TCR Advanced Engineering P. Ltd

Experts in Metallography, Failure Investigation and RLA

Metallurgy for Industries

Power | Petrochemical | Fertilizer | Chemical | Refinery | Engineering | Automobile

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Airborne Ultrasound Leak detection -

A novel application

Ultrasound leak detection is very convenient, fast and economical alternative to locate leakages in a pressurized or vacuum systems such as heat exchangers, boilers, condensers, valves, vacuum lines, turbines, etc. This technique is an important tool in asset integrity management.

Airborne Ultrasound Technology

Airborne ultrasound is an acoustic frequency that a human ear can't hear. Human-audible sound ranges from 20 Hz to 20 kHz; with the average being approximately 16,500 Hz.

Airborne ultrasound allows us to hear sounds in the 20 kHz to 100 kHz range.

Airborne ultrasound technology is used throughout the world for condition monitoring, energy conservation and quality assurance programs.

Airborne ultrasound technology provides solutions for locating a variety of potential problems in plants. The three main areas are leak detection, mechanical inspection / trending and electrical inspection.

Instruments based on airborne ultrasound sense high frequency sounds produced by leaks, electrical emissions and mechanical operations. They translate these sounds down into the audible range by an electronic process called heterodyning where they are heard through headphones and observed as intensity increments, typically decibels, on a display panel.

Since ultrasound is composed of high frequencies that are not heard by the human ear, the heterodyning process allows users of airborne ultrasound instruments to "hear" an accurate translation of these sounds helping them identify subtle changes in operating equipment that might normally be overlooked, providing early warning capability.

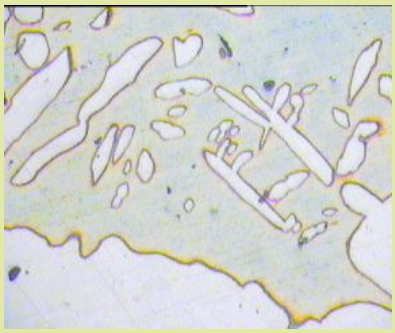
In addition, the heterodyning process enables users to record sounds either on-board the instrument equipped for this process or by connecting an airborne ultrasound detector to a recording device. These recorded sounds can then be used for sound analysis in spectral analysis software.

Portable airborne ultrasound instruments are available as either analog or digital models.

Ultrasonic leak detection

During a leak, a fluid (liquid or gas) moves from a high pressure to a low pressure. As it passes through the leak site, a turbulent flow is

Microstructure of the Month



Magnification: *400 X*

MOC: *ASTM A182 Gr. F 51*

Composition of Laves Phase: *Fe2Mo, Ti21Mo9, Fe50Cr5Si5*

Observation: *Microstructure shows austenite pools in ferrite matrix. Laves phase is observed as shown by arrow.*

Useful hints: *Color metallography is an important tool to reveal inter-metallic phases that may hamper the corrosion resistance of the high grade material like Duplex Stainless Steel.*

generated. This turbulence produces airborne ultrasound. Specialized equipment can detect this ultrasound and quantify the leak rate and location. This technique can be used to locate leaks in pressurized systems regardless of the type of gas used. This is especially beneficial in areas where there is a saturation of gases or where a wide variety of gases, pressurized vessels and vacuum processes exist. Time and convenience are also improved with ultrasonic detection since equipment may be tested while on-line.

Leak Detection Method

Ultrasound is a high frequency, short wave signal. The intensity of the ultrasound produced by a leak drops off rapidly as the sound moves away from its source. For this reason, the leak sound will be loudest at the leak site. Ultrasound is considered fairly "directional" and therefore, locating the source of the leak is quite simple.

For detection, scan the general area of a suspected leak and listen for a hissing sound (similar to the sound you hear when you fill a tire with air). Move in the direction of the loudest sound. The sound level should increase as you pass over the leak.

Heat Exchangers, Boilers, Condensers, Valves

Leak detection of heat exchangers, boilers and condensers most often involves inspection of three generic areas: tubes, tube sheets and housings. This technique can be used to detect leaks either pressure leaks or vacuum leaks. While it may be necessary to take a unit off-line to inspect for leaks, with ultrasound, it is often possible to perform an inspection while on-line or at partial load.

During a leak, the fluid will flow from high pressure to low pressure producing a turbulent flow at the leak site. This turbulence has strong ultrasonic components which are sensed by the testing equipment and quantified based on the intensity of signal.

Most often leak detection is concerned with tube leaks. In heat exchangers and condensers, there are situation where the end plates (headers) are removed or water boxes are isolated while the unit is still on-line or at partial load. The tube sheet is scanned while listening for a distinct "hissing" or "rushing" sound of a leak.

Should the unit require off-line inspection, it is possible to use the ultrasonic tone transmission method using ultrasonic transmitters. In this technique the heat exchanger is flooded with intense ultrasonic sound waves on the shell side and the tube sheet is scanned for a distinct high pitched warbling sound coming from the leak. The loudest point will indicate leaking tube.

TCR advanced has expertise and the necessary instrumentation for airborne ultrasonic leak detection and can provide the service to improve the reliability of process plant.

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