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## Condition monitoring and diagnostics of machines — Requirements for qualification and assessment of personnel — Part 2: Vibration condition monitoring

*Surveillance et diagnostic d'état des machines — Exigences relatives à la qualification et à l'évaluation du personnel —*

*Partie 2: Surveillance des vibrations*

[Revision of first edition (ISO 18436-2:2003)]

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## Contents

	Page
Foreword .....	iv
Introduction.....	v
<b>1 Scope.....</b>	<b>1</b>
<b>2 Normative references.....</b>	<b>1</b>
<b>3 Terms and definitions .....</b>	<b>1</b>
<b>4 Classification of personnel .....</b>	<b>2</b>
4.1 General .....	2
4.2 Category I .....	2
4.3 Category II .....	3
4.4 Category III .....	3
4.5 Category IV .....	4
<b>5 Eligibility.....</b>	<b>4</b>
5.1 General .....	4
5.2 Education .....	4
5.3 Training.....	5
5.3.1 Introduction.....	5
5.3.2 Additional training on machine knowledge .....	5
5.3.3 Mature candidate entry (Categories I, II and III only).....	5
5.4 Experience .....	6
<b>6 Examination .....</b>	<b>6</b>
6.1 Content .....	6
6.2 Examination conduct .....	7
<b>Annex A (normative) Training course requirements.....</b>	<b>8</b>
<b>Annex B (informative) Training syllabus - Applicable ISO Standards.....</b>	<b>11</b>
<b>Bibliography.....</b>	<b>13</b>

## 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 18436-2 was prepared by Technical Committee ISO/TC 108, *Mechanical vibration, shock and condition monitoring*, Subcommittee SC 5, *Condition monitoring and diagnostics of machine*.

This second edition cancels and replaces the first edition which has been technically revised.

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

- *Part 1: Requirements for assessment bodies and the assessment process*
- *Part 2: Vibration condition monitoring*
- *Part 3: Requirements for training bodies and the training process*
- *Part 4: Field lubricant analysis*
- *Part 5: Lubricant laboratory analyst (under preparation)*
- *Part 6: Acoustic emission*
- *Part 7: Thermography*

Annex A is a normative part of ISO 18436-2.

## Introduction

Vibration analysis using measurements to monitor condition and diagnose faults in machinery has become a key activity in predictive maintenance programmes for many industries. Other condition monitoring technologies including infrared thermography, acoustic emission, lubricant analysis, wear debris, and motor current analysis are used as complementary condition analysis tools. Those in the manufacturing industry who have diligently and consistently applied these techniques have experienced a return on investment far exceeding their expectations. However, the effectiveness of these programmes depends on the capabilities of individuals who perform the measurements and analyse the data.

A programme, administered by an assessment body (see ISO 18436-1 for definition), is developed to train and assess the competence of personnel whose duties require the appropriate theoretical and practical knowledge and relevant experience in vibration analysis for machinery condition monitoring.

This part of ISO 18436 defines the requirements against which personnel associated with vibration analysis for machinery condition monitoring are to be qualified and the methods of assessing such personnel.

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# Condition monitoring and diagnostics of machines — Requirements for qualification and assessment of personnel — Part 2: Vibration condition monitoring

## 1 Scope

This part of ISO 18436 specifies requirements for the qualification, training, relevant experience and assessment of personnel performing machinery condition monitoring using vibration analysis.

A certificate or declaration of conformity to the requirements of this standard, in accordance with ISO 18436-1, will provide recognition and evidence of the qualifications and competence of individuals to perform vibration measurements and analysis for machinery condition monitoring using vibration measurement equipment.

This part of ISO 18436 specifies a four-category classification programme that is based on the technical areas delineated herein.

## 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 2041, *Mechanical vibration, shock and condition monitoring – Vocabulary*

ISO 13372, *Condition monitoring and diagnostics of machines – Vocabulary*

ISO 21940-2, *Mechanical vibration — Rotor balancing – Part 2: Vocabulary* (formerly ISO 1925)

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

ISO/IEC 17050-1, *Conformity assessment -- Supplier's declaration of conformity -- Part 1: General requirements*

ISO/IEC 17050-2, *Conformity assessment -- Supplier's declaration of conformity -- Part 2: Supporting documentation*

ISO 18436-1, *Condition monitoring and diagnostics of machines – Requirements for qualification and assessment of personnel – Part 1: Requirements for assessment bodies and the assessment process*

ISO 18436-3, *Condition monitoring and diagnostics of machines – Requirements for qualification and assessment of personnel – Part 3: Requirements for training bodies and the training process*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 2041, ISO 13372, ISO 18436-1, ISO 17024, ISO 17050, and ISO 21940-2 apply.

## 4 Classification of personnel

### 4.1 General

Depending upon their qualifications and experience in vibration analysis, individuals meeting the requirements of this standard shall be classified in one of four categories. They shall have demonstrated competence appropriate to their classification category, as indicated in Annex A, in the concepts of machine condition monitoring using vibration analysis.

The classification of individuals at all categories shall be subject to the scope and any limitations of the award issued by the assessing body. Authority to work shall be limited or specified by the employer or client. Individuals shall provide recommendations based on the limits of their training and experience. This qualification shall not allow a practitioner to make recommendations or give advice that may affect plant design, safety or operation without discussion with, and approval from, the appropriate plant specialist/manager and/or operators. The limits of competence for the practitioner are specified in this clause whereas the limits of liability shall be agreed between the practitioner and their employer or client.

The qualification category of the practitioner and any requirements for additional knowledge to work with specific equipment shall be subject to agreement between the customer and service supplier. This qualification shall provide the practitioner with sufficient knowledge to be able to make measurements and interpret data as appropriate for their category. In addition, the applicability of the qualification to a particular specialized machine type or types should be verified by the client through reference to the previous experience and training of the practitioner. It is not appropriate for more standard rotating equipment such as motors, fans, pumps, etc.

It is recognized that different industrial applications require knowledge of varying aspects of Vibration Analysis (VA). Using supporting documented evidence, the supplier of the VA service shall be able to demonstrate to the employer or client, that staff carrying out work have the appropriate machine knowledge and experience.

Where an individual has specialized knowledge in a particular concept of vibration analysis or in specific types of machinery, they may be capable, when approved by the client/employer, of working to levels above their qualification category. Their qualification award from the assessment body shall remain at the level it was at the time it was issued.

Clauses 4.2 to 4.5 give an outline of the typical competencies and skills required in each category.

### 4.2 Category I

Personnel classified to Category I are qualified to perform a range of pre-defined machinery vibration condition monitoring activities in accordance with established procedures. All activities shall be performed under direction.

Personnel classified to Category I shall at least:

- a) know of the basic principles of vibration and recognize the different units of measurement;
- b) be able to collect reliable data ensuring appropriate standards of repeatability;
- c) be able to identify errors in collected data;
- d) be able to retrieve pre-defined measurement settings for use with vibration analysis equipment and transfer data from an analysis system to a computer based system;
- e) be able to compare overall or single value vibration measurements against pre-established alert settings
- f) be able to identify deviations from the norm for single value vibration values and trends;
- g) report on visual observations of equipment condition



They shall not be responsible for:

- a) the choice of sensor, test method or technique or for any analysis or diagnosis to be conducted;
- b) the assessment of test results, other than identifying alert conditions against pre-established acceptance criteria.

#### 4.3 Category II

Personnel classified to Category II require all the knowledge, experience and skills expected of personnel classified to Category I and in addition shall at least:

- a) be qualified to define the measurement activities to be undertaken by a Category I individual in the course of routine data collection;
- b) be aware of and capable of using the basic principles of signal analysis and, as such, can define acquisition and analysis settings to collect data appropriate to the machine(s) monitored;
- c) be able to perform single channel vibration tests to acquire natural frequencies;
- d) be able to define extra test points and be aware of and recommend, when necessary, alternative condition monitoring technologies to verify or investigate issues raised through routine data collection;
- e) be able to interpret and evaluate test results from routine analysis in accordance with specifications and standards;
- f) be able to diagnose common fault indications and recommend basic corrective actions commensurate with their area of machinery experience including the in situ balancing of rigid rotors;
- g) be able to provide technical guidance to and instruct personnel qualified to Category I.

#### 4.4 Category III

Personnel classified to Category III require all the knowledge, experience and skills expected of personnel classified to Categories I and II and in addition shall at least:

- a) be qualified to design, direct and establish routine condition monitoring programmes and non-routine investigations for the purpose of fault diagnosis;
- b) have an in-depth knowledge of the principles and techniques of machinery vibration analysis and be able to make initial diagnoses of suspected faults beyond the range of commonly encountered issues. This should include, but not be limited to, the use of single-channel frequency spectra, time wave forms and orbits, basic operating deflection shapes, and acceleration enveloping;
- c) be able to manage such condition monitoring programmes, evaluate the alarm sets and write working procedures, create budgets, prepare cost justifications, and manage personnel development;
- d) be able to direct machinery corrective actions including the *in-situ* two-plane rotor balancing;
- e) be able to recommend restrictions to machine operation;
- f) be able to understand and direct, when necessary, alternative condition monitoring technologies to verify or investigate issues raised through routine data collection;
- g) be able to provide technical guidance to and instruct personnel qualified to Categories I and II, and, subject to agreement with the employer, deem them competent to carry out certain duties which would normally be outside the scope of those qualifications.