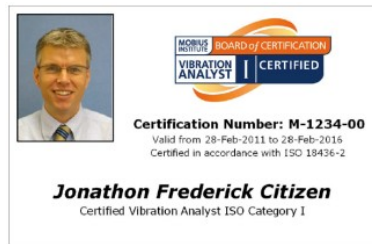
Certification is required by many employers, and a growing list of companies will not use consultants that have not been certified.

Certification by Mobius Institute Board of Certification is the most highly recognized certification available anywhere. MIBoC is recognized as certifying practical vibration analysts, not just people with good memorization skills.

You do not need to be trained by Mobius Institute to obtain MIBoC certification. As long as you meet the training requirements outlined in this Guide (along with the other certification requirements), you will be eligible to apply for MIBoC certification.

We do not charge annual fees to maintain your certification. Once you have obtained your certification, you will not need to pay anything further until its expiry date when you may wish to renew it.

When you are certified by MIBoC you will receive a certificate and card as evidence of your qualification. You will also receive your own personalized certification logo, and (if you consent) your name will be displayed on our website's list of certified analysts.



Certification Requirements

As per the requirements of ISO 18436-2, in addition to passing the certification exam, candidates for certification need to have a combination of education, training, and experience to ensure they understand the principles and procedures which apply to vibration measurement and analysis.

Education

Whilst candidates do not need to provide evidence of any formal education; it is recommended that candidates for Category I and II have at least secondary school graduation diploma or its equivalent.

For Category III and IV candidates it is highly recommended that they have successfully completed two or more years of mechanical technology or mechanical engineering at an accredited college, university or technical school.

Additionally they should be familiar with current VA technology.

All candidates must be able to use a basic scientific calculator and be familiar with the operation of personal computers.

Training

To be eligible to apply for certification, candidates need to provide evidence of successful completion (such as a Certificate of Attendance) of formal training conforming to the requirements of ISO 18436-3 (*Condition monitoring and diagnostics of machines – Requirements for qualification assessment of personnel – Part 3: Requirements of training bodies and the training process*) and based

on the Body of Knowledge specified in Annex A. The minimum training hours are specified in Table 1 below.

Table 1 – Minimum training (hours)

Category I	Category II	Category III	Category IV
30	Category I + 38	Category II + 38	Category III + 64

MIBoC recognizes a number of training courses as meeting the training requirements for certification. For a complete list of recognized courses, please refer to document [ED009](#), which can be downloaded from our website.

If you have attended a course which covers the required topics outlined in the Body of Knowledge specified in Appendix A but is not listed as a recognized course in ED009, then you can still apply to have your training recognized by sending us details of the course and training provider, using form [ED041](#).

Examination

To be eligible for certification, candidates must pass the MIBoC certification examination. As per ISO 18436-2, the required pass mark is 70%.

For more details of the exam, please refer to the *Certification Examination* section below.

Experience & previous certification

Candidates must provide evidence of their practical work experience in the field of machinery condition monitoring and diagnostics. The breadth and depth of the experience is expected to be in line with the category being applied for (refer *Classification of Vibration Analysis Categories* section above).

Candidates will be asked to provide the contact details of a manager/supervisor who can verify the work experience details submitted by the candidate.

The minimum experience requirements are shown in Table 2 below.

Table 2 – Minimum experience (months)

Category I	Category II	Category III	Category IV
6	18	36	60
<i>Note: the figures shown represent the cumulative total months of experience to be gained for each category, based on the nominal number of working hours per week specified by national or regional (e.g. EU) arrangements.</i>			

Certification at Category I is not a prerequisite for certification at Category II.

However, certification at Category III and IV requires previous certification at the lower category.

Candidates applying for certification at Category III only, who have at least 60 months of verifiable vibration analysis work experience, may apply as mature candidates, allowing them to bypass (at MIBoC’s discretion) the requirement of have obtained previous certification at Category II.

Code of Ethics

Candidates certified by MIBoC are expected to maintain the highest standards of personal integrity, professional competence and ethical principles, and will be required to agree to a Code of Ethics in accordance with ISO 18436-1.

The Code of Ethics form [ED034](#) is included in the exam package, and it can also be downloaded from our website.

Certification Exam

MIBoC certification examinations are available in a number of different languages, including English, Spanish, French, German, Chinese, Thai, Korean, Finnish, Norwegian, Swedish, Serbian, Italian, Dutch, Portuguese, Arabic and more. To enquire if an examination is available in the category and language of your choice please contact MIBoC’s Certification Administrator (certification@mobiuscertification.org).

The examinations consist of a number of multiple choice questions, selected from MIBoC’s exam question database. The content is based on the Body of Knowledge specified in Annex A. The questions are of a practical nature, yet test the candidate on the concepts and principles required to conduct machinery vibration analysis. They may involve the interpretation of charts and plots. Simple mathematical calculations using a basic scientific calculator are required; a summary of common formulae will be provided with the exam questions.

The duration and the number of questions in MIBoC’s certification examinations are outlined in Table 3 below.

Table 3 –Specifications of certification examinations by category

	Number of Questions	Exam Duration (hours)
Category I	60	2
Category II	100	3
Category III	100	4
Category IV	60	5

Examination Development Process

MIBoC’s certification examinations are developed and reviewed using a rigorous psychometric analysis process to ensure the fairness and validity of each exam.

The examination specification is based on the requirements of ISO 18436-2. All questions are reviewed by members of the Technical Committee to ensure they are fair, accurate and appropriate to the category.

Additionally, detailed analysis is carried out on the way the exam questions are answered by candidates to identify any potential anomalies or outliers.

How to apply for an exam

Candidates may sit a certification examination at one of MIBoC's many Authorized Examination Centers (AECs) around the world. You will find a list of AECs and their contact details on our website.

If you are unable to get to an AEC location you may take the exam using our invigilation process, which allows you to take the exam at a date and location of your choice, supervised by an invigilator or proctor nominated by you. The invigilator must be someone who is independent and has no involvement or background in Vibration Analysis or Reliability Based Maintenance in any manner. Examples include a Human Resource Representative, Training Coordinator, University or Community College exam center.

Invigilated exams may be taken in either a paper-based format or an online internet-based format.

To apply for an invigilated exam, please contact MIBoC's Office Manager (office@mobiuscertification.org).

Reporting of Results

Examination results are e-mailed directly to the candidate around 10-14 days after the examination is received at MIBoC's Australian office. Candidates will receive a score range indicating their performance in each of the sections on the exam, as well as an overall score range and a Pass/Fail result.

Due to Privacy Regulations, regardless of who paid for the certification application, results will be made available only to the candidate themselves. However, if the candidate consents, the exam score range will also be made available to the candidate's AEC where the exam was taken.

Special Consideration

Candidates may apply for accommodation of special needs, e.g. conditions which may require some form of consideration or compensation, such as language or disabilities. An example of compensation could be extended time for the candidate to complete the exam.

Accommodation for special needs is granted at MIBoC's discretion and candidates may apply using form [ED033](#) which can be downloaded from our website.

Distribution of Certificates

Certificates and certification cards are printed for successful candidates and sent to the candidate's AEC for final distribution. For candidates who sat an invigilated exam the certificate and card is sent directly to the address specified on the invigilation application form.

Printing usually occurs around 2-4 weeks after the examination results are sent to the candidate.

Appeals & Complaints

Candidates or other parties may lodge a complaint or appeal.

A complaint is typically a criticism of MIBoC's policies/procedures or how these were carried out by MIBoC or an AEC.

An appeal can be lodged against a failure by MIBoC to certify, renew or re-certify a candidate, or against a decision by MIBoC to withdraw or cancel a candidate's certification.

Details of the Appeals/Complaints process can be found on form [ED007](#) which can be downloaded from our website.

Exam Resits

In the event that a candidate is unsuccessful in passing the certification examination, he/she can apply to re-sit the exam twice, provided that the re-sit takes place no sooner than 30 days after the previous exam date.

A candidate who fails three consecutive attempts will be excluded from further examinations for a period of 12 months.

Renewal & Re-certification

The period of certification is 5 years. Within 6 months of the certification expiry date the candidate is able to apply to renew the certification for a further 5 years provided he/she can provide evidence of continued work experience in the field of vibration analysis for the previous five years without significant interruption.

Significant Interruption is defined as an absence from (or change of) work activity which prevents the holder of MIBoC certification from practicing the duties corresponding to the scope of the certification for a continuous period in excess of 365 days, or a number of periods exceeding two years.

NOTE: Legal holidays, or periods of sickness or courses of less than thirty days are not taken into account when calculating the interruption.

Certified analysts will be invited by e-mail (using the e-mail address specified by the candidate in the student database) to renew their certification.

Renewal applications should be made in writing using form [ED036](#) and accompanied by for [ED034](#), both of which can be downloaded from our website.

References

The following ISO standards can be obtained from the International Standards Organization Store at <http://www.iso.org/iso/home/store.htm>.

- ISO/IEC 17024:2012 - Conformity assessment — General requirements for bodies operating certification of persons
- ISO 18436-1:2012 - Condition monitoring and diagnostics of machines — Requirements for training and certification of personnel - Part 1: Requirements for certifying bodies and the certification process
- ISO 18436-2:2014 - Condition monitoring and diagnostics of machines — Requirements for training and certification of personnel - Part 2: Vibration condition monitoring and diagnostics
- ISO 18436-3:2012 - Condition monitoring and diagnostics of machines — Requirements for training and certification of personnel - Part 3: Requirements for training bodies

Appendix A – Body of Knowledge

Subject	Category			
	I	II	III	IV
1. Principles of vibration	6	3	1	4
Basic motion	*	*	*	
Period, frequency	*	*	*	
Amplitude: peak, peak-to-peak, r.m.s.	*	*	*	
Parameters: displacement, velocity, acceleration	*	*	*	
Units, unit conversions	*	*	*	
Time and frequency domains	*	*	*	
Vectors, modulation			*	*
Phase		*	*	*
Natural frequency, resonance, critical speeds	*	*	*	*
Force, response, damping, stiffness			*	*
Instabilities, non-linear systems				*
2. Data acquisition	6	4	2	2
Instrumentation	*	*	*	*
Dynamic range, signal-to-noise ratio			*	*
Transducers	*	*	*	
Sensor mounting, mounted natural frequency	*	*	*	
F_{max} , acquisition time		*	*	
Proximity sensor conventions		*	*	
Triggering		*	*	
Test planning		*	*	*
Test procedures	*	*	*	*
Data formats		*	*	
Computer database upload/download	*			
Recognition of poor data	*	*	*	
3. Signal processing	2	4	4	8
R.m.s./peak detection				*
Analogue/digital conversion				*
Analogue sampling, digital sampling		*	*	*
FFT computation			*	*

Subject	Category			
	I	II	III	IV
FFT application	*	*		
Time windows: uniform, Hanning, flat-top		*	*	
Filters: low pass, high pass, band pass, tracking		*	*	*
Anti-aliasing		*	*	*
Bandwidth, resolution		*	*	*
Noise reduction		*	*	*
Averaging: linear, synchronous time, exponential		*	*	*
Dynamic range		*	*	*
Signal-to-noise ratio				*
Spectral maps			*	*
4. Condition monitoring	2	4	3	1
Computer data base set-up, computer database maintenance			*	
Equipment evaluation and prioritization		*		
Monitoring programme design		*	*	*
Alarms set-up: narrowband, envelope			*	
Baseline assessments, trending		*	*	
Route planning		*	*	
Alternative technologies: oil analysis, infrared thermography, motor current analysis and acoustic emission			*	*
Fault condition recognition	*	*		
5. Fault analysis	4	5	6	6
Spectrum analysis, harmonics, sidebands		*	*	*
Time waveform analysis		*	*	*
Phase analysis		*	*	*
Transient analysis			*	*
Orbit analysis			*	*
Shaft centreline analysis		*	*	*
Enveloping		*	*	*
Mass unbalance		*	*	
Misalignment		*	*	
Mechanical looseness		*	*	
Rubs, instabilities			*	*

Subject	Category			
	I	II	III	IV
Bearing defects: rolling element, journal		*	*	
Electric motor defects		*	*	*
Flow induced vibration, aerodynamics and liquids			*	*
Gearbox analysis		*	*	
Resonance and critical speeds		*	*	*
Turbomachinery			*	*
General fault recognition	*			
6. Corrective action	2	4	6	16
Shaft alignment		*	*	
Field balancing		*	*	*
Replacement of machine parts			*	
Flow control			*	*
Isolation and damping			*	*
Resonance control			*	*
Basic maintenance action	*	*	*	
7. Equipment knowledge	6	4	4	-
Electric motors, generators and drives	*	*	*	
Pumps, fans	*	*	*	
Steam turbines, gas turbines		*	*	
Compressors	*	*	*	
Reciprocating machinery		*	*	
Rolling mills, paper machines, other process equipment	*	*	*	
Machine tools	*	*	*	
Structures, piping	*	*	*	
Gearboxes	*	*	*	
Rolling element bearings		*	*	
Journal bearings		*	*	
Gearing		*	*	
Couplings, belts		*	*	
8. Acceptance testing	2	2	2	-
Test procedure	*	*		
Specifications and standards		*	*	
Reporting		*	*	

Subject	Category			
	I	II	III	IV
9. Equipment testing and diagnostics	-	2	4	4
Impact testing		*	*	*
Forced response testing		*	*	*
Transient analysis			*	*
Transfer functions			*	*
Damping evaluation				*
Cross channel phase, coherence			*	*
Operating deflection shapes			*	*
Modal analysis			*	*
Torsional vibration				*
10. Reference standards	-	2	2	2
ISO		*	*	*
IEC		*	*	*
Relevant national standards		*	*	*
11. Reporting and documentation	-	2	2	4
Condition monitoring reports		*	*	
Vibration diagnostics reports		*	*	*
12. Fault severity determination	-	2	3	3
Spectrum analysis		*	*	*
Time waveform analysis, orbit analysis		*	*	*
Levels: overall, narrowband, component		*	*	
Severity charts, graphs and formula		*	*	*
13. Rotor/bearing dynamics	-	-	-	14
Rotor characteristics				*
Bearing characteristics				*
Rotor balancing				*

- **Note 1:** The symbol * indicates the subject is to be covered within the allotted time.
- **Note 2:** Category II includes the knowledge of Category I; Category III includes the knowledge of Category I and II; Category IV includes the knowledge of Category I, II and III.
- **Note 3:** If the symbol * appears in more than one category for a subject item, it should be understood that at Category X deeper knowledge of the subject is required than at Category X-1.