
**Condition monitoring and diagnostics of
machines — Requirements for training
and certification of personnel —**

**Part 1:
Requirements for certifying bodies and
the certification process**

*Surveillance et diagnostic d'état des machines — Exigences relatives à
la formation et à la certification du personnel —*

*Partie 1: Exigences relatives aux organismes de certification et au mode
opérateur de certification*



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Published in Switzerland

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 18436-1 was prepared by Technical Committee ISO/TC 108, *Mechanical vibration and shock*, Subcommittee SC 5, *Condition monitoring and diagnostics of machines*.

ISO 18436 consists of the following parts, under the general title *Condition monitoring and diagnostics of machines — Requirements for training and certification of personnel*:

- *Part 1: Requirements for certifying bodies and the certification process*
- *Part 2: Vibration condition monitoring and diagnostics*

The following parts are under preparation:

- *Part 3: Requirements for training bodies*
- *Part 4: Lubrication management and analysis*
- *Part 5: Thermography*
- *Part 6: Diagnostics and prognostics*
- *Part 7: Condition monitoring specialists.*

Introduction

Condition monitoring and diagnostics of machines are integral parts of an effective maintenance programme. Non-intrusive technologies used in condition monitoring and fault diagnosis include vibration, infrared thermography, lubrication, oil analysis, acoustic and ultrasonic analysis, and electric current analysis. In many instances these technologies act as complimentary condition-analysis tools. The skills and expertise of the practitioners performing the measurements and analysing the data are critical to the effective application of these technologies.

This part of ISO 18436 defines the requirements for bodies operating certification systems in the non-intrusive machine condition monitoring, diagnostic, and correction technologies. General requirements for certification body personnel are contained in this part of ISO 18436. Specific requirements for personnel in condition monitoring and diagnostics will be contained in subsequent parts of ISO 18436.

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Condition monitoring and diagnostics of machines — Requirements for training and certification of personnel —

Part 1: Requirements for certifying bodies and the certification process

1 Scope

This part of ISO 18436 defines the requirements for bodies operating certification systems for personnel who perform machinery condition monitoring, identify machine faults, and recommend corrective action. Procedures for the certification of condition monitoring and diagnostic personnel are specified. These requirements are in addition to those of ISO/IEC 17024.

NOTE Further parts covering specific technologies will be developed.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 17024:2003, *Conformity assessment — General requirements for bodies operating certification of persons*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 17024 and the following apply.

3.1

certificate

written testimony that an individual has shown proof of fulfilment of the requirements specified in the relevant part of ISO 18436 dealing with the specific technology concerned

3.2

certification body

organization that meets the requirements of ISO/IEC 17024 for certification bodies

3.3

examination centre

centre, authorized and monitored by a certification body, where written or practical qualification examinations are administered

3.4

invigilator

person who administers a written examination as part of a certification programme but does not evaluate the competency of the candidate

3.5

technical committee

committee organized by an assigned certification body to direct the technical aspects of certification

3.6
significant interruption
absence from (or a change of) work activity which prevents the holder of certification from practising the duties corresponding to the scope of the certification for

- a) a continuous period in excess of 365 days, or
- b) two or more periods for a total time exceeding two-fifths of the total period of validity of the certificate

4 Certification body

4.1 Charter

The certification process, which includes all procedures adopted to demonstrate the conformity of individuals with the requirements specified in this part of ISO 18436 (and, when published, to subsequent parts of ISO 18436) and leads to a written evidence of their qualifications, shall be administered by an accredited certification body.

4.2 Requirements

A certification body

- a) shall conform to this part of ISO 18436 (and, when published, to subsequent parts of ISO 18436) for personnel involved in the condition monitoring and diagnostics of machines,
- b) shall be in accordance with ISO/IEC 17024:2003, Clause 4,
- c) shall have the administrative resources needed to conduct examinations and administer examination centres,
- d) shall be independent of any commercial interest,
- e) shall use non-discriminatory policies and procedures in the administration of the certification system, and
- f) shall comply with all applicable national and international laws.

4.3 General provisions

Qualifications for certification shall not be based on limiting conditions, such as undue financial commitment, training by a specific organization, or membership in any specific organization. However, specific training courses involving standard curricula may be required for recognition of compliance.

There shall be no limit to the number of persons certified in any category.

The certification body shall be responsible for granting, maintaining, renewing, extending, restricting and withdrawing certificates.

4.4 Responsibilities

A certification body shall meet the following requirements:

- a) it shall initiate, maintain and promote the certification procedures to demonstrate the qualification of an individual to carry out tasks in machinery condition monitoring and diagnosis, which leads to written evidence of their qualifications;
- b) it shall administer the procedures and operations for certification in accordance with the requirements of this part of ISO 18436, and a stringent code of ethics (see Annex A), including sanctions, that will apply to certificate holders;
- c) it shall take the ultimate responsibility for the certification procedures, including technical and administrative requirements;

- d) it will ensure the adherence to training curricula as specified in the individual technical specifications of subsequent parts of ISO 18436 (when published);
- e) it shall approve properly staffed and equipped examination centres, which it shall monitor on a periodic basis;
- f) it shall develop and/or approve suitable certification examination questions;
- g) it shall approve the eligibility of candidates;
- h) it shall authorize the time and location of the examination, the examination centre, and the invigilator or examiner for each examination;
- i) it shall prepare and distribute examinations to the examination centre;
- j) it shall receive and evaluate the completed examinations;
- k) it shall notify the examinee of the results of the examination;
- l) it shall issue the certification written evidence;
- m) it shall keep appropriate records of the operations of certification;
- n) upon written request of the examinee, it shall provide an overview of the examination results;
- o) it shall develop and implement recertification procedures and requirements;
- p) it shall monitor all delegated functions.

4.5 Organizational structure of the certification body

The certification body shall have an organizational structure, accessible to the public, that invites and permits participation by all interested persons, and meets the requirements of ISO/IEC 17024.

4.6 Examination centres

4.6.1 General

Examination centres, which can include technical organizations, vendors, companies and independent training organizations, are bodies that meet the requirements stated in 4.6.2 and have the responsibilities given in 4.6.3.

4.6.2 Requirements

Examination centres shall be designated by a certification body and, as a minimum,

- a) shall work under the direction of the certification body,
- b) shall have adequately qualified staff to organize and conduct qualification examinations,
- c) shall have adequate physical and financial resources to sponsor examinations, and
- d) shall follow the instructions of this part of ISO 18436.

4.6.3 Responsibilities

The examination centres

- a) shall conduct examinations following the prescribed procedures of the certification body, using authorized examination invigilators (see Annex B),
- b) shall use only current original examinations provided by the certification body,
- c) shall return all original examinations (including unused examinations) to the certification body, and
- d) shall assure that the integrity of the examinations is not compromised in any way.

4.7 Technical committees

4.7.1 General

Technical committees are groups assigned by a certification body that meet the requirements stated in 4.7.2 and have the responsibilities given in 4.7.3.

4.7.2 Requirements

Separate technical committees shall be formed by a certification body to monitor and direct technical efforts associated with certification. The committees shall have, as a minimum requirement, membership that is certified to the level of the certification the committee represents, or equivalent competence during a start-up period.

4.7.3 Responsibilities

The technical committees

- a) shall develop or rework examination questions, and
- b) should adhere to the technical areas of proficiency, as defined in subsequent parts of ISO 18436 (when published), for each level of certification.

5 Requirements for certification body personnel

5.1 General provisions

In order to ensure that the certification process is carried out effectively and uniformly, the competence requirements for personnel involved in the entire process shall be defined by the accredited certification body and approved by the responsible committee (see ISO/IEC 17024).

The certification body shall require its personnel (internal or external) to sign a contract, or other document, by which they commit themselves to comply with the rules defined by the certification body, including those relating to confidentiality and those relating to independence from commercial and other interests, and from any prior and/or present link with the persons to be examined that would, in the opinion of the interested parties, compromise impartiality.

Clearly documented instructions shall be available to the personnel, describing their duties and responsibilities. These instructions shall be maintained up to date. All personnel involved in any aspect of certification activities shall possess appropriate educational qualifications, experience and technical expertise, which satisfy defined competency criteria for the tasks identified. They shall be trained for their specific responsibilities within the certification body and shall be made aware of the significance of the certification offered.

The certification body shall establish and maintain up-to-date documentation on the qualification, training and experience relevant to the certification activity of each individual. This information shall be accessible to the individual(s) concerned and shall include the following:

- a) name and address;
- b) organization affiliation and position held;
- c) educational qualifications and professional status;
- d) experience and training in each field of the certification body's competence;
- e) their specific responsibilities and obligations within the certification body;
- f) performance appraisals;
- g) date of most recent updating of records.

5.2 Additional criteria for examiners

Examiners shall meet the requirements of the certification body, based upon applicable standards and normative documents.

When selecting examiners for a specific examination or part of one, the certification body shall ensure that the competence brought to each assignment is sufficient. Examiners

- a) shall be familiar with the relevant certification system,
- b) shall have a thorough knowledge of the relevant examination methods and examination documents,
- c) shall have appropriate technical knowledge of the activities which are to be examined,
- d) shall be able to communicate effectively, both in writing and orally (through an interpreter if necessary), in the language of the examination, and
- e) shall be free from any conflicting interests so that they can make impartial and non-discriminatory judgements (assessments).

Provisions shall be made by the certification body to ensure that the examination is not compromised. If conditions exist which force the participation of the trainer/instructor in the testing of the candidates trained and/or instructed by him or her, the instructor, who acts as an invigilator, shall not have access to the examination. Candidates shall be provided with sealed examination papers and shall return the sealed results to the invigilator, who shall take no part in the qualification process.

6 Classification of personnel

6.1 General

Individuals certified in accordance with the technical parts of ISO 18436 shall be classified in one of several categories depending on their qualifications. They should demonstrate competence in the concepts of machinery condition monitoring and diagnostics for their classification category, as indicated in the subsequent parts of ISO 18436 (when published) which relate directly to the specific technologies.

6.2 Categories

It is recommended that each technology be divided into three general categories (basic, intermediate and advanced), based on natural boundaries of technical difficulty. If required, a technology may be divided into more or fewer categories.

6.3 Employer

The employer shall provide applications for the candidates to the certification body and shall document the validity of the personal information provided, including the declaration of training and experience needed to establish the eligibility of candidates, but shall not be directly involved in the certification procedure itself. The employer shall be fully responsible for the authorization to perform machinery condition monitoring and diagnosis, and the quality and validity of the results of such work. If the candidates are self-employed, they shall assume all responsibilities described for the employer.

7 Eligibility for examination

7.1 General

Candidates shall have a combination of education, training and experience to ensure that they understand the principles and procedures applicable to the machinery condition monitoring and diagnosis technology in which they have chosen to qualify.

7.2 Education

Future parts of ISO 18436 dealing with individual technologies will specify the required or recommended formal education for each certification category.

EXAMPLE Secondary school, technical school and/or university.

7.3 Training

The minimum duration of the recommended or required training will be established for different technologies in subsequent parts of ISO 18436 (when published). See Table 1 for an example. Training may be in the form of lectures, demonstrations and practical exercises. Training course topics and requirements for different technologies will be given in annexes to subsequent parts of ISO 18436. An overview will show hours of training for each certification category and major subject area. The major subject areas will be broken down into a detailed list of topics, where hours of instruction are given for each certification category. See Annex A of ISO 18436-2:2003 for requirements for the training of personnel involved in vibration condition monitoring and diagnostics.

Table 1 — Minimum cumulative duration of training (hours)

Technology category I	Technology category II	Technology category III	Technology category IV
A	A + B	A + B + C	A + B + C + D
NOTE Each technology group will determine the number of training hours for its specific programme.			

Recommended sources of technical information for different technologies will be provided for each certification category in an annex to each part of ISO 18436.

It is required that the training include examinations to ensure that the subject matter has been understood. To receive credit for the successful completion of a course, the candidates shall satisfy the certification body that

- they have successfully completed the training or equivalent self-study on the subjects documented in the relevant part of ISO 18436 for which they are attempting to qualify,
- the time devoted to each topic was as specified in the annex on subject areas,
- the training was consistent with the scope of the certification category sought, and
- the subject areas, as required for each technology, chosen for self-study are documented in a manner acceptable to the certification body, or course examinations provided by approved training organizations were passed.

7.4 Experience

To be eligible to apply for certification, the candidates shall provide written evidence of experience in the field of machinery condition monitoring and diagnosis. The minimum experience requirements will be defined in the relevant parts of ISO 18436. See ISO 18436-2 for requirements for personnel involved in vibration condition monitoring and diagnostics. See Table 2 for a general example.

Table 2 — Minimum cumulative experience requirements (months)

Technology category I	Technology category II	Technology category III	Technology category IV
A	A + B	A + B + C	A + B + C + D

8 Qualification examinations

8.1 Examination type and content

For each certification category, the candidates shall be required to answer a number of questions over a specified time. The examination shall be closed book; however, formula sheets or a standard text reference may be permitted at the discretion of the certification body. The examination may be partially oral or demonstrative depending on the requirements of the relevant part of ISO 18436.

The details will be included in subsequent parts of ISO 18436. See ISO 18436-2 for details for personnel involved in vibration condition monitoring and diagnostics. An example of the information to be included is shown in Table 3. The questions, covering the subjects covered in various part of ISO 18436, will have been selected from a database of questions existing at the time of the examination. Questions shall be of a practical nature, yet test the candidate on concepts and principles required to conduct machinery condition evaluations. The questions may involve the interpretation of charts and plots. Simple mathematical calculations may be required.

Table 3 — Example of examination details

Classification	Number of questions	Time h	Passing grade %
Category I	48	2	75
Category II	100	3	75
Category III	100	4	75
Category IV	60	5	75

8.2 Conduct of examinations

All examinations shall be conducted at examination sites approved by the certification body and according to the following requirements:

- at the examination, the candidates shall have in their possession valid proof of identification and a notification of the examination, which shall be shown to the invigilator upon request;
- the examination shall be closed book, except for material provided by the certification body (e.g. a summary of common formulae); however, the examination for the highest category may, at the discretion of the certification body, be open book;
- the candidates shall have access to simple drafting instruments and basic, non-programmable scientific calculators;
- they shall be prohibited from answering questions in pencil or using correction fluid, and shall be required to initial any corrections they may make on examination papers;
- at the start of the examination, the individual sealed envelopes, labelled with the candidates' names and containing the examination questions, shall be distributed to the candidates by the invigilator;
- upon instructions from the invigilator, the candidates shall open their envelopes and answer the questions;
- at the completion of the examination, the candidates shall each place their examination papers into the envelopes provided, seal and sign them, and give them to the invigilator, who shall forward them directly to the certification body;
- any candidate who, during the course of the examination, does not abide by the examination rules or who perpetrates, or is an accessory to, fraudulent conduct shall be excluded from further participation in that examination session (see also 8.4).

8.3 Grading

All examinations shall be scored by a person authorized by the certification body. To achieve certification, the candidates shall obtain the percentage of correct answers as shown in Table 3. The test scores shall be held confidential to the certification body.

8.4 Re-examination

A candidate who fails to obtain the pass grade required for certification may be re-examined any number of times, provided that the re-examinations take place not sooner than 30 days after the previous examination. A certification body may use its discretion in allowing an earlier re-examination in the event that further training acceptable to the certification body concerned is undertaken. Candidates excluded for reasons of unethical behaviour shall wait at least 12 months before reapplying.

9 Certification

9.1 Administration

After the candidate satisfies all requirements for certification at a given category, the certification body should announce the certification, and issue certificates indicating certification in accordance with this part of ISO 18436.

9.2 Certificates

Certificates and/or corresponding wallet cards shall include at least the following:

- a) the full name of the individual certified;
- b) the date of certification;
- c) the date upon which certification expires;
- d) the category of certification;
- e) the applicable machinery condition monitoring technology (e.g. vibration condition monitoring and diagnostics of machines);
- f) the name of the certification body;
- g) a unique personal identification number;
- h) the signature of the certified individual on the wallet card;
- i) photograph of the certified individual in the case of a wallet card;
- j) a device to prevent falsification of the wallet card (i.e. use of a cold seal, welding into plastic, etc.);
- k) the signature, on the certificate, of a designated representative of the certifying body;
- l) the seal of the certification body.

There may be a special space on either or both the certificate and the wallet card for a statement of limitations, and for the signature and stamp of the employer authorizing the holder of the certificate to operate, and taking responsibility for the test results.

NOTE By issuing the certificate, the certification body attests to the qualification of the individual as defined in the technical parts of ISO 18436, but does not give any authority to perform machinery vibration measurements or analysis.

10 Validity and renewal of certification

10.1 Validity of certification

The period of validity shall not exceed 5 years from the date of certification indicated on the certificate and/or wallet card. Certification shall become invalid before this time period has elapsed

- a) if an individual becomes physically and/or mentally incapable of performing the duties, or
- b) at the option of the certification body, after reviewing evidence of unethical behaviour.

10.2 Renewal of certification

At any time in the final 6 months of certificate validity, certification may be renewed by the certification body for a new 5-year period, plus the period of unexpired certification, so long as the certificate holder provides verifiable evidence of continued satisfactory work activity without significant interruption. If the criteria for renewal are not met, the individual shall apply for recertification following the procedure for new candidates.

11 Files

The certification body shall maintain the following:

- a) an updated list of all individuals certified at each category;
- b) an individual file for each candidate who has not been certified, for at least 3 years from the date of the application or examination, whichever is the latest;
- c) an individual file for each individual certified and for each individual whose certification has lapsed or has been withdrawn, containing
 - 1) application forms,
 - 2) examination documents, including questionnaires and grade sheets,
 - 3) renewal documents, including evidence of continuous activity and significant interruptions, and
 - 4) reasons for withdrawal or cancellation of certification.

Individual files shall be kept under suitable conditions of safety and discretion according to the requirements of ISO/IEC 17024:2003, 4.6.

12 Transition period

When a certification body initially applies the certification scheme, it may appoint personnel as examiners, for a period not exceeding 5 years, who meet the following requirements:

- a) they shall have knowledge of the principles of condition monitoring and diagnostics of machines;
- b) they shall have industrial experience of the application of condition monitoring and diagnostics of machines;
- c) they shall have the ability to conduct examinations;
- d) they shall be able to interpret the questionnaire and the results of examinations.

Annex A

(normative)

Code of ethics

Individuals certified according to this part of ISO 18436 shall recognize the precepts of personal integrity and professional competence according to international principles. Accordingly, certified individuals

- a) shall perform their professional duties with proper regard for the physical environment and the safety, health, and well-being of the public,
- b) shall undertake only those measurements and analysis for which they are competent by virtue of their training and experience and, where warranted, engage or advise the engagement of such specialists as are required to enable them to properly complete assignments,
- c) shall conduct themselves in a responsible manner and utilize fair and equitable business practices in dealing with colleagues, clients and associates,
- d) shall protect to the fullest extent possible, consistent with the well-being of the public, any information given them in confidence by an employer, client, colleague or member of the public,
- e) shall refrain from making unjustified statements or from performing unethical acts which would discredit the certification programme based on this part of ISO 18436,
- f) shall indicate to the employer or client any adverse consequences which may result from an over-ruling of their technical judgement by a non-technical authority,
- g) shall avoid conflicts of interest with any employer or client and, if any such conflicts should arise in the performance of work, shall inform the affected persons promptly of the circumstances, and
- h) shall strive to maintain their proficiency by updating their technical knowledge as required to properly perform condition monitoring measurement and analysis techniques.