Infrared Thermography

# CERTIFICATION GUIDE

MIBoC Certification according
to ISO 18436-1 and 18436-7
**CATEGORY I-II**

MOBIUS INSTITUTE
BOARD of CERTIFICATION

ISO/IEC 17024 & ISO 18436 ACCREDITED

JAS-ANZ

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**Mobius Institute Board of Certification**
www.mobiuscertification.org

# MOBIUS INSTITUTE

## E-MAIL:

- Sales: learn@mobiuscertification.org
- General Questions and Certification: mobiussupport@mobiusinstitute.com
- Technical Support: training-support@mobiusinstitute.com

## TELEPHONE:

- Toll Free (North America): (877) 550-3400
- Worldwide: (+1) 615-216-4811 or (+61) 3-5977-4606

## WEBSITE:

www.mobiusinstitute.com/miboc/

## MAIL:

**Mobius Institute Board of Certification**
1525 Frankston-Flinders Road, Tyabb
Victoria, 3913
AUSTRALIA

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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 condition monitoring personnel from over 175 countries. MIBoC certification is delivered globally through MIBoC authorized examination centre. See our Authorized Partners Map 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 infrared thermography certification provider, you must be assured that the certification does meet the ISO 18436 specification that all thermographers are measured to. Many equipment vendors, consultants and training organizations offer thermography training and certification and may advertise that 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).

## Getting Started

MIBoC is here to help you. We have friendly and knowledgeable staff that will guide you along your way through your thermography 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 mobiussupport@mobiusinstitute.com and we will respond promptly with email.

## Thank you

We hope that this Certification Guide provides you with a good understanding of what thermography 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 thermographer.

# Table of Contents

# Introduction

This Certification Guide has been written to provide the reader with the essential information, in layman's terms, about the infrared thermography 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 thermography 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 Thermography Scheme Requirements (ED133). These documents can be downloaded from the website.

# MIBoC's Thermography Roadmap

MIBoC's scheme covers thermography certification for Category I and Category II. Our classification of the thermography categories is based on those outlined in standard ISO 18436-7.

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

## Category I Thermography

Thermographers certified to Category I will have a good understanding of the fundamentals. They are qualified to perform infrared thermography according to established and recognized procedures. They will also be able to set up and operate thermal imaging equipment for safe data collection, perform basic fault detection, severity assessment and diagnoses and perform basic image post-processing. They will be able to maintain a database of results as well as evaluate and report test results.


## Category II Thermography

In addition to having the knowledge and capability of a Category I thermographer, a Category II thermographer is able to select and apply thermographic theory and techniques, including measurement and interpretation of survey results. Additionally, they can perform advanced fault diagnosis and recommend appropriate field corrective actions and perform advanced image post-processing. They can prepare reports on equipment condition, fault diagnoses, corrective actions and effectiveness of repairs and they will be aware of the use of alternative or supplementary condition monitoring technologies.

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.

In 2017 MIBoC expanded its certification scheme to include Infrared Thermography and Ultrasound and Field Lubrication Analysis certification began in 2023.

MIBoC's aim is to provide access to condition monitoring 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).

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

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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.

### Governing Body

The remit of the Governing Body 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. Additionally, it 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

MIBoC has established separate Technical Committees for each of the condition monitoring technologies in its certification schemes: Vibration Analysis, Thermography and Ultrasound.

Members of MIBoC's Technical Committees 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 infrared thermography 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 18436-7:

- 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 18436-7 is the ISO standard which outlines the technical requirements that are specific to certification of Thermography 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 condition monitoring personnel, 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 digital 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.




## Thermography Certification Requirements

As per the requirements of ISO 18436-7, 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 infrared thermography.

Additionally, it is required that all candidates have their colour perception assessed by the Ishihara 24 plate test. A record of test results should be retained and presented to the MIBoC upon request. In the event that a colour perception deficiency, indicated by misreading four or more of the 24 plates, is detected during the Ishihara test, a secondary colour shade perception test shall be administered by MIBoC to assess the candidate's ability to differentiate between shades of colours. Failure of both the Ishihara and the secondary test will result in conditional certification being issued (assuming all other certification requirement are met), noting that a colour perception deficiency may exist.

### Education

Whist 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.

Category II and III candidates must be able to manipulate simple algebraic equations, use a basic scientific calculator and be familiar with the operation of personal computers.

For Category III 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.

## 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 |
|---|---|
| 32 | 32 |

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 ED144, 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 ED144, then you can still apply to have your training recognized by sending us details of the course and training provider, using form ED041.

In addition to the training hours shown in Table 1, candidates should attend machinery and component training, or equivalent on-the-job training, of at least a similar duration to that specified in Table 1. If undertaken, the additional training should cover the design, manufacturing, installation, operation and maintenance principles of machines and components, the failure modes and mechanisms associated with each principle, and the typical thermodynamic behaviors associated with each mechanism.

## Examination

To be eligible for certification, candidates must pass the MIBoC thermography certification examination. As per ISO 18436-7, the required pass mark is 75%.

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 thermography-based 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 Thermography 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 |
|---|---|
| 12 | 24 |
| *Note: the experience months are based on 16 hours per month of thermography-based machinery condition monitoring experience.* | |

Certification at Category II requires previous certification at the lower category.

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

### 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 as part of their registration in our online Training Management System (TMS).

## Certification Exam

MIBoC certification examinations are available in a number of different languages, to enquire if an examination is available in the category and language of your choice please contact MIBoC's Certification Administrator mobiussupport@mobiusinstitute.com

MIBoC certification 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 infrared thermography. 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 | 50 | 2 |
| Category II | 60 | 2 |

## 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 18436-7. All questions are reviewed by members of the Thermography 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. See our Authorized Partners Map to locate an authorized examination center near you.

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 independent and not related to you, and has no involvement or background in condition monitoring or reliability-based maintenance in any manner. Examples include a Human Resource Representative, Training Coordinator, University or Community College exam center.

Invigilated exams are taken in an online format only using our secure online platform.

To apply for an invigilated exam, please contact mobiussupport@mobiusinstitute.com

## 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 and logos are issued digitally to successful candidates, who are notified by email. Issuing digital certificates usually occurs around 10-14 days after the examination results are sent to the candidate.

## Appeals & Complaints

Candidates or other parties may lodge a complaint or appeal.

A complaint may be in the form of 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, they can apply to re-sit the exam 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 they can provide evidence of continued work experience in the field of thermography 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 of certification can be commenced through your own student profile under the renewals tab.

## 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 - Conformity assessment — General requirements for bodies operating certification of persons
- ISO 18436-1 - Condition monitoring and diagnostics of machines — Requirements for training and certification of personnel - Part 1: Requirements for certifying bodies and the certification process
- ISO 18436-3 - Condition monitoring and diagnostics of machines — Requirements for training and certification of personnel - Part 3: Requirements for training bodies
- ISO 18436-7:2014 - Condition monitoring and diagnostics of machines — Requirements for training and certification of personnel - Part 7: Thermography

# Appendix A – Body of Knowledge

| Subject | Topics | CAT I | CAT II |
|---|---|---|---|
| **0. Introduction** | Context of condition monitoring versus NDT, overviews of intent behind topics, and explanation of personnel classification categories | **0.5** | **-** |
| **1. Principles of infrared thermography** | | **6** | **7** |
| | Heat and heat transfer | * | |
| | Conduction fundamentals | * | |
| | Fourier's Law | | * |
| | Conductivity/resistance | * | |
| | Convection fundamentals | * | |
| | Newton's Law of Cooling | | * |
| | Radiation Fundamentals | * | |
| | Electromagnetic spectrum | * | |
| | Atmospheric transmission | * | * |
| | IR wavebands and lens materials | * | |
| | Radiation reference sources | | * |
| | Planck's Law | | * |
| | Wien's Law | | * |
| | Stefan-Boltzmann Law | * | |
| | Emmitance, reflectance and transmittance | * | |
| | Emissivity | * | * |
| | Factors affecting emissivity | * | * |
| **2. Equipment and data acquisition** | | **5** | **3** |
| | How your infrared camera works | * | |
| | Infrared camera selection criteria | | * |
| | Spectral band | * | * |
| | Temperature measurement range | * | |
| | Thermal sensitivity (NETD) | | * |
| | Lens selection | * | * |
| | Optical resolution | * | * |
| | Operation of equipment | * | * |
| | Accessories | * | * |

| Subject | Topics | CAT I | CAT II |
|---|---|---|---|
| | Camera controls | * | |
| | ISO 18434-1 | * | * |
| | Safe data acquisition | * | * |
| | Getting a good image | * | |
| | Image composition | * | * |
| | Image clarity (optical focus) | * | |
| | Thermal tuning (range, level and span) | * | |
| | Palette selection | * | |
| | Emissivity determination | * | * |
| | Error source recognition, prevention or control | * | * |
| | Waveband selection criteria | | * |
| | Recognizing and dealing with radiation (reflections, reflected apparent temperature) | * | * |
| | Recognizing and dealing with convection | * | * |
| | Recognizing and dealing with conduction | * | * |
| | Effects of Emissivity | * | * |
| | Camera calibration | * | * |
| | Environmental and operational conditions | * | * |
| | Data and image storage | * | |
| **3. Image processing** | | **6** | **2** |
| | Temperature measurement | * | * |
| | ISO 18434-1 | * | * |
| | Non-contact thermography | * | |
| | Comparative quantitative thermography | * | * |
| | Comparative qualitative thermography | * | * |
| | Environmental influences | * | * |
| | Camera measurement tools | * | * |
| | Measurement tools | * | * |
| | Palette selection | * | |
| | Level and span adjustment | * | |
| | Distance (atmospheric) correction | * | * |
| | Emissivity correction | | * |
| | Statistical analysis | | * |

| Subject | Topics | CAT I | CAT II |
|---|---|---|---|
| | Image subtraction | | * |
| | Image montage | * | * |
| | Temperature trending | * | * |
| | General image interpretation guidelines | * | * |
| | General guidelines for establishing thermal severity assessment criteria (ISO 18434-1, engineering codes and standards) | | * |
| **4. General applications** | | **4.5** | **-** |
| | Discussion on general industrial applications | * | |
| | Active and passive thermography | * | |
| **5. Diagnostics and prognostics** | | **1** | **2** |
| | Basic principles of diagnostics (ISO 13379) | * | * |
| | Basic principles of prognostics (ISO 13381-1) | | * |
| **6. Condition monitoring applications** | | **4** | **10.5** |
| | Machinery engineering principles (components and construction) | * | * |
| | Typical machinery failure modes and mechanisms and their associated signatures | * | * |
| | Severity assessment and acceptance criteria (engineering codes and standards) | * | * |
| | Safety issues | * | * |
| | ISO 18434-1 | * | * |
| **7. Corrective actions** | | **-** | **3** |
| | Machinery corrective and/or preventative actions | | * |
| **8. Reporting and documentation (ISO International Standards)** | | **1** | **0.5** |
| | Report writing | * | * |
| | Thermographers' and end users' responsibilities | * | * |
| **9. Condition monitoring programme design (ISO 17359, ISO 18434-1, ISO 13379, ISO 13381-1)** | | **0.5** | **0.5** |
| | General principles | * | * |
| | Technique selection | | * |
| | Measurement intervals | | * |
| | Reference temperatures | * | * |

| Subject | Topics | CAT I | CAT II |
|---|---|---|---|
| | Baseline temperatures | * | * |
| | Procedure development | | * |
| **10. Condition monitoring programme implementation (ISO 17359, ISO 13381-1, ISO 18434-1)** | | **1** | **1** |
| | Overview | * | |
| | Safe systems of work | * | * |
| | Roles and responsibilities | | * |
| | Training and assessment | | * |
| **11. Condition monitoring programme management** | | **0.5** | **0.5** |
| | Safety management | * | * |
| | Equipment management | * | * |
| | Procedure management | | * |
| | Skills and competencies management | | * |
| | Database management | * | * |
| | Managing corrective action implementation | | * |
| **12. Training examination** | | **2** | **2** |
| **TOTAL HOURS** | | **32** | **32** |