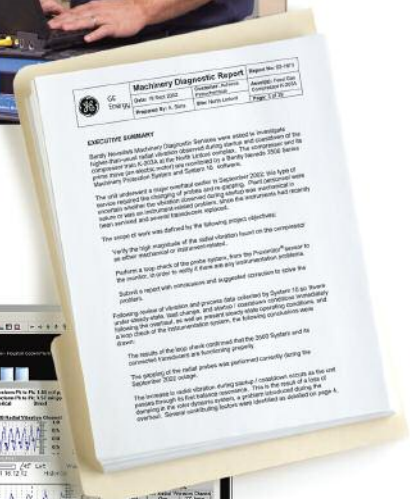
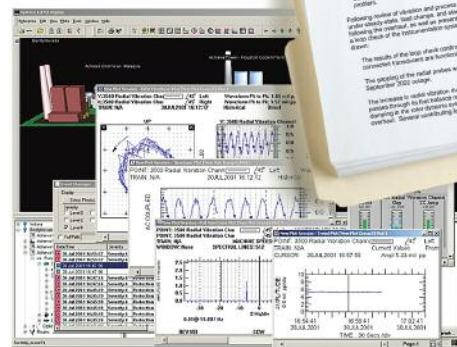


GE's Bently Nevada product line offers a comprehensive scope of machinery diagnostic services (MDS) through an experienced team of field engineers able to offer unbiased expertise on both rotating and reciprocating machinery, regardless of original equipment manufacturer. Our MDS capabilities include:

- On-site and Remote Rotating Machinery Diagnostics and Troubleshooting
- Machinery Startup/Turnaround Assistance
- Condition Monitoring System Optimization
- Field and Shop Rotor Balancing
- Machinery Alignment Services
- Thermal Growth Studies
- Rotordynamic Modeling
- Machinery Failure Analysis
- Reciprocating Machinery Diagnostics
- Specification Consulting
- Machinery Diagnostics Training

### Experienced

From a single engineer in 1972, our MDS capabilities have grown to encompass a team of nearly 100 dedicated professionals today, many with decades of experience. We have completed more than 10,000 machinery diagnostic projects and the results are maintained in an extensive archive so that lessons learned on one project benefit other projects where similar machinery problems are encountered. Our sophisticated IT capabilities allow MDS colleagues from around the world to easily collaborate in real time using this archive and their collective areas of expertise. This ensures that our extensive knowledge and deep experience can be brought to bear on each problem, regardless of where the machinery is located.



### Unbiased

We are extremely proud of the reputation we have built over more than 35 years for offering unbiased diagnostic assistance regardless of manufacturer. It is a reputation we continue with each project and consultation, ensuring that we will always "call it as we see it" no matter who manufactured, installed, maintained, or operated your machine.



## Moving Data, Not People

Many of the data acquisition and analysis tools used by our MDS team have been specifically designed to allow remote access, meaning that many of our services can be performed remotely—either in full or in part—including:

- Rotating and Reciprocating Machinery Diagnostics and Troubleshooting
- Machinery Startup/Turnaround Assistance
- Rotor Balancing
- Condition Monitoring System Optimization
- Rotordynamic Modeling
- Specification Consulting

Depending on your needs and installed IT infrastructure, remote capabilities can range from full connectivity to the online and other systems at site, or simply sending the appropriate data to us via CD, e-mail, or FTP site.

## Strategically Located

Our MDS engineers are strategically positioned in the principal industrial centers of nearly 20 countries around the world, ensuring we remain close to our customers and their machinery. When on-site assistance is required, our travel costs are minimized. When remote assistance is employed, it's likely that you'll have an experienced professional in your own time zone that speaks your language and, of course, one who understands your machinery.

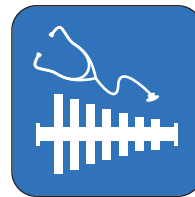
## Information – Not Just Data

Although we typically collect gigabytes of data on the condition of a machine during the course of our diagnostic services, we understand that data all by itself is meaningless without clear, concise reports that turn this data into meaningful information. Our professional, written reports summarize our findings into easily understood conclusions and recommendations that are both actionable and appropriate for the current situation.

## Consistent, Proven Methodology

The ability to correctly diagnose machinery problems is rooted in the application of fundamental engineering principles. In the more than three decades that we have been performing MDS jobs for customers, we have developed a proven methodology that is taught to our field engineers and has repeatedly demonstrated its efficacy in thousands of successfully completed projects. This methodology is applied consistently and repeatably across our entire MDS organization, assuring that no matter where these services are required, you will receive the same high-quality results.

## Rotating Machinery Diagnostics



Our machinery experts are available to perform diagnostics on your machinery on an individual event basis or as part of a contractual agreement.

We can perform these services on-site or, in many cases, via remote access when an appropriate communications and condition monitoring infrastructure exists in your facility.

Our machinery diagnostic services involve the collection and analysis of vibration and other relevant machinery data, correlation with other pertinent data such as process conditions, reduction of the data into meaningful information, and provision of a written report with our findings and conclusions. We identify potential changes in machinery condition or behavior and if any machine faults are observed, the severity is assessed and additional review is performed to determine the root cause. Our recommendations will include required maintenance, changes to operating procedures, and other actions that can be taken to eliminate or reduce the severity of a malfunction condition.

While we are able to address any size or type of machine, we are often called to assist with the most critical turbomachinery in the plant, typically involving multiple machine cases and multiple bearings.

## Machinery Startup/Turnaround Assistance



Whether commissioning a brand new machine on-site or restarting after a maintenance outage, collection of startup data and comparison with baseline data is often highly beneficial. Our MDS engineers have extensive experience gathering and documenting such data and are fully versed in the urgencies and time constraints that often accompany a major plant outage. In addition to collecting startup data for future reference, our engineers are also able to assess the data in real time to advise whether conditions are normal or if any anomalies observed would warrant adjustments to startup procedures or aborting a startup attempt altogether.

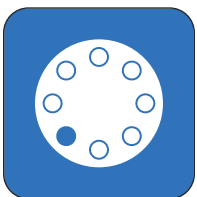
Because we have field engineers in so many locations worldwide, we are able to reach your site quickly and with a minimum of travel-related expenses. These are important factors given the unpredictable nature of many machinery startup schedules. To further reduce costs, many of the activities associated with startup and turnaround assistance can now be performed remotely.

## Condition Monitoring System Optimization



The sophistication of modern condition monitoring systems translates to hundreds or even thousands of different software alarms and configuration settings that are designed to detect mechanical problems proactively. However, to get the most from these systems, they must be regularly reviewed and optimized. Our MDS engineers have extensive experience in configuring the optimal setting for such systems and can often perform these services remotely to save costs.

## Field and Shop Rotor Balancing



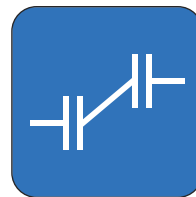
One of the most common machinery problems is unbalance. However, before balancing is carried out, it is critical that unbalance is confirmed as the underlying machinery problem. Attempting to balance a machine when a

different malfunction is present can exacerbate the situation. Our engineers are skilled in both isolating unbalance problems and then correcting those problems. We are proficient in both single-plane balancing for simple machines and multi-plane balancing for more complex machines with numerous bearings combined with multiple measurement and correction planes.

Increasingly, many customers are using our services to review data remotely and provide balancing calculations/recommendations that can be implemented on-site by their own people.

These services can be provided for both in-situ field applications as well as shop rotor balancing.

## Machinery Alignment Services



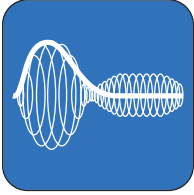
Next to rotor unbalance, misalignment is one of the most frequently encountered machinery problems. We are fully equipped to handle both hot and cold alignment projects on your machinery. These services range from the simplest two-case machine configuration to the most complex multi-case scenario such as large steam turbine generators. We are also able to align reciprocating compressors in addition to your rotating machinery.

## Thermal Growth Studies



Closely related to hot alignment is the topic of thermal growth in the machine, whether normal alignment or differential expansion. Such studies represent highly specialized machinery knowledge and are well within our capabilities.

## Rotordynamic Modeling



Our capabilities include sophisticated rotor modeling tools that allow us to understand your machinery more fully and document its predicted and actual behavior. This modeling can be useful when contemplating design or operating changes, or simply documenting an existing configuration. Customers often use these services from us to help analyze new seal or bearing modifications they may be contemplating, or changes to the rotating assembly such as couplings or impellers.

## Machinery Failure Analysis



In the unfortunate event of an actual machinery failure, such as cracked shafts, severe rubs, loss of thrust bearing, or other malfunctions, we are able to provide expert analysis that isolates root cause, helping to prevent a recurrence. Our shaft crack methodology is one such example of our extensive expertise in this area, and we were pioneers in the industry for understanding the mechanisms leading to shaft crack, developing monitoring schemas for identifying shaft crack very early, and for design considerations that can help prevent cracks from occurring in the first place.

## Reciprocating Machinery Diagnostics



Because many plants have a combination of rotating and reciprocating machinery, our service offerings are able to address this important class of machines. Diagnostics on reciprocating machinery is a specialized discipline that reflects the unique characteristics and thermodynamics of these units and we possess deep experience extending back more than a decade. We are able to diagnose not only mechanical

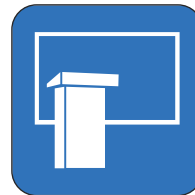
problems but also performance-related problems through analysis of Pressure-Volume (PV) data on the machine. In addition, we are able to provide alignment services on this class of machinery.

## Specification Consulting



Whether specifying a piece of rotating or reciprocating machinery, modifications to a machine, or the instrumentation used on a machine, we can assist with development of technical, design, front-end engineering design, and purchasing specifications. We possess broad knowledge of relevant industry specifications related to machinery and instrumentation, such as from the American Petroleum Institute, ISO, IEEE, and many others.

## Machinery Diagnostics Training



We are pleased to offer standard training offerings that impart the same machinery diagnostic methodologies to our customers as are employed by our own MDS engineers. Courses are available for basic and advanced machinery diagnostic topics, rotor balancing, machinery alignment, and getting the most from machinery diagnostic tools such as our ADRE\* portable data acquisition system and System 1\* software.

## Contact Us

To reach your nearest Bently Nevada MDS engineer, visit [www.ge-energy.com/mds](http://www.ge-energy.com/mds) or call our 24/7 support number where a live person will respond rapidly to your service requests, whether routine or urgent.

**Inside USA: (800) 488-1915 (toll-free)**

**Outside USA: (775) 215-1818**

