
**Condition monitoring and diagnostics
of machines — Vibration condition
monitoring —**

Part 2:

**Processing, analysis and presentation
of vibration data**

*Surveillance des conditions et diagnostic des machines — Surveillance
relative aux conditions des vibrations —*

Partie 2: Traitement, analyse et présentation des données vibratoires



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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 13373-2 was prepared by Technical Committee ISO/TC 108, *Mechanical vibration and shock*, Subcommittee SC 2, *Measurement and evaluation of mechanical vibration and shock as applied to machines, vehicles and structures*.

ISO 13373 consists of the following parts, under the general title *Condition monitoring and diagnostics of machines — Vibration condition monitoring*:

- *Part 1: General procedures*
- *Part 2: Processing, analysis and presentation of vibration data*

Further parts are under preparation:

- *Part 3: Basic techniques for diagnostics*

Introduction

The purpose of this part of ISO 13373, which covers the area of vibration condition monitoring of machines, is to provide recommended methods and procedures for processing signals and analysing data obtained from vibration transducers attached to a machine at selected locations for the purpose of monitoring the dynamic behaviour of a machine.

Broadband vibration measurements provide an overview of the severity of machine vibration that can be observed and trended to alert machine users when an abnormal condition exists with a machine. Processing and analysing these vibration signals further in accordance with the procedures specified in this part of ISO 13373 gives the user an insight into ways of diagnosing the possible cause or causes of the machinery problems, which allows for more focused continued condition monitoring.

The advantages of such a monitoring programme are that machinery operators will not only be made aware that a machine may fail at a certain time, and that maintenance should be planned prior to the failure, but it will provide valuable information regarding what maintenance should be planned and performed. The vibrations are manifestations or symptoms of problems such as misalignment, unbalance, accelerated wear, flow and lubrication problems.

ISO 13373-1 contains guidelines for vibration condition monitoring of machines. This part of ISO 13373, however, contains guidelines for the processing, presentation and analysis of the vibration data thus obtained, and that can be used for diagnostics to determine the nature or root causes of problems.

The signal processing, analysis and diagnostic procedures applied to vibration condition monitoring may vary depending on the processes to be monitored, degree of accuracy desired, resources available, etc. A well-conceived and implemented condition monitoring programme will include consideration of many factors, such as process priority, criticality and complexity of the system, cost-effectiveness, probability of various failure mechanisms and identification of incipient failure indicators.

An appropriate process analysis needs to dictate the types of data desired to monitor the machinery condition suitably.

The vibration analyst needs to accumulate as much pertinent information as possible about the machine to be monitored. For example, knowing the vibration resonant frequencies and the excitation frequencies from design and analytical information will provide an insight regarding the vibration frequencies anticipated and, consequently, the frequency range that is to be monitored. Also, knowing the machine's initial condition, the machine's operational history, and its operating conditions provides additional information for the analyst.

Other advantages to this pre-test planning process are that it provides guidance as to what types of sensors are needed, where they should optimally be located, what kind of signal conditioning equipment is required, what type of analysis would be most appropriate, and what are the relevant criteria.

Further standards on the subject of machinery condition monitoring and diagnostics are in preparation. These are intended to provide guidance on the overall monitoring of the "health" of machines, including factors such as vibration, oil purity, thermography and performance. Basic techniques for diagnostics will be described in an additional part of ISO 13373, which is under preparation at present.

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Condition monitoring and diagnostics of machines — Vibration condition monitoring —

Part 2: Processing, analysis and presentation of vibration data

1 Scope

This part of ISO 13373 recommends procedures for processing and presenting vibration data and analysing vibration signatures for the purpose of monitoring the vibration condition of rotating machinery, and performing diagnostics as appropriate. Different techniques are described for different applications. Signal enhancement techniques and analysis methods used for the investigation of particular machine dynamic phenomena are included. Many of these techniques can be applied to other machine types, including reciprocating machines. Example formats for the parameters that are commonly plotted for evaluation and diagnostic purposes are also given.

This part of ISO 13373 is divided essentially into two basic approaches when analysing vibration signals: the time domain and the frequency domain. Some approaches to the refinement of diagnostic results, by changing the operational conditions, are also covered.

This part of ISO 13373 includes only the most commonly used techniques for the vibration condition monitoring, analysis and diagnostics of machines. There are many other techniques used to determine the behaviour of machines that apply to more in-depth vibration analysis and diagnostic investigations beyond the normal follow-on to machinery condition monitoring. A detailed description of these techniques is beyond the scope of this part of ISO 13373, but some of these more advanced special purpose techniques are listed in Clause 5 for additional information.

For specific machine types and sizes, the ISO 7919 and ISO 10816 series provide guidance for the application of broadband vibration magnitudes for condition monitoring, and other documents such as VDI 3839 and VDI 3841 provide additional information about machinery-specific problems that can be detected when conducting vibration diagnostics.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1683, *Acoustics — Preferred reference quantities for acoustic levels*

3 Signal conditioning

3.1 General

Virtually all vibration measurements are obtained using a transducer that produces an analog electrical signal that is proportional to the instantaneous value of the vibratory acceleration, velocity or displacement. This signal can be recorded on a dynamic system analyser, investigated for later analysis or displayed, for example,