Portable Solutions

FOR NON-DESTRUCTIVE TESTING

HIGH-PERFORMANCE NDT SOLUTIONS

INSPECTIONS
MRUT & LRUT (Medium Range and Long Range UT)
Welds and Volumes

MEASUREMENTS
Thickness
Material Properties

Innerspec
www.innerspec.com
**Technology**

**Ultrasonic Testing**

**Piezoelectric UT**

- Piezo
- Couplant
- Ultrasonic Wave
- Eddy Currents
- Magnetic Field
- Ultrasonic Wave

**EMAT UT**

- Magnet
- EMAT Coil Circuit
- Lorentz Force

**Eddy Current**

- Coil
- Eddy Currents
- Magnetic Field
- Conductive material

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**ULTRASONIC TESTING (UT)**

UT refers to a family of non-destructive testing techniques based on the propagation of ultrasonic waves in the object tested. Ultrasound in frequencies ranging from 20 kHz to 50 MHz are transmitted into materials to detect internal flaws or to characterize materials. Ultrasound in industrial NDT can be generated with piezoelectric transducers, EMAT, or Lasers.

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**ELECTRO MAGNETIC ACOUSTIC TRANSDUCER (EMAT)**

EMAT is an UT technique that uses electromagnetic induction to generate ultrasound in the part inspected instead of the transducer. EMAT works on most metals, including steel and aluminum, and has important advantages over other UT techniques:

- Dry inspection. EMAT does not require couplant for transmitting sound, which makes it very well suited for inspection of very hot and cold parts, and integration in automated environments.
- Imperviousness to surface conditions. EMAT can inspect through coatings and is not affected by pollutants, oxidation, or roughness.
- Easier sensor deployment. Not having wedges or couplant, the angle of the sensor does not affect the direction of propagation. This makes EMAT transducers easier to control as the only practical means for generating shear waves with horizontal polarization (SH waves).

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**ULTRASONIC TESTING (UT) WITH PIEZOELECTRIC TRANSDUCERS**

UT with piezoelectric transducers is the most common way of generating ultrasound. The advantages of piezoelectric transducers include:

- Applicable to most materials. Including metals, plastics, composites, and ceramics.
- Highly efficient. Unlike EMAT, they can be used with low-power instruments and provide good signal-to-noise even with very small transducers.
- High-resolution and sizing capabilities. Techniques such as Phased Array (PAUT) can increase signal-to-noise, improve inspection speed, size defects, and create accurate images of objects.

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**EDDY CURRENT (EC)**

In EC, an alternating current flows through a wire coil and generates an oscillating magnetic field. When the coil approaches a conductive material, currents opposed to the ones in the coil are induced in the material. Variations in electrical conductivity and magnetic permeability of the test object and/or the presence of defects causes changes in phase and amplitude of the induced eddy currents that can be detected by measuring impedance changes in the coil. The advantages of EC include:

- Can be performed without direct contact with the material, including applications with coatings, paint, thin insulators, etc.
- Highly sensitive to surface defects, sub-surface defects, and variations in material properties.
- Capable of detecting defects in any orientation.
- Capable of detecting linear, crack-like defects as short as 0.025" and as shallow as 0.005".
- Capable of detecting volumetric defects (e.g., surface pitting) as small as 0.020" in diameter.
- Capable of a wide range of industry-based applications using variations of the EC technique such as Eddy Current Array (ECA), Near Field Testing (NFT), Remote Field Testing (RFT), and Pulsed Eddy Current (PEC).
Instruments

PowerBox H-NB
Cost-effective portable instrument designed specifically for normal beam applications. Standard software permits thickness measurement (spot and scanning) and flaw detection. Optional software available for stress measurement (railroad wheels, plates, beams), and bolt-load measurement using a patented double wave technique.

MRUT (Medium Range UT)
MRUT (Medium Range UT) describes a suite of techniques that permit covering an area between approximately 25 mm to 3000 mm from the location where the inspection is performed. MRUT uses guided wave and/or bulk wave techniques and complements LRUT (Long Range UT) by covering the near field area where LRUT cannot be used.

LRUT (Long Range UT)
LRUT (Long Range UT) describes the inspection technique that uses guided waves to cover distances from 1 to 100 m. The LRUT technique is used exclusively for pipeline inspection to cover long distances from one inspection point.

VOLTA
VOLTA is a high-power 2-channel portable ultrasonic instrument custom-designed for Electro Magnetic Acoustic Transducer (EMAT) applications.

VOLTA features patented pulser technology capable of generating up to 1,100 V or 6 kW of peak power per channel at speeds of 1,000 Hz in frequencies ranging from 20 kHz to 8 MHz. Standard software built on Innerspec Technologies Operating Platform (ITOP) includes an intuitive menu to set up any EMAT application using standard sensors from Innerspec’s catalog for normal beam, angled beam, and guided waves.

Advanced application software is available with easy-to-use wizards to facilitate setup and analysis for MRUT (Medium-Range UT / 0-3 m), LRUT (Long-Range UT / 1-100 m), Rail Heads, Thin Welds, and other exclusive solutions.

PowerBox 1
Designed exclusively for Innerspec’s proprietary boiler tube inspection solution. The instrument includes custom software and requires a 110-220 VAC input. The instrument includes a ruggedized PC for field use.

Applications

WELD INSPECTION
EMAT technology coupled with custom instrumentation, software, and sensors permit weld inspections that are not feasible or very difficult with conventional ultrasonic techniques. Innerspec has developed unique solutions including: inspections of thin-welds (<6 mm) using guided waves, inspections-while-welding of multi-pass welds during the welding process, and inspections of dissimilar metal welds using Shear Horizontal waves. Lack of couplant permits using these techniques below freezing and at high temperatures.

BOILER INSPECTION
The tennate® TG-IS(8) is designed for detecting and measuring wall loss, hydrogen damage, and caustic gauging in boiler tubes. The tennate TG-IS(8) is available for purchase or rental from Innerspec Technologies.

THICKNESS MEASUREMENT
Off-the-shelf and custom solutions for thickness measurement in the field using EMAT and DCUT (Dry-Coupled UT) sensors.

STRESS
Custom and off-the-shelf applications for internal stress measurement on plates, train wheels, and thick structures. The technique uses two orthogonal linearly polarized Shear Horizontal waves at 0 and 90 degrees to provide a birefringence measurement that is directly correlated with internal stress.

BOLT LOAD
The tennate® BL is used to measure bolt-load by measuring ultrasonic Time-Of-Flight corresponding to changes in bolt elongation. Innerspec uses a patented two-wave solution to determine load on bolts without knowing the original length.
In addition to Portable Solutions, Innerspec is the leading supplier of advanced integrated systems for inspections during the manufacturing process. Our systems use state-of-the-art technologies including EMAT, conventional UT (Phased Array and mono-element), Eddy Current, and Laser Measurement / Digital Imaging.

Visit our website to learn more about:
- Weld Inspection (blanks, tubes, structures).
- Surface inspections (billets, ingots, tubes, rods).
- Inspection of laminated materials.
- Thickness measurement without couplant (EMAT & Dry-Coupled UT).
- Volumetric inspection (composites, forgings, castings).
- Roll inspection.
- Measurement of material properties (conductivity, stress, nodularity).

Contact-us to help you with your custom solutions.