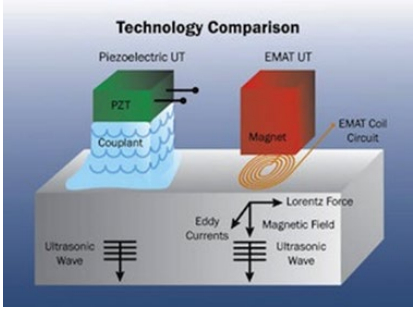
Subsea Electro Magnetic Acoustic Transducer (EMAT)

EMAT is an Ultrasonic Testing (UT) technique that generates sound in the part to be inspected instead of, as with conventional UT, the transducer. EMATs induce ultrasonic waves into a test object using two interacting magnetic fields. A high frequency (RF) field generated by electrical coils interacts with a low frequency or static field generated by magnets to generate a Lorentz force in a manner like an electric motor.

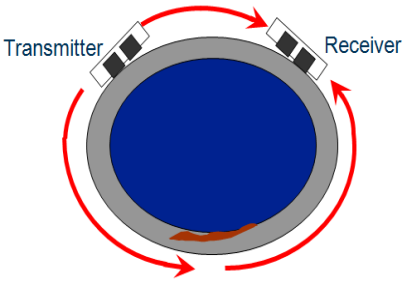
This disturbance is transferred to the lattice of the material, producing an elastic wave. In a reciprocal process, the interaction of elastic waves in the presence of a magnetic field induces currents in the receiving EMAT coil circuit. For ferromagnetic conductors, magnetostriction produces additional stresses that enhance the signals to higher levels than can be achieved by the Lorentz force alone. Multiple different waves can be generated using different combinations of RF coils and magnets.

Advantages

- Diver or ROV Deployable in water up to 3,000m deep
- Inspect through 2/3LPP and FBE Coatings up to 4mm thick
- Scan speeds of up to 150mm / sec
- Requires access to top third of the pipe only
- Does not require coating removal to provide inspection
- Inline Inspection Data Verification for subsea pipes
- Inspection of non-piggable/scrapable lines
- Real-time analysis from topside control
- Data and inspection reports electronically recorded



UT Wave Generation Comparison

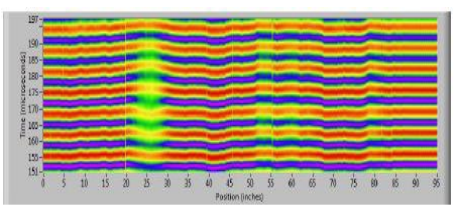


Provides 360 degree coverage from the top of the pipe

Sensor Deployment on a Pipe



Subsea Scanner on Deployment



EMAT Data

EMAT does not require direct contact with the inspection surface which makes it suited for inspection where coatings are present. Further to this EMATs are impervious to surface conditions such as pollutants, oxidation, or roughness. Due to the lack of requirement for wedges or couplant, Snell's law of refraction does not apply, and the angle of the sensor does not affect the direction of propagation. In practical terms this makes the sensors easier to deploy.

The antenna-type construction of the coil combined with a multi-cycle excitation provides great specificity in the frequency domain, thus the ability to precisely select the wave mode of interest, which is of significant importance for guided wave generation and interpretation.