

Efficient Vibration Condition Assessment

Methodology Overview

DLI Engineering's 40 years of experience in providing early prognosis of incipient faults in rotating equipment have taught us that customers need a proven methodology, recognized by international standards¹, that provides the following capabilities in the most efficient manner:

- Data Acquisition (Sensor Selection & Mounting)
- Data Manipulation (Signal Processing)
- State Detection (Baseline Profiles)
- Health Assessment (Automated Fault Diagnostics)
- Prognostic Assessment (Prioritized Repair)
- Advisory Generation (Reports/Documentation)

Data Acquisition / Sensor Selection & Mounting



DLI Engineering introduced the first commercially available triaxial accelerometer over 20 years ago and still supports its use with all of its portable data collectors. A triaxial accelerometer with mounting pad is the most efficient method available to collect a complete set of vibration data in three mutually perpendicular directions. This method of data collection for portable, periodic data collection offers the following advantages:

¹ The DLI methodology outlined in this paper meets or exceeds ISO 13374-1 guidelines on condition monitoring

- FAST – Collect vibration data in all three directions in one step instead of moving a single axis accelerometer from one location to the next. The DLI Watchman® DCA-50™ or DCX™ can collect data in all three directions simultaneously.
- COMPLETE DATA SET – Besides collecting data in three directions all of DLI's portable data collectors support the collection of two frequency ranges, typically, low range (10 x machine speed) and high range (100 x machine speed).
- REPEATABLE – The use of a permanent mounting pad affixed to each measurement location (e.g. inboard & outboard bearing housing) for mounting the triaxial accelerometer insures repeatable data that can be accurately trended over time. DLI also facilitates repeatable data by supporting barcode-based data collection which minimizes the danger of storing data on the wrong machine or measurement location.

For online monitoring of critical or inaccessible machines it may not be economical to mount a triaxial sensor at every desired machine location. The DLI methodology is flexible enough to support the data collection and analysis of single axis accelerometers, velocity probes, proximity probes or a wide variety of process sensors such as speed, motor current, temperature or pressure.

Data Manipulation / Signal Processing

All portable and online data acquisition instruments support the following signal processing:

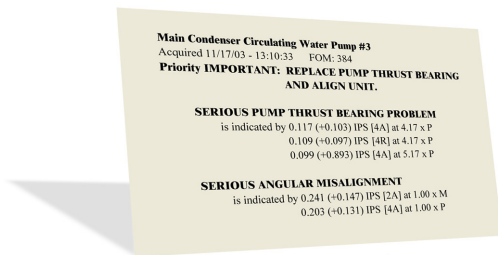
- Spectra/FFT (general fault determination)
- Time Waveforms/Orbits (impacting/sleeve bearings)
- Envelope Demodulation (rolling element bearings)
- Overall Amplitude (overall machine severity)
- Phase (troubleshooting)
- Cepstrum (harmonic family analysis)

State Detection / Baseline Profiles

The efficiency of ExpertALERT is based on its ability to use statistical baseline data from specific machine(s) to compare with current data. By comparing incoming spectra to statistical baseline spectra, ExpertALERT effectively uses over 500 frequency “bands” in its initial data screening process to identify machine faults. This technique of data comparison is far more sensitive and selective than traditional methods that use only 6-12 frequency “bands”.

Health / Prognostic Assessment

DLI's ExpertALERT™ Condition Assessment software includes a rule-based, automated diagnostic module as well as all of the necessary graphical analysis tools to confirm or analyze a wide range of machinery faults. Its diagnostic system identifies even the most subtle patterns in the vibration data and provides repeatable, quantifiable and detailed diagnostics. Identified faults are trended over time allowing you to track actual faults rather than just vibration levels. Over 4,700 individual rules can recognize over 956 specific machine fault patterns in 47 different machinery components. Refer to DLI's paper entitled “Machinery Faults Diagnosed by ExpertALERT” for a sampling of the wide range of machines and faults that the software is capable of identifying and automatically reporting.



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Advisory Generation

Another real efficiency of our methodology is its unique ability to generate a report listing the following critical machine status/condition information:

- Specific machine fault(s)
- Severity of fault (OK, Slight, Moderate, Serious or Extreme)
- Specific repair recommendation
- Repair priority (Desirable, Important or Mandatory)
- Details of specific vibration peaks and frequencies contributing to fault

This actionable information is far easier to interpret than the raw spectral data that is typically presented with other vibration analysis systems. The entire process of data screening, data analysis, fault diagnostics and report generation is completely automated which can save hours of labor compared to other systems currently on the market. This is not to say that human expertise is removed from the DLI methodology. DLI recommends that all significant automatic machine fault diagnoses be reviewed by a trained vibration analyst. We put this recommendation into practice with our PdM Express™ remote vibration analysis service where a senior engineer reviews all results to ensure 100% accuracy.

Information Everywhere

DLI believes that the distribution of the actionable information generated automatically by ExpertALERT software is critical. As such, we have developed a variety of delivery mechanisms ranging from the traditional hard copy reports to email alert notifications to machine condition status results available via a standard web browser. DLI is also on the forefront of database synchronization and replication via the internet. We currently have customers electronically transmitting data to us for analysis from around the globe while we distribute their results back to them as well as optimize their databases remotely.

Additional Information:

Contact DLI Engineering or your local DLI sales representative regarding our Contract Engineering Services