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

Part 4:

Field lubricant analysis

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

Partie 4: Analyse de la lubrification sur le terrain

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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 (see 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 (see 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 machine systems*.

This second edition cancels and replaces the first edition (ISO 18436-4:2008), 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 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 under preparation:

- *Part 9: Condition monitoring specialists*

Introduction

Using lubricant analysis to monitor condition and diagnose faults in machinery is a key activity in predictive maintenance programmes for most industries. Other non-intrusive technologies including thermography, vibration analysis, acoustic emission, 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, has been developed to train and assess the competence of personnel whose duties require the appropriate theoretical and practical knowledge of machinery 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 field lubricant 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 4: Field lubricant analysis

1 Scope

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

A certificate or declaration of conformity to this part of ISO 18436 will provide recognition of the qualifications and competence of individuals to perform field lubricant analysis for machinery condition monitoring. This procedure is not applicable 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.

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2 Normative references (standards.iteh.ai)

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 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*

3 Terms and definitions

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

3.1 lubricant

any substance interposed between two surfaces in relative motion for the purpose of modifying the friction and reducing the wear between them

Note 1 to entry: Hydraulic and heat transfer fluids are considered lubricants.

3.2 lubricant analysis

process of monitoring and performing investigative testing of lubricants, with subsequent interpretation, reporting, and response to obtained results

4 Classification of personnel (field lubricant analysis)

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 field lubricant analysis 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

Individuals classified as category I are qualified to perform field lubricant analysis according to established and recognized procedures. Personnel classified as category I shall be able to

- a) dispense lubricants, re-lubricate, and/or inspect lubricants on a pre-programmed route, as appropriate, in accordance with established procedures,
- b) properly maintain lubrication devices and equipment,
- c) install sampling hardware deemed appropriate, safe, and non-intrusive by category II or higher personnel (any intrusive sampling hardware installation shall be undertaken by a suitably qualified person authorized by the customer),
- d) verify that analysis instruments are calibrated and report to the appropriate personnel where action is needed,
- e) operate (and maintain) portable lubricant analysis instrumentation on pre-programmed routes,
- f) download and upload raw test data from portable lubricant analysis instrumentation,
- g) acquire lubricant samples from machine systems, equipment, and/or storage containers in accordance with established procedures, and
- h) prepare samples for transport and/or testing in accordance with established procedures.

4.3 Category II

Individuals classified as category II are qualified to perform basic field lubricant testing and analysis according to established and recognized procedures. Personnel classified as category II shall be able to

- a) set up instruments for basic on-site testing,
- b) perform calibration checks on instruments used for on-site testing,
- c) establish procedures for sample acquisition, preparation, and transport,
- d) select sample point locations, methods, and hardware and oversee installation of sampling hardware,
- e) apply selected test methods for on-site testing and wear debris analysis,
- f) liaise with an off-site laboratory,
- g) classify, interpret, and evaluate basic test results (including acceptance tests) in accordance with applicable specifications and standards,
- h) employ basic lubricant analysis techniques to troubleshoot lubricant, machinery, and components,
- i) maintain a database of analysis schedules, results, and diagnoses,

- j) prepare reports for appropriate personnel on basic lubricant and machine condition, recommend corrective action (non-intrusive maintenance), and report on effectiveness of repairs/changes,
- k) be aware of the use of alternative or supplementary condition monitoring technologies, and
- l) provide guidance and supervision to category I personnel.

4.4 Category III

Individuals classified as category III are qualified to perform and/or direct all types of field lubricant testing and analysis. Personnel classified as category III shall be able to

- a) interpret and evaluate test methods, standards, codes, specifications, and procedures,
- b) select the appropriate machinery lubricant analysis technique,
- c) specify the appropriate instrumentation hardware and software for both portable and permanently installed systems,
- d) design and manage calibration programmes,
- e) establish lubricant monitoring programmes, including determination of machines for periodic/continuous monitoring, frequency and type of testing, route plans, etc., and quality assurance testing,
- f) establish programmes for the specification of targets, alarms, and limits for machinery,
- g) perform advanced on-site tests and wear debris analysis,
- h) classify, interpret, and evaluate advanced test results and wear debris analysis (including acceptance tests) in accordance with applicable specifications and standards,
- i) manage and perform administrative tasks for lubricant analysis software and databases,
- j) perform Failure Mode, Effect, and Criticality Analysis (FMECA),
- k) perform prognostics for fault conditions,
- l) evaluate the performance of outside lubricant analysis services and recommend necessary corrective changes,
- m) prepare reports for appropriate personnel based on advanced lubricant testing and wear debris analysis on lubricant and machine condition,
- n) make major maintenance corrective action recommendations (normally intrusive maintenance) and report on effectiveness of repairs/changes,
- o) be able to manage condition monitoring programmes, evaluate alarm sets, write working procedures, and specify acceptance testing procedures,
- p) recommend the use of alternative condition monitoring (CM) technologies,
- q) based on the accrued data, review the lubricants currently in use and make recommendations, inclusive of required lubrication specification changes, with a view to enhancing performance,
- r) assess the influence of physical/chemical properties on stability of rotor in bearings, stability of turbine control systems, wear of gears, and hydrodynamic seals, and
- s) provide guidance and supervision to category I and II personnel.

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 machinery lubrication and lubricant analysis. General machinery knowledge is required.

5.2 Education

Candidates seeking classification do not need to provide evidence of formal education to establish eligibility. However, it is recommended that candidates for category I and II have at least a secondary school qualification or its equivalent. Category II and III candidates shall be able to manipulate simple algebraic equations, use a basic scientific calculator (including trigonometric and logarithmic functions), and be familiar with the operation of personal computers. Successful completion of two or more years of mechanical technology or mechanical engineering at a college, university, or technical school is highly recommended for candidates seeking classification to category III.

5.3 Training

5.3.1 General

To be eligible to apply for assessment based on this part of ISO 18436, the candidates shall provide evidence of successful completion of training based on the requirements of [Annex A](#). The documents in the Bibliography should be used as the domain of knowledge for the training syllabus. Such training shall be compliant with the requirements of [ISO 18436-3](#). The minimum duration of training is shown in [Table 1](#). Training should be in the form of lectures, demonstrations, practical exercises, or formal training courses.

Qualification requirements shall be in accordance with this part of ISO 18436. Training time devoted to each topic shall be in accordance with [Annex A](#) and [Table 1](#).

Table 1 — Minimum duration of cumulative training (hours)

Category I	Category II	Category III
24	48	80

5.3.2 Additional training on tribology and lubrication management

In addition to the training hours shown in [Table 1](#), candidates should attend tribology and lubrication management training of at least a similar duration to that shown in [Table 1](#).

Such training shall be in addition to any formal education compliant with [5.2](#), inclusive of any college or university education. If undertaken, the additional training shall cover the design, implementation, and operation of lubrication and lubricant analysis systems and programmes, maintenance principles of machines and components, the failure modes and mechanisms associated with each principle, and the typical tribological aspects associated with each mechanism. Such training shall be validated by verifiable records.

5.4 Experience

5.4.1 To be eligible to apply for assessment based on this part of ISO 18436, the candidate shall provide evidence to the assessment body of experience in the field of lubricant-analysis-based machinery condition monitoring in accordance with [Table 2](#). Classification to category II and category III requires previous classification to the lower category.

Table 2 — Minimum cumulative sampling and analysis experience requirements (months)

Category I	Category II	Category III
12	24	36
NOTE The months of experience are based on 16 h minimum per month of lubricant-analysis-based machinery condition monitoring experience.		

5.4.2 Candidates shall keep verifiable documentary evidence of the hours and nature of work for their lubricant-analysis-based machinery condition monitoring experience. Candidates for categories I and II shall have this evidence validated by a category II or III person or, in the absence of such a person, by the candidate's technical supervisor.

5.4.3 Candidates for category III shall have this evidence validated by a category III person or, in the absence of such a person, by the candidate's technical supervisor.

5.4.4 The validation process for all categories requires the signature of the validating person on the documentary evidence. The validating person should augment this validation process via oral assessment, accompanied task performance, report submission and review, procedure submission and review, or a combination thereof, in order to increase the confidence in the validation.

6 Examinations

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6.1 Examination content (standards.iteh.ai)

6.1.1 For each category, the candidates shall be required to answer a fixed minimum number of multiple choice questions in a specified time duration as indicated in [Table 3](#).

6.1.2 Questions shall be of a practical nature, yet shall test the candidate on concepts and principles required to conduct machinery lubrication and lubricant analysis for condition monitoring of machines.

6.1.3 Some questions can involve the interpretation of charts and plots. Simple mathematical calculations using a basic scientific calculator can be required. A summary of common formulae can be provided along with the examination questions.

6.1.4 The examination content shall be proportionate with the training syllabus contained in [Annex A](#).

6.1.5 Assessment bodies can, at their discretion, make accommodations for candidates with conditions that can require some form of compensation.

Table 3 — Minimum examination content

Category	Number of questions	Time h	Passing grade %
Category I	70	2	70
Category II	100	3	70
Category III	100	3	70

6.2 Conduct of examinations

All examinations shall be conducted in accordance with ISO 18436-1:2012, 8.1, except that candidates may also have access to pencils and erasers if computer-based marking is used.