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**Condition monitoring and diagnostics  
of machines — Requirements for  
qualification and assessment of  
personnel —**

Part 6:

**Acoustic emission**

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

*Partie 6: Émission acoustique*

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2. [www.iso.org/directives](http://www.iso.org/directives)

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received. [www.iso.org/patents](http://www.iso.org/patents)

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT), see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 108, *Mechanical vibration, shock and condition monitoring*, Subcommittee SC 5, *Condition monitoring and diagnostics of machines*.

This second edition cancels and replaces the first edition which has been 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 and diagnostics*
- *Part 3: Requirements for training bodies and the training process*
- *Part 4: Field lubricant analysis*
- *Part 5: Lubricant laboratory technician/analyst*
- *Part 6: Acoustic emission*
- *Part 7: Thermography*
- *Part 8: Ultrasound*

The following part is planned:

- *Part 9: Condition monitoring specialists*

## Introduction

The use of acoustic emission technology in condition monitoring is one of the key activities in predictive maintenance programmes for most industries. Other non-intrusive technologies including infrared thermography, vibration analysis, lubricant analysis, wear debris analysis and motor current analysis are used as complementary condition analysis tools. Those in the manufacturing industry who have diligently and consistently applied these technologies 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, has been developed to train and assess the competence of personnel whose duties require the appropriate theoretical and practical knowledge of machinery condition monitoring and diagnostics.

This part of ISO 18436 defines the requirements against which personnel in the non-intrusive machinery condition monitoring and diagnostics technologies associated with acoustic emission 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 6: Acoustic emission

### 1 Scope

This part of ISO 18436 specifies the requirements for qualification and assessment of personnel who perform machinery condition monitoring and diagnostics using acoustic emission.

A certificate or declaration of conformity to this part of ISO 18436 will provide recognition of the qualifications and competence of individuals to perform acoustic emission measurements and analysis for machinery condition monitoring using acoustic emission equipment. This procedure may not apply to specialized equipment or other specific situations.

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

### 2 Normative references

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

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

ISO 13374 (all parts), *Condition monitoring and diagnostics of machines — Data processing, communication and presentation*

ISO 13379-1, *Condition monitoring and diagnostics of machines — Data interpretation and diagnostics techniques — Part 1: General guidelines*

ISO 17359, *Condition monitoring and diagnostics of machines — General guidelines*

ISO 18436-1:2012, *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*

ISO 22096:2007, *Condition monitoring and diagnostics of machines — Acoustic emission*

ISO/IEC 17000, *Conformity assessment — Vocabulary and general principles*

ASTM E2374-10, *Standard Guide for Acoustic Emission System Performance Verification*

ASTM E1106-12, *Standard Test Method for Primary Calibration of Acoustic Emission Sensors*

ASTM E650-M12, *Standard Guide for Mounting Piezoelectric Acoustic Emission Sensors*

EN 13477-1:2001, *Non-destructive testing — Acoustic emission — Equipment characterization — Part 1: Equipment description*

EN 13477-2:2001, *Non-destructive testing — Acoustic emission — Equipment characterization — Part 2: Verification of operating characteristic*

EN 13554:2002, *Non-destructive testing — Acoustic emission — General principles*

EN 1330-9:2000, *Non-destructive testing — Terminology — Part 9: Terms used in acoustic emission testing*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 13372, ISO/IEC 17000 and the following apply.

#### 3.1

##### **trainee**

person who is being trained to become qualified

### 4 Classification of personnel (acoustic emission)

#### 4.1 General

Individuals assessed as conforming to the requirements of this part of ISO 18436 shall be classified in one of three categories, depending upon their qualifications. They shall have demonstrated the necessary skills in acoustic emission condition monitoring for their category as indicated in [Annex A](#).

Personnel classified as Category II need to have all the knowledge and skills expected of personnel classified as Category I, while personnel classified as Category III need to have all the knowledge and skills expected of personnel classified as Category II.

#### 4.2 Category I

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Individuals classified as Category I are qualified to perform acoustic emission measurements according to established and recognized procedures. Personnel classified as Category I shall be able to:

- a) apply a specified acoustic emission measurement procedure;
- b) set up and verify operation of equipment for basic acoustic emission data collection;
- c) verify the integrity of collected data and prevent or control poor data;
- d) perform basic acoustic emission analysis;
- e) record and categorize the results in terms of written criteria;
- f) maintain a database of results or trends; and
- g) evaluate and report test results in accordance with instructions.

Persons classified as Category I shall not be regarded as competent to choose the test method or technique to be used nor to assess the test results.

#### 4.3 Category II

Individuals classified as Category II are qualified to perform and/or direct acoustic emission analysis according to established and recognized procedures, and will be aware of the limitations of the acoustic emission method. Personnel classified as Category II shall be able to:

- a) select the appropriate acoustic emission technique;
- b) define the limitations of the application;



- c) specify the appropriate hardware and software for both portable and permanently installed systems;
- d) set up and verify equipment settings;
- e) measure and perform diagnosis of acoustic emission signals;
- f) measure, interpret and analyse acoustic emission data;
- g) verify the calibration of acoustic emission measurement systems;
- h) prepare reports on condition, recommend appropriate corrective actions and comment on effectiveness of repairs;
- i) provide technical direction to acoustic emission personnel at or below Category II;
- j) carry out, supervise and instruct all Category I duties; and
- k) be aware of the use of alternative condition monitoring (CM) technologies, at least to Category I level.

#### 4.4 Category III

Individuals classified as Category III are qualified to perform and/or direct all types of acoustic emission measurements and analysis. Personnel classified as Category III shall be able to:

- a) apply acoustic emission theory and techniques, including measurement and interpretation of survey results;
- b) understand and perform data analysis, including limitations;
- c) determine the acoustic emission data acquisition systems and component assemblies;
- d) use non-standard techniques for acoustic emission and fault diagnosis;
- e) recommend all generally recognized types of corrective actions;
- f) interpret and evaluate standards, codes, specifications and procedures;
- g) establish acoustic emission programmes, including determination of the requirement for periodic/continuous monitoring, frequency of testing, etc.;
- h) establish programmes for acceptance and severity criteria for new and in-service systems and faulty equipment;
- i) perform prognostics for fault conditions;
- j) recommend the use of alternative or supplementary condition monitoring (CM) technologies; and
- k) guide personnel below Category III.

NOTE It is the employer's responsibility to ensure that category III personnel have the necessary competency in the required management skills, for example, creating budgets, preparing cost justifications and managing personnel development.

## 5 Eligibility

### 5.1 General

Candidates should have a combination of education, training and experience to ensure that they understand the principles and procedures applicable to acoustic emission measurement and analysis.