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Standards and Courses for Condition Monitoring and Vibration

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This is an incomplete, annotated list of standards relevant to condition monitoring, with an emphasis on vibration. If you download a standard, you should print it out as you will lose access to your electronic version eventually.

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

ISO 13379.1 Condition monitoring and diagnostics of machines — **Data interpretation and diagnostics techniques** — Part 1: General guidelines

ISO 13379.2 Condition monitoring and diagnostics of machines — Data interpretation and diagnostics techniques — Part 2: **Data-driven applications**

ISO 13381.1 Condition monitoring and diagnostics of machines—**Prognostics**

Part 1: General guidelines

AS 17359 Condition monitoring and diagnostics of machines—General guidelines

ISO 18434.1 Condition monitoring and diagnostics of machines—**Thermography**

Part 1: General procedures

IEEE Std 1415-2006

IEEE Guide for **Induction Machinery** Maintenance Testing and Failure Analysis

Sponsor: Electric Machinery Committee of the IEEE Power Engineering Society

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ISO 18436

The 18436 series of standards form the basis of a number of commercially available courses for practitioners of vibration condition monitoring, thermography, lubricant analysis, ultrasound and acoustic emissions.

ISO 18436.1 Condition monitoring and diagnostics of machine systems — Requirements for certification of personnel —

Part 1: Sector specific requirements for certification bodies and the certification process

ISO 18436.2 Condition monitoring and diagnostics of machines — Requirements for qualification and assessment of **personnel** —

Part 2: **Vibration condition monitoring and diagnostics**

Part 2 specifies four categories of classification, on which the **VCAT 1, 2, 3 and 4 courses** are based. It specifies between 30 and 64 teaching hours for each category. It also specifies a minimum experience of 6, 18, 36 and 60 months respectively for each category. VCAT 1 'qualifies' a person to do a limited set of tasks, including:

- conducting measurements;
- identifying measurement errors;
- copying data onto the server;
- comparing single value measurements against a predefined alert setting;
- checking whether a single value measurement deviates from the norm; and
- making and reporting on visual observations.

In other words, VCAT 1 does not qualify a person to identify bearing faults, analyse a spectrum, set up a measurement, work unsupervised, and generally limits work to simple single channel measurements. A VCAT 1 course will typically cover how to analyse a few fault types such as unbalance.

This poses a challenge for training new staff or setting up a new condition monitoring program in-house, while remaining compliant with the standard. The requirement that a VCAT 1 person can only work "under direction" is particularly onerous, especially if this is interpreted as requiring a VCAT 2 or higher person be physically present. This can create a barrier to entry, as people are less likely to take on the commitment, and employers are less likely to invest the resources needed in a person to get them to a

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VCAT 2 or 3 standard. This is somewhat self-reinforcing, as it means that people with a VCAT 2 or 3 qualification are often paid more, which increases the risk that trained staff leave for a firm that only hires qualified personnel. The “under direction” requirement is also easier for a larger service provider to meet, as they are more likely to be able to schedule work in a way that allows 2 people to be present for a job that might only require one person onsite.

The pathway for an unqualified person to become VCAT 1 qualified with 6 months of experience is also not entirely clear, as that would require the person to do 6 months of useful work that is not compliant with the standard.

The last paragraph of the introduction suggests alternative options for people to carry out vibration condition monitoring work that is essentially not compliant with this standard. It also highlights the primary benefit of compliance, for both the practitioner and the asset owner, which is that employers and customers (asset owners) are likely to have the greatest confidence in certified people. This suggests that the standard should be interpreted as a way to provide consistency in recognizing training and experience in vibration condition monitoring staff, rather than as a requirement for conducting work, subject of course to the requirements imposed by employers and asset owners.

ISO 18436.4 Condition monitoring and diagnostics of machines—Requirements for qualification and assessment of personnel

Part 4: **Field lubricant analysis**

FL CAT 1

ISO 18436.6 Condition monitoring and diagnostics of machines—Requirements for qualification and assessment of personnel

Part 6: **Acoustic emission**

ISO 18436.7 Condition monitoring and diagnostics of machines—Requirements for qualification and assessment of **personnel**

Part 7: **Thermography**

IRT CAT 1

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ISO 18436.8 Condition monitoring and diagnostics of machines —

Requirements for qualification and assessment of **personnel** —

Part 8: **Ultrasound**

UCAT 1

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The ISO 20816 series of standards provides useful guidelines on industry-standard approaches to measuring vibration on machinery and establishing guidelines for acceptable levels. As you would expect, there is no 'one size fits all' vibration criteria for any type of machine. The guidelines usually come in the form of a large number of rating bands, most of which vary with frequency. The intention is typically that an equipment owner agrees as part of a contract with their equipment supplier which rating from the relevant standard will be used for accepting the plant as installed. Some standards give further advice on what is a typical increase in vibration amplitude for an older machine, and what is acceptable for long term operation or short term use.

This series largely replaces the ISO 10816 series. Note that some of the criteria are now rather complicated due to the large number of options that feed into them.

ISO 20816.1 Mechanical vibration — Measurement and evaluation of machine vibration — Part 1: General guidelines

ISO 20816.2 Mechanical vibration — Measurement and evaluation of machine vibration —

Part 2: **Land-based gas turbines, steam turbines and generators in excess of 40 MW, with fluid-film bearings and rated speeds of 1 500 r/min, 1 800 r/min, 3 000 r/min and 3 600 r/min**

ISO 20816.3 Mechanical vibration — Measurement and evaluation of machine vibration —

Part 3: **Industrial machinery with a power rating above 15 kW and operating speeds between 120 r/min and 30 000 r/min**

ISO 20816.4 Mechanical vibration — Measurement and evaluation of machine vibration — Part 4: **Gas turbines in excess of 3 MW, with fluid-film bearings**

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ISO 20816.5 Mechanical vibration — Measurement and evaluation of machine vibration —

Part 5: **Machine sets in hydraulic power generating and pump-storage plants**

ISO 20816.8 Mechanical vibration — Measurement and evaluation of machine vibration — Part 8: **Reciprocating compressor systems**

ISO 20816.9 Mechanical vibration — Measurement and evaluation of machine vibration — Part 9: **Gear units**