

IRIS NDT

On-line Monitoring with Acoustic Emission

Acoustic emission testing detects defects and other damage that is 'active' at operating loads. In particular, AE testing is sensitive to cracking or defects developing in service.



Most AE tests use a load increase to stimulate AE from defects. This allows detection of defects from an entire vessel within a short time. For some applications, a discrete load test is not feasible or there is a need to track damage as it occurs. This will typically involve AE monitoring of areas where there is a history or likelihood of fatigue cracking, stress corrosion cracking or other environmental damage.

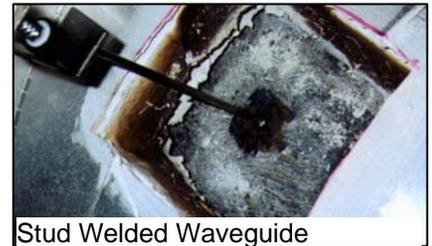
Acoustic Emission Monitoring

Acoustic Emission is high frequency sound from cracks and other flaws under stress. For on-line monitoring the operating condition or environment is the stimulus for AE. This may be cyclic mechanical loading as found in PSA vessels and bridges or environmental damage such as stress corrosion cracking.

AE from environmental cracking occurs both infrequently and unpredictably so continuous, long-term AE monitoring is needed. This is achieved with a semi-permanent sensor installation and instrumentation accessed remotely through a broadband connection. The remote connection allows real time monitoring and control of the AE instrument as well as uploading of data for analysis.

The type and location of AE sensors and mounting method depends on the vessel or structure and its operating conditions. Waveguides are needed for surface temperatures over 100°C (212°F). These are steel rods attached to the surface to conduct AE signals to the sensors. High temperature sensors are available up to 500°C (932°F) but in general installing waveguides is cheaper and easier.

On line monitoring detects AE from 'active' defects but does not determine their size or exact position. The uses are to assess behaviour of known defects before deciding on repairs, identify conditions causing crack growth and to look at AE activity trends to aid inspection planning.



Stud Welded Waveguide

Installation

AE sensors are mounted around the area of interest. Unless on waveguides, the sensors are secured by magnets or bonded to the surface depending on the material and application.

High frequency (300-400 kHz) sensors may be needed to reduce the effects of flow noise. Intrinsically safe (Atex certified) sensors are available if required.



Bonded Sensor, Cold Service

Cabling from the sensors is connected back to the AE instrumentation installed in a convenient, climate-controlled location. Ideally, this should be within a reasonable distance of the vessel but cable lengths of 300m (1000') or more are possible.

The installation technicians carry out checks on sensitivity, location accuracy and the remote connection. They also assess the background noise and fine-tune the instrument settings. Checks are also carried out remotely once the system is on-line by pulsing each sensor electronically and recording the response of its neighbours.

Process Data

The absence of a controlled loading to stimulate AE activity means the on-line data must be correlated with process inputs. These normally include pressure, temperature or other parameter that ties in with the damage mechanisms of interest. The AE instrument accepts up to four voltage inputs in the range $\pm 10V$, additional process data may be supplied in spreadsheet form at agreed intervals.

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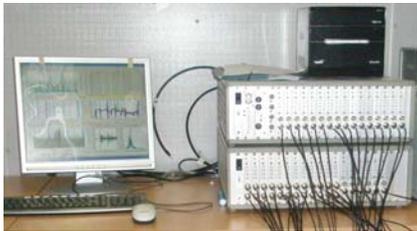
IRISNDT

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Remote Monitoring

The AE instrument is operated by a computer accessed remotely via a VPN or other secure connection. This allows our technicians to view data in real time, adjust the instrument and upload AE data for analysis.

AE data is also processed on the local computer. Where relevant, this allows alarms to be set up to transmit an email or other alert in the event of abnormal AE activity.



Reporting is tailored to the application and customer needs. Normally a report on the installation and initial monitoring period is issued followed by monthly summaries. IRISNDT will also contact plant personnel immediately in the event of significant AE activity being detected. We aim to have at least two technicians involved to ensure there is full coverage.

Processing

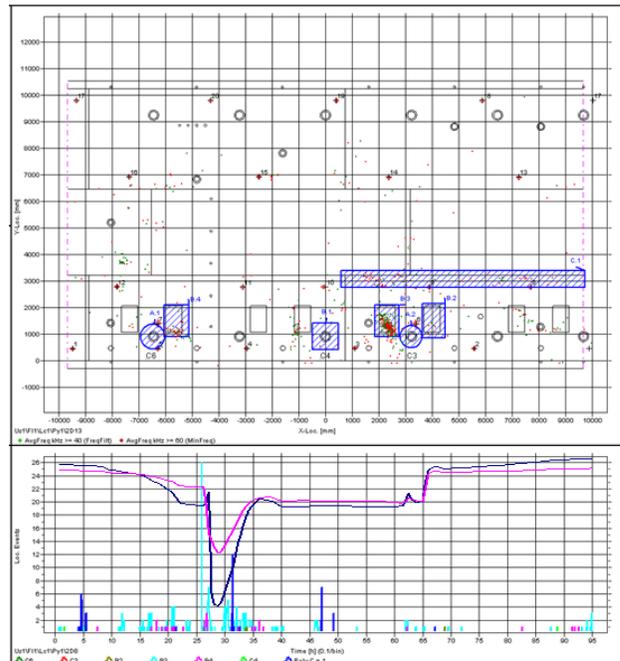
With on-line monitoring, any AE of interest occurs infrequently and unpredictably. It is, therefore, important to make AE activity stand out from the continuous operating noise.

The techniques used by IRISNDT are pattern recognition, source location and correlation with process parameters. This means it can take a few weeks to establish 'normal' patterns of AE activity as well as that from occasional short-term bad weather or process variations.

The upper plot on the next page shows localised AE activity. Colour coded traces on the lower plot show how the AE from each location cluster behaves with respect to time, temperature and pressure.

Capabilities

- Monitor known defects or areas of interest to detect defect growth.
- Correlate AE activity with operating conditions to help determine when damage is occurring.
- Provide approximate locations of AE activity for future follow up inspection or repair work.



Limitations

- Qualitative assessment only. Does not give a physical measure of defect size or growth.
- High noise conditions due to abnormal process conditions or bad weather will reduce sensitivity to AE from defect growth.

Preparation

- Review vessel drawings and operating conditions, the damage mechanism, areas of concern, monitoring objectives.
- Plan the installation including the number and type of sensors, mounting method, and equipment location.

Services Required

- Broadband Internet, 110V (or 240V) power.
- Process (voltage) inputs such as pressure and temperature to the AE system.
- Access for mounting sensors and cable installation. Installation of waveguides or cutting of installation ports.
- Local contractor or instrument technicians to install long cable runs if needed.