CALIBRATION OF TRANSDUCERS
AND VERIFICATION OF VIBRATION MONITORING SYSTEMS

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Since the mid-80s DONG Energy has gathered extensive experience in vibration measurement and analysis.

Our specialists work in this field on a full-time basis, and their contact with power plants and the industry has provided them with thorough knowledge of various monitoring systems.

Reliability

Today, most primary machinery is equipped with some sort of vibration protection. Most common is a monitoring system which disconnects the machinery at a predefined vibration level. Such a system is typically covered by a warranty period of two to five years from the installation date. After that period, it is up to the owner of the equipment to ensure that the system is serviced properly and that its measurements are correct.

If system measurements are incorrect, the actual vibration level will either be over estimated, leading to undue trips and inspections, or the machinery will be insufficiently protected from overloads with a risk of increased wear or breakdown

It is therefore very important that the system's measurements and trip function are checked on a regular basis. Such testing should comprise the entire signal route, ie from the transducer to the control system. This will ensure that the total vibration level is recorded correctly, that the cabling is correct and that the safety disconnection functions as intended.

Optimising operations

Today, an increasing number of power plants choose to add a Vibration Analysis System to their Vibration Monitoring System, allowing them to continuously monitor vibration signatures, diagnose the fault and thus perform condition-based maintenance.

A Vibration Analysis System places other demands on measuring data than a Vibration Monitoring System. In a Vibration Analysis System, the analysis is based on more detailed signals, including among other things levels of single frequencies – often in high frequency areas. In most cases the results of the analysis will be monitored over a long period of time, for example to observe the development of wear.

The reliability of such a system thus depends on credible and stable recordings and the certainty that all measured frequencies and amplitudes are correct.

Accredited calibration

Elsam Engineering possesses automatic calibration equipment which enables us to carry out accredited calibrations, in accordance with ISO/CD 16063, of accelerometers, velocity sensors and displacement sensors in the frequency range 5 Hz to 5 kHz. Control of frequency and amplitude is carried out.

Calibration may be carried out at the Elsam Engineering laboratory, but on-site calibration is often advantageous at the production plant.

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Verification of vibration monitoring systems
Calibration of vibration transducers on site may be combined with subsequent control of the entire measuring system, ie from transducer to control system. It is tested that alarm and trip relays work and that alarms occur in the overall control system. The test is carried out at selected frequencies and amplitudes according to API 670 and will reveal possible faults in the overall measuring system. The following figure shows typical frequency and phase characteristics from calibration of an accelerometer.

Typical errors
After a number of years, faults and misreadings are bound to occur in any measuring system, partly because the electronic components are ageing, partly because of handling of transducers and cables during overhauls.

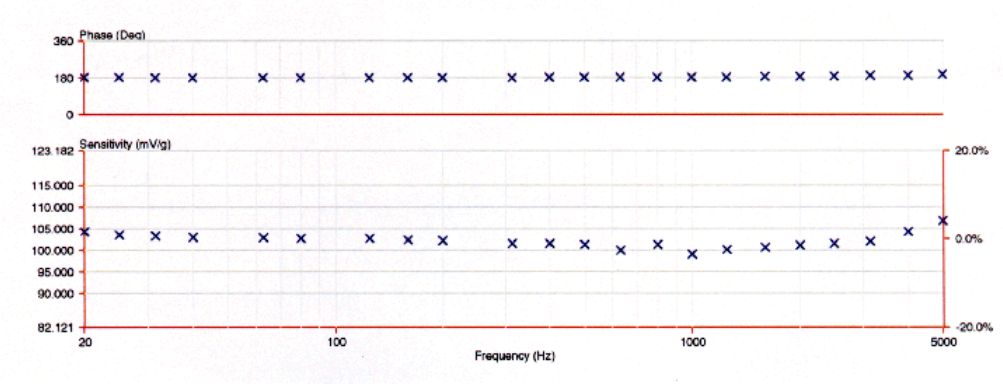
Faults will most often involve the transducers as they are physically located in a harsh environment. Typically, the transducers have been mounted and dismounted several times with a risk of secondary failure. Impacts on an accelerometer entail a risk of reduced sensitivity in some frequency areas. Very often, this fault can be revealed only when the calibration is performed with a frequency sweep.

Also, displacement transducers with sensitivities clearly exceeding the tolerance area have been detected.

Damage to the cables is also a quite common phenomenon which, in the long term, may entail corrosion and bad connections. Such bad connections may, at a later time, result in several trips.

Tests of the general control system have revealed faults in the cabling between transducer and monitoring system, ie the machinery was left practically unprotected.

Selected references
- Verification of Bently Nevada Vibration Monitoring System for steam turbine at Kommunekemi, Nyborg
- Calibration of vibration transducers and verification of Bently Nevada and Schenck Vibration Monitoring Systems as well as Rovsing Vibration Analysis System at Skærbæk Power Plant
- Calibration and adjustment of AEG axial monitoring system on a 20 MW steam turbine at Silkeborg CHP Plant
- Calibration of accelerometers and displacement sensors as well as verification of Bently Nevada Vibration Monitoring System and VibroMeter Vibration Analysis System at Silkeborg CHP Plant
- Calibration of displacement transducers and verification of vibration monitoring at Sønderborg CHP Plant
- Test of Bently Nevada system 3500 with Trendmaster 2000 on a water turbine in Venezuela
- Accredited calibration of various types of vibration transducers and vibration calibrators in the laboratory



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