

Certification and Accreditation for Condition Monitoring and Diagnostics

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A wise person once said, "There are those that know and those that think they know." When a company hires an individual to perform a skilled job, they want to be assured that they are competent and can meet the requirements of the job both technically and safely. In the absence of accredited certification, this often becomes a guessing game. Individuals can declare that they have the knowledge and experience necessary to meet the job requirements; but do they really? In the case of vibration condition monitoring, the International Organization for Standardization (ISO) has published standards over the past several years that define the requirements for training and certification of personnel. Many companies claim they teach and test to these standards; but do they really?

To ensure the credibility of organizations that claim to offer certification of persons to standards, ISO, in conjunction with the International Electrotechnical Commission (IEC) have published ISO/IEC 17024 that defines a "globally accepted benchmark for organizations operating certification of persons." This standard, which has been nationally adopted in the U.S. as ANSI/ISO/IEC 17024, requires that an independent accrediting body examine the organization for conformity to the general requirements for bodies operating certification of persons. In the United States, the accrediting body is ANSI (American National Standards Institute). Receiving certification from an accredited organization ensures that the individual has met minimum defined requirements.

Vibration Institute Accreditation. The Vibration Institute has recently been accredited by ANSI to the International Standard ANSI/ISO/IEC 17024, "Conformity assessment – General requirements for bodies operating certification of persons" and now provides accredited third-party certification of persons in accordance with all four classification categories of ISO 18436-2, "Condition monitoring and diagnostics of machines – Requirements for training and certification of personnel, Part 2: Vibration condition monitoring and diagnostics." The Vibration Institute is one of two organizations in the world that has earned this accreditation for certification of personnel in vibration condition monitoring and diagnostics. The other organization is BINDT (British Institute for Nondestructive Testing) which was accredited by the United Kingdom Accreditation Service (UKAS). Additionally, the Vibration Institute conforms to the more rigorous standard, 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."

Accreditation. To become an accredited certifying body, an organization must conform to ISO/IEC 17024 and demonstrate compliance in many areas, including organizational structure, development and maintenance of a certification scheme, management, record keeping, confidentiality, and security. It is not enough to simply have a certification exam that claims to conform to a standard. ISO/IEC 17024 specifically states that the policies and procedures for certification must be "fair and equitable among all candidates." It further states the certification body must be structured to ensure "competence, impartiality, and integrity" in the administration of its program. And, the certifying body must maintain documented structure and procedures.

Separation of Training and Certification. An often misunderstood requirement as stated in the standard is, "The certification body shall not offer or provide training, or aid others in the preparation of such services, unless it demonstrates how training is independent of the evaluation and certification of persons." Simply put, there must be a clear and distinct separation between all training and certification administration, structure, and activity including the separation of the personnel involved. This becomes one of the largest obstacles for most organizations to overcome, since personnel that develop the training materials for, and/or teach subjects related to, the body of knowledge cannot also be involved in the development or administration of the certification scheme and exams. This is a hard and fast ISO/IEC 17024 requirement.

Scheme. Developing the scheme (certification exams) must include, according to ISO/IEC 17024, "review and validation of the scheme by the scheme committee." Additionally, "the scheme committee shall fairly and equitably represent the interests of all parties significantly concerned." To this end, the Vibration Institute scheme committee is made up of an international panel of 23 members from a variety of industries and academia. This panel represents more than 580 years of experience in vibration analysis.

Psychometrics. Early into the accreditation process, it became evident that it required more than just 580 years of vibration analysis experience to meet the requirements of ISO/IEC 17024. To help guide us through the requirements, the Vibration Institute enlisted the aid of a psychometrician specializing in certification and classification of personnel. According to Wikipedia, "psychometrics is the field of study concerned with the theory

and technique of educational and psychological measurement, which includes the measurement of knowledge." In our first meeting he asked, "What is your passing score?" Our response was, 75%. But his follow-up question stopped us cold: "How do you know?" How, indeed? How do we determine what score accurately defines if a candidate's knowledge and understanding of the body of knowledge is sufficient to warrant certification? As we learned in the ensuing months, there were many areas in our scheme that needed to be analyzed and subsequently updated using normally accepted examination and educational methods.

Body of Knowledge. The Vibration Institute uses ISO 18436-2 as the body of knowledge for its certification program. Wikipedia defines a body of knowledge as "a term used to represent the complete set of concepts, terms and activities that make up a professional domain." The distribution and difficulty of test questions (technically called items) on the exams are based on this standard or body of knowledge.

Job Task Analysis. To assess an individual's capabilities, it is not enough to just have developed a body of knowledge. It is also necessary to define the job requirements, assess the tasks to be performed, and determine the knowledge and skills that must be applied to accomplish them. Early and Wheeler state, "For a certification program to be defensible, the use of job task analysis is an essential component for the program." The job task analysis process involves the defined body of knowledge, the job requirements of a certified person at a particular classification category, and determining the use or cognitive level the candidates need to possess for each topic and subject area.

The Vibration Institute uses the job requirements of ISO 18436-2, Clause 4, for its certification program. The three usage or cognitive levels applied to the body of knowledge are know, understand, and apply. At a low certification classification, a certified analyst may be required to know a lot of facts, but at a higher classification, they need to be able to apply learned concepts to the solution of problems. The process of determining the content and distribution of test questions based on the body of knowledge and the cognitive level to meet the job requirements is another lengthy and laborious process that draws on the experience of the scheme committee in performing the expert panel job task analysis. Completion of the job task analysis according to recognized methods provides evidence as to the validity of the exams and certification scheme.

Exam Questions. There are well-accepted psychometric methods for developing test questions, for testing those questions, and statistical methods for analyzing them to determine if they are effective and acceptable. A good question will discriminate between minimally qualified candidates who know and understand the material and those candidates who do not. According to ISA (International Society of Automation, formerly the Instrument Society of America), “An acceptably (minimally) competent person is defined as someone who adequately performs all job functions safely and requires no further training to do so.” All questions used by the Vibration Institute on its certification exams were statistically evaluated, reviewed, and updated by the scheme committee to follow normally accepted guidelines and to better discriminate between the minimally qualified and less than minimally qualified candidates.

Test Scores. Each exam was evaluated using the widely used and recommended Angoff Modified Method for determining the actual passing score. This particular method is used to determine the passing score on tests such as the SAT (a widely used college admission exam) and other criterion-referenced tests. According to the National Center for Fair and Open Testing, criterion-referenced tests measure candidates against a standard in contrast to norm-referenced tests that measure candidates against each other. As we found out, a passing score cannot be decided arbitrarily; it must be justified with empirical data. This analysis requires a compilation of past test results, a full and common understanding of the minimally qualified candidate’s job requirements at that particular classification category, and an arduous process of evaluation by the subject matter experts of the scheme committee. This item-by-item process must be repeated for each and every version of an exam, meaning different versions of an exam are likely to have different passing scores. To normalize this result, many exams such as the ACT test (another college entrance exam), use a scaled score.

Validity and Reliability. Early and Wheeler note, “The purpose of NDT (non-destructive testing) examinations is to make a clear distinction between personnel who are competent to perform NDT at the desired level and those who are not.” To do this, an exam must have both validity and reliability; “neither by itself is sufficient to create a good examination.”

Early and Wheeler add, “Validity requires an examination to measure the required knowledge and understanding and to produce scores that measure these without giving advantage or disadvantage to any group of candidates.” Validity means, does an exam accurately measure a candidate’s required knowledge? Utilizing the appropriate body of knowledge, an accurate job task analysis, discriminating examination questions, and setting the correct criterion based passing score all lead to a valid certification scheme.

Reliability, on the other hand, according to Early and Wheeler, “refers to the consistency of the results of the examination each time it is administered.” This means that equally competent persons should get similar scores on similar exams. Reliability is established by calculating a statistically based Kuder-Richardson 20 coefficient (KR20) and standard error of measurement (SEM) on a number of completed exams. A high KR20 means that the exam is relatively free of errors, while the SEM estimates the variability of a candidate’s scores if he or she repeatedly took the same exam.

The Vibration Institute strives to ensure the certification scheme remains valid and that the examinations are reliable. Procedures are in place to routinely review factors affecting scheme validity and to assess the statistical reliability of given exams as part of the continual improvement process.

Misconceptions and False Claims. In an effort to jump on the ISO 18436-2 band wagon, many companies are making false claims. Due to the inherent complexities of the standards, certification, and accreditation process, it’s not hard to understand how they can be misinterpreted and lead to such claims.

ISO Certification. Many companies claim they offer ISO certification and/or ISO certificates; both claims are incorrect. ISO neither certifies nor provides certificates, period. ISO develops and publishes international standards.

Accredited Training. References to “accredited courses” or “vibration analysis training accredited to ISO 18436-2” are false. In a recent e-mail to the authors of this paper, John McDonald, conformity assessment and standard consultant, said “users of the ISO 18436 series might be confused if those standards were to provide for accreditation of training bodies and the accreditation of certification bodies as if accreditation would have the same meaning in either case.” He added that “those standards (could) make provisions for the work of training bodies to be validated in some way, but that this should be separately defined and described so that no such confusion could arise.”

The definition of accreditation from ISO/IEC 17000 is “third-party attestation related to a conformity assessment body conveying formal demonstration of its competence to carry out specific conformity assessment tasks.” Simply put, this all means that the term accreditation is applicable only to attestation regarding a conformity assessment body. So no one has ISO 18436-2 accredited courses or training.

Training and Certification. Another company is advertising that its training team is working in conjunction with a certification scheme committee to develop “course material and examinations in accordance with ISO 18436.” As noted previously, there must be a clear separation between training and certification. This is a clear violation of ISO/IEC 17024 and ISO 18436-1.


Department of Defense. In contrast with

the many false claims being made, some entities do understand standards and the value of accreditation. A May 2010 ANSI press release announced that the U.S. Department of Defense “named ANSI the approved accreditor of certification bodies.” It went on to say, “the DOD further attests to the highest quality of ANSI’s personnel certification accreditation program and is the latest example of how governmental agencies in key sectors such as national security, public safety, and healthcare rely upon ANSI accreditation for third-party verification of the competence of certification bodies.” The Vibration Institute can also attest to the high quality of the ANSI personnel certification accreditation program as stated by the DOD.

Conclusion. It’s an easy thing to claim compliance with a standard as many organizations are doing with ISO 18436-2; maybe they are and maybe they are not. It’s another thing to meet the rigorous requirements for a certifying body and become accredited. Accreditation is important because it ensures the organization is meeting all the necessary requirements to run a competent and impartial certification program with integrity. Industry should feel comfortable in working with vibration analysts that achieve certification from an accredited certifying body.

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