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Part 7: Diagnostic techniques for machine sets in hydraulic power generating and pump-storage plants

Surveillance et diagnostic d'état des machines — Surveillance des vibrations —

Partie 7: Techniques de diagnostic pour machines équipant les centrales hydro-électriques et les stations de turbine-pompe

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ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

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Foreword

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

A list of all the parts in the ISO 13373 series can be found on the ISO website.

Introduction

This document is a guideline for procedures to be considered when carrying out vibration diagnostics of machine sets in hydraulic power generating and pump-storage plants, shortly named hydropower units. It is intended to be used by vibration practitioners, engineers and technicians, and it provides them with diagnostic tools. These tools include the use of diagnostic process tables and fault tables. The material contained herein presents the most basic, logical and intelligent steps that should be taken when diagnosing problems associated with these particular types of machines.

Acceptable vibration values for hydropower units, however, are contained in ISO 10816-5 (vibration of non-rotating parts) and ISO 7919-5 (vibration of rotating shafts), which are at present under revision and amalgamation to be published as ISO 20816-5.

ISO 13373-1 presents the basic procedures for narrow-band signal analysis of vibration. It includes description of the types of transducers to be used, their ranges and their recommended locations on various types of machines, online and periodic vibration systems, and potential machinery problems.

ISO 13373-2 leads to the diagnostics of machines. It includes descriptions of the signal conditioning equipment that is required, time and frequency domain techniques, and the waveforms and signatures that represent the most common machinery operating phenomena or machinery faults that are encountered when performing vibration signature analysis.

ISO 13373-3 provides some procedures to determine the causes of vibration problems common to all types of rotating machines. It includes systematic approaches to characterize vibration effects, the diagnostic tools available, tools needed for particular applications and recommendations on how the tools are to be applied to different machine types and components. However, this does not preclude the use of other diagnostic techniques.

It should be noted that ISO 17359 indicates that diagnostics can be

— started as a succeeding activity after detection of an anomaly during monitoring, or

— executed synchronously with monitoring from the beginning.

This document considers only the first case in which diagnostics is performed after an anomaly has been detected. Moreover, it focuses mainly on the use of process tables as diagnostic tools, as well as fault tables since it is felt that these are the tools that are most appropriate for use by practitioners, engineers and technicians in the field.

When approaching a machinery problem that manifests itself as a high or erratic vibration signal, the diagnosis of the problem should be carried out in a well-thought-out systematic manner. ISO 13373-3 and this document achieve that purpose by providing to the analyst guidance on the selection of the proper measuring tools, the analysis tools and their use, and the recommended step-by-step procedures for the diagnosis of problems associated with various types of machine sets in hydraulic power generating and pump-storage plants.

The diagnostic process table methodology presents a structured procedure for a person in the field to diagnose a fault and find its cause. The step-by-step procedure is able to guide the practitioner in the vibration diagnostics of the machine anomaly in order to detect the probable root cause.

The fault tables present a list of the most common faults in machinery, as well as their manifestations in the vibration data. The tables assist with the identification of machinery faults.

For some cases, it can be dangerous to start the machine again after a serious anomaly caused a trip. Then, the diagnosis to be performed may differ from the methods described in this document.

