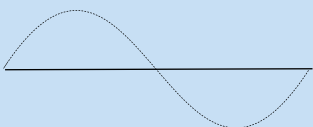


Vibration Diagnostics



An independent rotor dynamics and vibration analysis
consultancy with over 25 years experience in the power industry



Converting data into knowledge

Vibration Diagnostics

From over 25 years of experience within the commercial power industry Vibration Diagnostics are acutely aware of the importance of being an informed operator, able to make effective investment and operational decisions affecting commercial plant performance.

Recognising this, we have created a range of Diagnostic Services providing information from rotating plant data analysis, essential in enabling operators to improve commercial, engineering and environmental plant performance.

Now, based on the expertise gained from monitoring over 100 large steam, hydro and gas turbine generator shaft lines, Vibration Diagnostics can bring tangible benefits to you. We offer a complete package with a range of services, from ad-hoc investigations through to routine monitoring, providing a level of in-depth expert advice designed to meet specific market demands. We focus on providing practical solutions to keep plant running safely, whilst maximising its availability in a commercial environment.



Converting data into knowledge

Vibration Diagnostics approach turns the mass of vibration and plant data into event knowledge and enables informed decisions and actions. Our experts have a vast experience of all the major steam and gas turbine generators in operation, in over 20 locations worldwide, with a generating capacity in excess of 25,000MW.

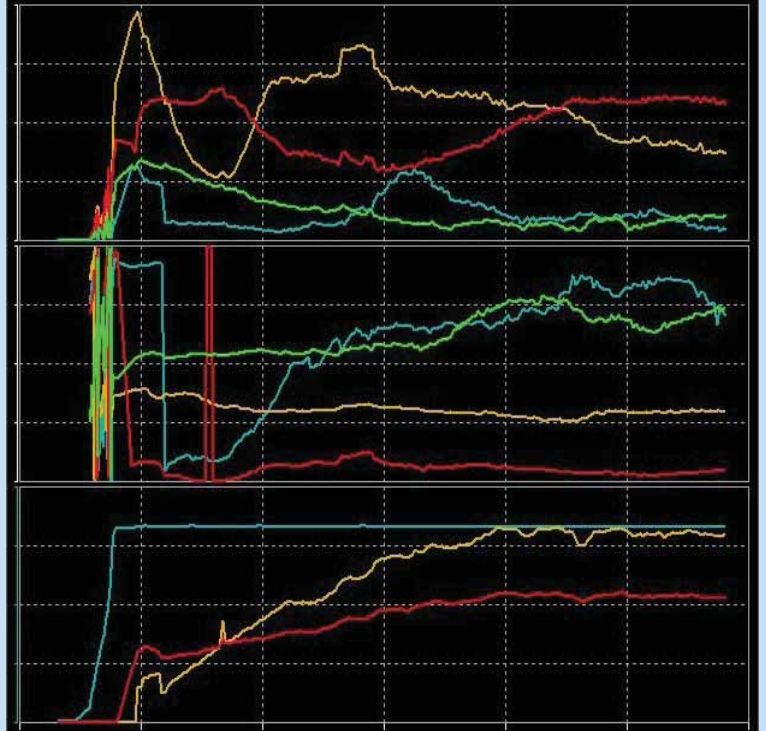


Routine Turbine Generator Vibration Monitoring

Using our Vibration Diagnostic Service means that not only are potential problems identified but practical solutions are provided, taking into account your operational requirements. Vibration Diagnostics can supply a fully customised service, tailored to meet individual operational requirements and market demands. We are able to install remote diagnostics anywhere in the world and monitor from our central Diagnostics Centre in the UK.

Early detection of potential problems provides valuable information that allows any repairs / outages to be actively managed in line with operational requirements. Our sophisticated Vibration Diagnostics Service enables you to:

- reduce unexpected failures
- avoid extensive secondary damage
- increase operating flexibility
- prevent extended outages



The Service

Monitoring analysis activities can be divided into three levels, primary, secondary and comprehensive, with each step requiring a varying level of competence and expertise.

To reap the benefits of vibration analysis, all steps in the monitoring chain should be covered. Vibration Diagnostics can provide this as a complete package or depending on site expertise and staffing availability, customers may choose to undertake some functions using their own staff.

Primary analysis

Primary analysis consists of daily, weekly or monthly checks, to ensure that the monitoring equipment is operational and any abnormal vibration behaviour is quickly highlighted, enabling a proactive approach.

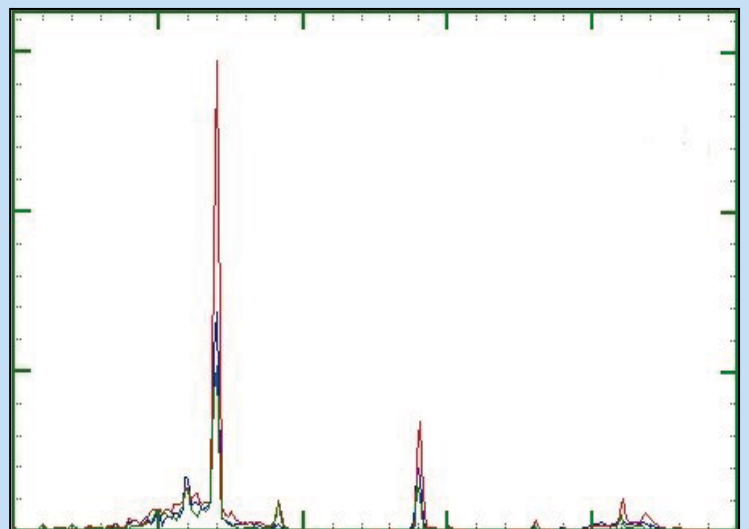
Secondary analysis

Secondary analysis is a regular activity intended to examine areas highlighted during the primary analysis and illustrate long-term trends.

It will identify problems before they become critical and provide information for planned maintenance activities.

Comprehensive analysis

Comprehensive analysis is the provision of expert advice when abnormalities have been identified. Such support is non-routine and requires the highest level of expertise and experience.



Problem investigations

Turbine generator failures are likely to result in a significant loss of income. An informed technical understanding of the cause is critical to ensuring maximum availability and flexibility. When vibration problems are encountered, detailed investigation and the determination of plant condition, including risk arising from continued operation, is key.



Vibration Diagnostics can write procedures, liaise with Original Equipment Manufacturers, provide site investigation equipment and undertake further detailed tests to isolate fault conditions that cannot be located with the turbo-visory or installed instrumentation package.

This may include:

- rotor balance problems on return to service
- cold to hot turbine alignment issues
- sticking pedestal sliding surfaces and excessive tilt
- white metal bearing performance and failure mechanisms

Vibration Diagnostics can participate in full investigations with you and your plant supplier to identify and rectify turbine generator or key auxiliary plant problems.



Vibration Diagnostics have detailed knowledge of all aspects of problem investigation and can provide expert consultancy, troubleshooting and forensic services across the full range of turbine generator plant including steam turbines, gas turbines, generators, pumps and motors. Services can be tailored to suit client requirements, including:

- on-site investigations
- assessment, reporting and recommendations
- in-situ balancing
- client representation in liaison with the OEM



Rotor balancing and acceptance tests

Vibration Diagnostics possess a wealth of experience of all aspects of rotor balance activities. We can provide the necessary capabilities and experience, at a level to ensure credibility with national and international experts.

Our experience in the planning of remedial work during outages can help minimise the need to carry out expensive high-speed balancing and reduce outage time. Careful planning for the correct balance procedures can reduce balancing costs and avoid unnecessary outage extensions.



Vibration Diagnostics is expertly qualified to ensure your rotors are being balanced correctly and to the most appropriate criteria. Our range of balancing services includes:



- providing advice during outage rework to minimise imbalance
 - defining low and high turbine rotor balance requirements
 - witness and acceptance of high speed balanced turbine rotors
 - defining thermal testing of large generator rotors
 - mechanical and electrical acceptance of high speed balanced generator rotors
 - in-situ balancing at both running speed and during transient conditions
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- pre-testing the rotor system to establish if balancing is the correct remedial action
 - using the correct instrumentation to carry out in-situ balancing remotely

Turbine Blades

Blades fitted to large steam and gas turbines have to be moment weighed and optimised around the disk to minimise the imbalance. Sets of large blades have to be matched and the same issues need to be considered if a number of blades are changed. Vibration Diagnostics provides a turbine blade service that includes the optimisation of the blade sets.



Vibration Training

Effective training for operators to heighten awareness of dynamic care and the impact of vibration on plant operation can provide tangible benefits to your business. Vibration Diagnostics has developed vibration and rotor dynamics training workshops that can be tailored to suit any audience, with the objective of improving operator and engineer awareness of vibration. The workshops cover rotor dynamics in the context of large gas and steam turbine generators and include basic principles, analysis, system training and case studies from many different designs of plant from around the world.

Auxiliary Plant Condition Monitoring

Failure to identify critical plant and apply the correct maintenance and condition monitoring procedures can lead to unnecessary maintenance and unexpected plant failures.

Vibration Diagnostics has expert knowledge of plant condition monitoring and can offer the following services to ensure the most effective condition monitoring procedures are adopted:

- critical analysis to determine the plant suitable for monitoring
- implementation of best practices for condition monitoring
- advice and interpretation of appropriate techniques and data

New Steam and Gas Turbine Generator Vibration Specification and Commissioning

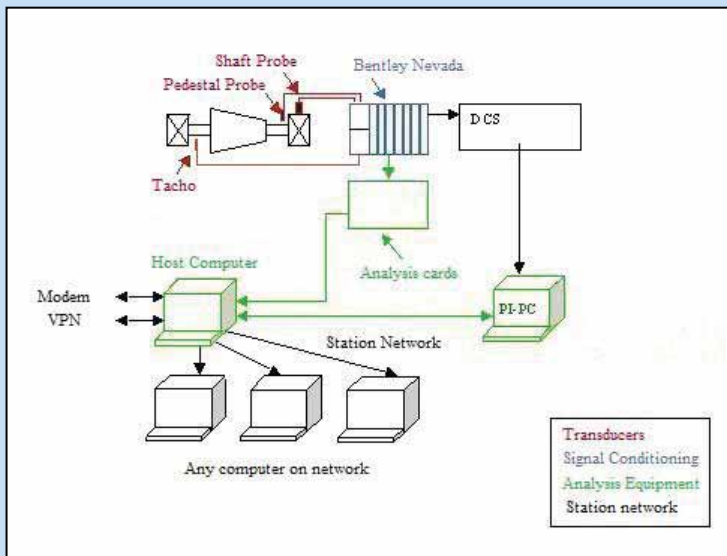
Customers of new and re-commissioned plant often require technical support and guidance during contractual negotiations to ensure the setting of clear, binding contracts. Vibration Diagnostics can provide vibration specification and commissioning services including:

- vibration acceptance requirements
- rotor balance specifications
- selection of correct instrumentation and vibration analysis systems

Our experience in the areas of purchase, construction and commissioning of new stations and major refits on older plant has allowed us to develop a great depth of expertise.

Vibration Monitoring System (VMS) specification

To identify potential turbine generator fault mechanisms and so enable informed operational decisions, sophisticated vibration data analysis is required. To do this a modern dedicated vibration monitoring system (VMS) is required. Vibration Diagnostics can provide vibration specification and commissioning services.

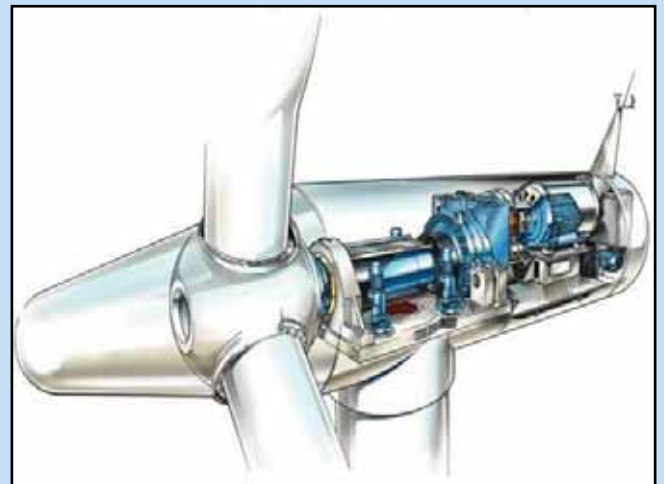


Wind Turbines

Renewable energy from wind turbines is the fastest growing sector in the industry, in which condition monitoring is not always fitted by the OEM.

When condition monitoring is fitted from new by the OEM, the owner/operator is not always given access to the data and so can not be aware of why maintenance work has been carried out.

Vibration Diagnostics has experience of all the major turbine and condition monitoring systems, as well as experience of the major fault mechanisms leading to poor availability.



Range of Plant Monitored

- Siemens V94.2 and V94.3A Gas turbine in single shaft and 2+1 CCGT arrangement
- GE 7FA & 9FA Gas turbine single shaft and 2+1 CCGT arrangement
- Alstom GT24 & GT26 Gas turbine single shaft and 2+1 CCGT arrangement
- ABB 13E1 & 13E2 Gas turbine
- GE 9E Gas turbine
- GE LM6000 Gas turbine
- GEC 660 MW steam turbine
- Parsons 660 MW steam turbine
- GE 600 MW steam turbine
- Parsons 500 MW steam turbine
- AEI 500 MW steam turbine
- GEC Erith 500 MW steam turbine
- GEC Erith 350 MW steam turbine
- ABB 350 MW steam turbine
- Parsons 200 MW steam turbine
- Main boiler feed pumps
- Electric feed pumps
- CW pumps
- CW make up pumps
- ID, FD and PA fans
- FGD booster fans

Vibration Diagnostics Ltd
9 Stoppers Hill
Brinkworth
Wiltshire
SN15 5AW

Email enquiries@vibrationdiagnostics.co.uk