Certification of Condition Monitoring Personnel and How It Relates to NDT

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Abstract. With the development of ISO18436 for the training and certification of condition monitoring (CM) personnel, a new level of harmonisation exists between the various CM methods. Methods being covered include vibration analysis (VA), acoustic emission (AE), lubrication management (LM) and infrared thermography (IRT). AE and IRT are methods also specified in some NDT standards such as EN473 and ISO9712. With the acceptance of ISO18436 the world is now experiencing 'growth pains' and a confused direction for some trainers and certifying bodies wishing to train candidates and issue certificates of competence to ISO18436. This paper discusses some of the problems being experienced by certifying bodies and trainers in CM as they struggle to implement ISO18436.
The commonality that exists for some methods in both the NDT and CM industries is also discussed. Ultrasonic time-of-flight-diffraction could potentially be recognised as a CM method under a NWIP 22096-2 to start in 2007, together with airborne UT in NWIP 22096-1. Also laser shearography and motor current analysis will be added to the CM stable of methods in 2007. It is crucial that the relevant ISO committees developing both NDT and CM standards liaise on the development of standards for these common methods.
Existing NDT trainers should welcome the emergence of CM personnel qualification and certification schemes, to bring their experience to bear in developing training resources to include Condition Monitoring. As the British Institute of NDT has long recognised, NDT and CM are closely allied engineering disciplines. Personnel certification for Condition Monitoring offers huge potential for training providers over the next few years.
The British Institute of NDT (BINDT) has been in the forefront of development and implementation of qualification and certification systems aimed at compliance with ISO 18436 since 2004. As a result a fully developed certification scheme covering all four CM methods at three levels of competence is now completed and available to industry. This paper offers some insights into the problems that BINDT have overcome - and which others are about to face.

1.0 Introduction

With the development of a new training and certification standard for condition monitoring (CM), namely ISO18436 [1], [2], through the efforts of ISO/TC108/SC5, a new level of harmonisation exists between the various CM methods. Methods being covered include vibration analysis (VA) [3], acoustic emission (AE), lubrication management (LM) and infrared thermography (IRT). AE and IRT are testing methods also specified in some NDT standards such as EN473 [4] and ISO9712 [5]. With the acceptance of ISO18436 the world is now experiencing 'growth pains' and a confused direction for some trainers and certifying bodies (CB) issuing certificates of compliance to ISO18436. Some of the issues of concern include the following:

1. two different ISO committees (TC108 and TC135) are developing parallel training specification documents for CM and NDT, respectively;

2. many people in the NDT community do not appreciate the differences between NDT and CM for the same method;
3. many companies are unfamiliar with ISO18436 and the 30+ 'technical foundation' CM standards;
4. not all CBs within the EFNDT will extend their scope to include certification of CM under ISO18436 within 2006-2007, leaving implementation of the programme to a few CBs;
5. the world recognising the growth in CM, but a significant number of 'rogue' trainers are falsely claiming to be accredited trainers complying to ISO18436;
6. some CBs are preferring to stay with EN473, ISO9712, IAEA 628 and ASNT for training and certification of AE and IRT personnel under an NDT umbrella, even though their duties are really CM-based, thus increasing the confusion amongst practitioners;
7. some NDT training bodies see the establishment of CM training bodies as being detrimental to their business, therefore offering resistance to CM scheme development in general;
8. some confusion exists within the CM industry, which has never had certification standards, as to who accredits or approves whom and who certifies whom.

These are some of the concerns being experienced by people in the CM community with the roll-out of ISO18436, which are also topics of discussion at ISO/TC108. This paper looks at these issues and some possible solutions.

With some large multi-national companies looking to include ISO18436 into company policy in 2006 and many global CM-training companies looking to supply the demand, the future for CM is bright. Resolving some of these issues and improving the relationship with NDT practitioners will ease the growth pains.

To begin discussion on these issues it is pertinent to state that both NDT and CM methods have been serving industry, side by side, for many decades. The mature NDT methods are adequately specified in standards such as EN473 and ISO9712 and guidelines such as SNT-TC-1A. CM methods such as VA and LM (which includes tribology and wear debris analysis) are also mature methods but have never been covered by a certification of competence. In CM, approximately ten years ago the ISO technical committee (ISO/TC108/SC5) began work on standards for vibration and shock in machines. The scope of TC108 has since evolved to include AE, LM and IRT, with the most recent extension to scope (December 2005) to include airborne UT, laser shearography (interferometry) and motor current analysis. The committee scope has now been extended to also include monitoring of structures. Let's now look at the methods common to NDT and CM, and then review the relevant standards.

2.0 Commonality between NDT and CM

The commonality of methods between NDT methods and CM methods specified by ISO18436 exist mainly with AE and IRT, in which there is dissention amongst practitioners. More specifically, there is a genuine equivalence only in AE at level 3, as specified in ISO/DIS18436-6 and ISO9712:2005. Of added concern throughout the CM community is the inclusion of IRT and AE into the NDT technical reference documents ISO/TR 25107 (Non-destructive testing- Guidelines for NDT training syllabuses), which enhances the similarity of these methods in NDT and CM. However, the member certifying bodies of CEN/TC138 decided in 2005 not to adopt the ISO9712: 2005 version, instead deciding to review EN473: 2000.

Regardless of commonality of these methods between NDT and CM in areas of general theory and basic applications, there is a definite delineation in areas such as CM programme design, implementation and management, CM standards and CM applications (in machines, structures, electrical and other applications) which do not exist in NDT training. Any commonality is restricted by the differences in scope and applications in different industrial applications. That is, CM is primarily predictive in intent, as it applies test methods to monitor the condition (or health) of a machine or structure over time, generating diagnostic data that provides prognostic (predictive) output using CM prognostic standards, providing residual life determination and whole life cycle costing analysis of major assets. NDT applications are restricted to reactive or scheduled testing within a defined maintenance or production protocol, normally on materials or components which are not part of a machine. The latter is also an application undertaken by a CM practitioner, suggesting that NDT methods are tools (a subset) of a CM programme.

In order to bring harmony between NDT and CM, each certifying body (CB) could establish training modules that comply with both CM and NDT requirements, for example, theory and basic applications, to which all NDT qualified persons would satisfy. Then the remaining CM specific modules could be CM-diagnostics/prognostics, CM-design/implementation and management, CM-standards & codes and CM-sector specific machine, structures or electrical systems applications. Future development of IRT modules may include medical and/or veterinary thermography for monitoring the condition (health) of patients (human or animal). That is, for example, a level 2 NDT qualified AE person could have his/her NDT certificate accepted as proof of partly meeting the CM prerequisite, and needs only to sit a shortened training program consisting of selected CM-specific modules, together with meeting the CM experience requirement of testing in a CM environment.

3.0 ISO CM Standards

3.1 ISO18436

Table 1 lists the development phase of the parts of ISO18436 ‘Condition monitoring and diagnostics of machines: Training and certification of personnel’. With a voting period of 5 months at DIS, it is anticipated that the remaining parts of ISO18436 will be at the FDIS stage by end of 2006. FDIS documents can be included into a CBs programme since an FDIS cannot be changed in technical content.

With this eventuality looming and the continued evolution of condition monitoring standards, some of which are shown in Table 2, many CBs are preparing to establish and develop their own CM certification programmes based on ISO18436, as indicated in Table 3.

Table 1 progress of ISO18436 (as from mid 2006)

Part	**Requirement**	**status**
1	Requirements for certifying bodies and the certification process	IS- 2004
2	Vibration analysis	IS- 2003
3	Requirements for training bodies and the training process	FDIS
4	Lubricant field analyst	DIS
5	Lubricant- laboratory analyst	DIS
6	Acoustic emission	DIS
7	CM specialist	PWI
8	Thermography	DIS

Table 2 Some key condition monitoring standards published or being developed

ISO	Title
18431-1	Mechanical vibration and shock- signal processing: Part 1- General introduction
FDIS 18434-1	Condition monitoring and diagnostics of machines- Thermal imaging
13372	Condition monitoring and diagnostics of machines: Vocabulary
13374-1	Condition monitoring and diagnostics of machines- Data processing, communication and presentation: Part 1- General guidelines
DIS13374-2	Condition monitoring and diagnostics of machines- Data processing, communication and presentation: Part 2- General data processing and analysis procedures
17359	Condition monitoring and diagnostics of machines: General guidelines
18430	Condition assessment of structures
13381	Condition monitoring and diagnostics- prognostics

The BINDT has developed a set of specification documents (CMGEN) compliant to the evolving standard and are published in www.bindt.org. This accessibility by other CBs allows them to use these documents as templates for their own programme if they wish. This paper presents more detail of the BINDT CM structure as a guide to our colleagues in other CBs.

4.0 CBs developing CM Certification programmes

Table 3 indicates the intent of the main CBs to establish and develop a CM-based programme. Countries who are not members of EFNDT, such as USA, Canada, Vietnam, New Zealand etc are also investigating ways to implement an ISO18436-based programme, either regionally or in alliance with other CBs.

Looking at the key issues above, the following discusses how a CM scheme could be structured, based on the experiences of BINDT.

4.1 How a scheme could be structured

Any scheme for the certification of condition monitoring personnel could contain the basic structure as shown in Figure 1. This basic structure could deter training centres from making false claims of being accredited or approved, as they must identify the accredited certifying body involved. The detailed structure for BINDT is shown in Figure 2.

In Figure 1 the accrediting body, usually a nationally approved service, audits a certifying body against a conformity standard such as ISO17024 [6], and in CM, this could include ISO18436-1. In the UK this company is UK Accrediting Service (UKAS). The certifying body is then authorised to approve/endorse their appointed examination bodies/centres (AEC) in accordance with specifications defined by the CB (for BINDT it is PSL63 and PSL65) and in accordance with relevant standards such as, in this case, ISO18436-1.

Table 3 CBs intent to develop a CM programme according to ISO18436

CB	Intent- Yes	Intent- No	Undecided
Korea Society of NDT	√ (2006)		
Australian Institute of NDT	√ (2006)		
British Institute of NDT	√ (2004)		
Japanese Society of NDT	√ (2005)		
Czech Assoc for Personnel Certification	√ (2005)		
Norwegian NDT Society		√	
COFREND (France)			√ (IR,VA)
Belgrade, SDIBR (Serbia & Montenegro)		√	
Swedish Society NDT		√	
Hungarian Assoc NDT		√	
Danish NDT Society –Force Technology		√	
ABENDE (Brazilian Ass NDT)	√		
Hellenic Society NDT (Greece)	√ (IR, VA)		
SKO, The Netherlands			√
SSNT, (SGZP) Switzerland			√
CICPND, Italy			√
OGfZP, Austria			√
CERTIAEND, Spain		√	
Testing & Diagnostics, Russia			√
Finnish NDT Committee, Inspecta OY, Finland			√
BANT, Belgium			√
UDT-CERT, (SIMP) Poland			√
ISRACERT, Israel			√
CHSNDT, China			√
DGZfPeV, Germany			√
BGS NDT			√
CrSNDT, Croatia		√	
ISNT, India			√
IIWE, Ireland			√
LSNDT, Latvia			√
ARoENd, Romania		√, but looking	
Slovak Soc NDT			√
Slovenian Soc NDT		√	
Ukrainian Soc NDT	√ All		√

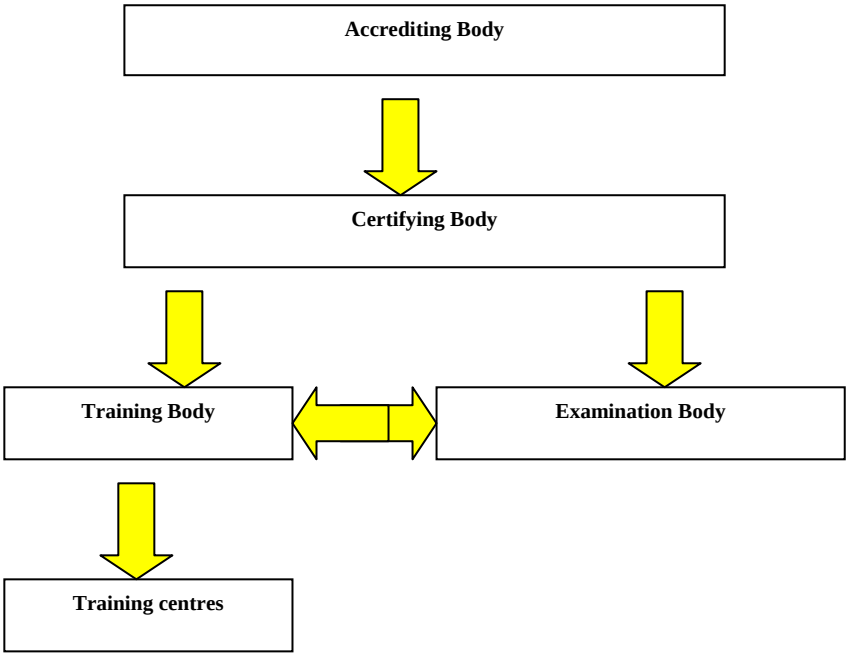

Figure 1 Basic structure

The CB is also authorised to approve/endorse their appointed training bodies (also known as training organisations- ATO) against their own established criteria and ISO/FDIS 18436-3. However, if they have within their audited management structure, an accreditation panel, governed by a managing committee, that audits an ATO against a standard, such as ISO/FDIS18436-3, together with ISO9001 and ISO17024, using ISO9001 auditors, then they should be allowed to accredit that training body to be 'accredited training organisation'. The BINDT scheme audits ATOs against a specification document Acc Doc 4 which is derived from these standards and CMGEN, a BINDT specification document based on ISO18436. The BINDT management committee meeting the requirements of ISO/FDIS 18436-3 is the Accreditation Panel, which is part of the 'Membership, Qualification and Education' (MQ&E) committee and it oversees the accreditation process of training bodies. The ATO can also, in accordance with an allowance within ISO/FDIS18436-3, establish remote 'training centres' which are satellites to the main company, and which are subject to the management regulations and authority from that ATO. A training centre should be a remote part of the company accredited, not another large facility of that company which is close to the registered ATO in that region. For example, an ATO in Aberdeen and a remote centre in Niger should be allowed as it satisfies the intent in ISO/FDIS18436-3. However, an ATO in Germany that also lists a large college in Netherlands as a 'training centre' violates the intent of ISO/FDIS18436-3. In this situation both colleges should be accredited or approved as individual ATOs. In special circumstances an ATO can act as an AEC providing they can demonstrate that the two processes of training and examination are never crossed.

In Figure 2 a committee denoted as CMATOG represents the 'condition monitoring accredited training organisation group'. This is a special interest group comprised of ATO representatives. This group feeds back into the CB management process all information relating to the ATO network and any adverse or constructive consequences of the process. It is a realism check for the development and continued improvement of the training network to optimise the management documents and the training process. It considers factors such as language, work-time differences, and cultural differences etc from trainers around the world. It cannot discuss training fees and any aspect controlled by the training

bodies, as the certifying body must remain totally impartial and have no influence on the business side of an ATO.

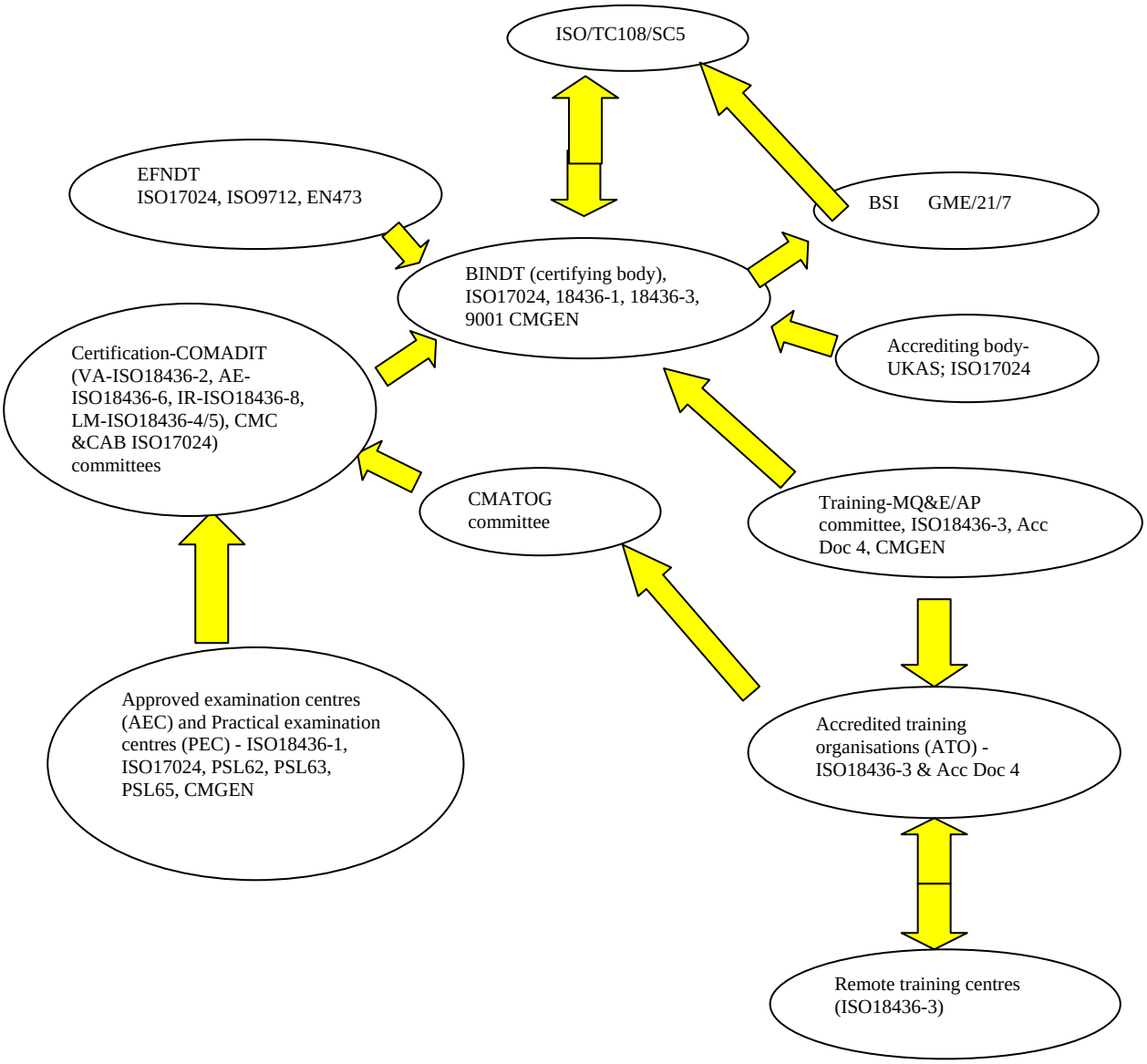

Figure 2 The BINDT CM structure

With regard to approved examination centres (AEC), their remit is to facilitate the CM theory examinations, since ISO18436 is fundamentally a theory-only based standard. The BINDT however believes that it is imperative that CM practitioners also be tested for practical competence, and has undertaken to establish a small network of 'practical examination centres (PECs) within the UK. The intent is to provide a facility consisting of working machines, electrical systems and structural elements, all with managed faults that can be 'mastered' (at least 1 day prior to the examination) and offered to CM practitioners in AE, LM, VA and IRT certificated by BINDT at levels 1 and 2 in accordance with ISO 18436. Success at the PEC examination will result in an endorsement of the current BINDT certificates.

The most recent developments of ISO18436 will see part 8 for IRT to include a practical examination exception option for experience requirements at level 1 only. The BINDT development however will offer a more comprehensive practical examination for

all methods at levels 1 and 2 through the PEC network. The latter will give added-value endorsement to the BINDT issued certificates.

5.0 Conclusion

The commonality that exists for some methods in both the NDT and CM industries has been discussed. Ultrasonic time-of-flight-diffraction could potentially be recognised as a CM method by ISO/TC108 in the near future, while airborne UT will be developed as a CM method within ISO/TC108/SC5 working group 15 in 2007. Laser shearography and motor current analysis will also be added as a CM method in ISO18436 and CMGEN in 2007.

It is crucial that the relevant ISO committees developing both NDT and CM standards liaise on the development of standards for these common methods. Also, existing NDT trainers should welcome the emergence of CM personnel qualification and certification schemes, to bring their experience to bear in developing training resources to include condition monitoring. As the British Institute of NDT has long recognised, NDT and CM are closely allied engineering disciplines. Personnel certification for condition monitoring offers huge potential for training providers over the next few years.

The BINDT has been in the forefront of development and implementation of qualification and certification systems aimed at compliance with ISO 18436 since 2002. As a result a fully developed certification scheme covering all four CM methods at three levels of competence is now completed and available to industry [7].

6.0 References

[1] ISO18436-1: 2004: Condition monitoring and diagnostics of machines: Requirements for certifying bodies and the certification process.

[2] ISO/FDIS18436-3: Condition monitoring and diagnostics of machines: Requirements for training bodies and the training process.

[3] ISO 18436-2: 2003: Condition monitoring and diagnostics of machines: Requirements for training and certification of personnel: Vibration condition monitoring and diagnostics

[4] BS EN 473: 2000, Non-destructive testing: Qualification and certification of NDT personnel –General principles

[5] ISO 9712: 2005: Non-destructive testing: Qualification and certification of personnel

[6] BS EN ISO/IEC 17024: 2003: Conformity assessment: General requirements for bodies operating certification of persons

[7] CM/GEN: 2004: General requirements for qualification and certification of condition monitoring and diagnostic personnel (BINDT).