GE
Oil & Gas

Monitoring System

Radial Vibration, Axial Displacement and Bearing Temperature

Benefits

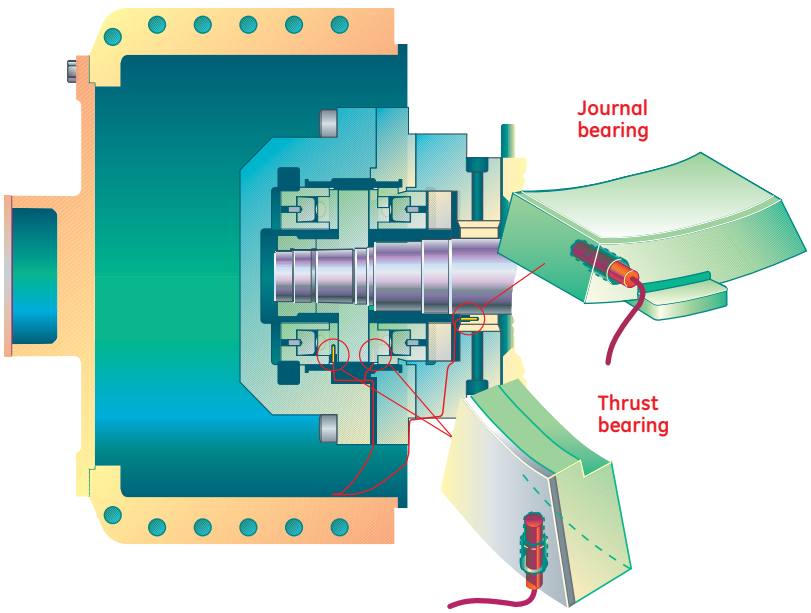
- ■■□ Increased production
- ■■□ Higher efficiency
- ■□□ Compliance with environmental regulations
- ■■□ Availability and Reliability
- ■■■ Life extension

Although machinery protection alone is sufficient reason for equipping critical machine parts with a supervisory instrumentation system, monitoring systems can bring several additional advantages. They are essential for diagnostics and predictive maintenance, which is a growing industry trend and is replacing preventive maintenance wherever possible. Generally, preventive maintenance has a high economic penalty that is not always justified in technical terms. A predictive instead of a preventive approach, means servicing a machine or component only when it is needed, and postponing service when the system is running reliably. Early identification of machinery problems therefore, offers several benefits including:

- Shut downs can be timed
- Replacement parts can be secured in advance, saving time
- Defects causing increased vibration and temperature levels can be eliminated

What it is

It is normal for all machines, even those in top condition, to vibrate and generate noise. The level of vibration of a mechanical system depends on its operational condition - when vibration levels increase and deviate from the normal level, it is a sure indication that some components have deteriorated.
Reliable vibration measurement instrumentation gives sufficient information for a detailed analysis of the state of any mechanical component. Analysis of vibration signals combined with experience and familiarity with the machine are key to accurate troubleshooting.
In addition to vibration measurements, temperature is one of the most important parameters for providing information on bearing stress and operating conditions. The sensing elements together with the monitoring instruments to which they are connected constitute a diagnostic system that provides an indication of bearing wear and deterioration, as well as misalignment.



How it works

Axial Displacement Measurement

Non-contact probes are used to measure rotor axial displacement. Due to the criticality of these measurements, two proximity probes are used instead of one for redundancy. The objective is to measure the average axial displacement with respect to the initial position. This information is used for early detection of thrust bearing malfunction before machine components are damaged.

Radial Vibration Measurement

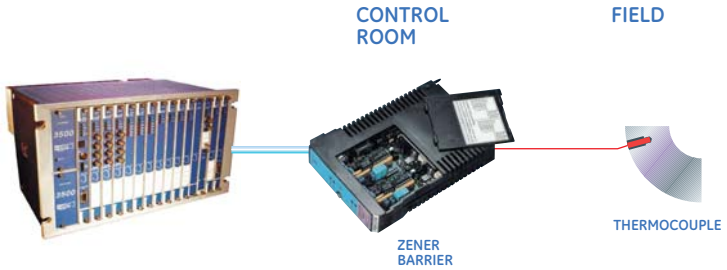
Two non-contact proximity probes (offset by 90°) are mounted on the bearing cap.
The surface conditions of the shaft in the probe reading area are very important because any imperfections induce background noise in the probe signals. Precision finishing (burnishing) is required to minimize surface roughness. For complete information on rotor behaviour, a phase reference is necessary. This is obtained by means of an additional non-contact probe (key phasor) positioned opposite a notch so that it transmits a pulse on each revolution.
Using the key phasor signal it is possible to reconstruct the vibration orbit, filter the signal, and measure the speed of shaft rotation. The key phasor can be positioned at any point along the compressor train with the same rotating speed and is often mounted on the end of the machinery train on the non-drive end cover.
By correlating the signals from the two proximity probes and the key phasor, an elliptical wave shape is displayed (for instance on a 2-channel oscilloscope) representing the shaft orbit. By simply observing deviations from the ideal orbit pattern, it is possible to identify any defects or irregularities that may be present.
Every defect generates a characteristic vibration mode and is represented in the form of a particular vibration frequency. The analysis of vibration frequencies can identify many types of problems including, for example, unbalance of rotating parts and reduction of the oil film that lubricates the journal bearings.

Bearing Temperature Measurement

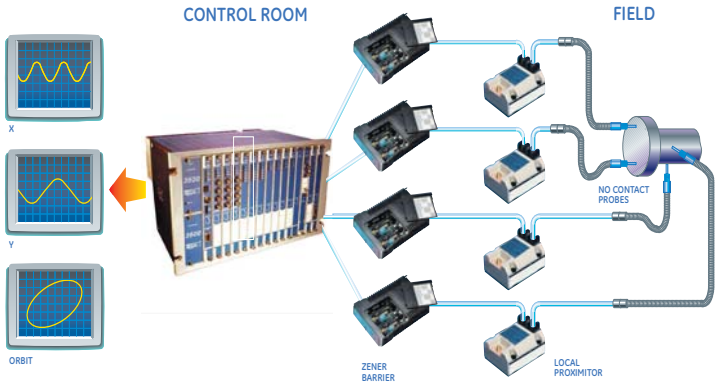
Temperature is one of the most important parameters for obtaining information on journal and thrust bearing stress and operating conditions.
The bearing temperature monitoring system of rotating machines consists of temperature elements (RTD or TC) installed in a hole drilled in the bearing pads to measure the temperature of the hot section of the bearing.
The temperature elements are connected to the monitor or PLC system in the control room, which needs to be configured to display and record temperature data for analysis purposes.

Installation and Machine Modification

The bearing cap and outer casing have to be drilled in order to install the non contact probes. In addition, the area of the shaft exposed to the probes must be burnished.
In terms of temperature sensors, more recent machinery is designed to accommodate thermocouples, and in this case, they only need to be inserted. However, in older machines, the bearing needs to be modified and the exact procedure will be identify case-by-case.
All modifications can be done on site with modification drawings supplied by GE Oil & Gas.



Temperature monitoring



Vibration monitoring

GE imagination at work

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