Assessing condition of pipework and pressure vessels under insulation can be advantageous to plant operators. The PEC system was developed as a solution to the detection of corrosion under insulation (CUI) and validated by Shell Global Solutions. It is now available from TÜV Rheinland Sonovation under license from the developers.

Compared with conventional eddy-current testing, pulsed eddy-current inspection requires no direct contact with the object being tested. Measurements can be made through any material not conducting electricity including coatings, insulation materials, weather sheeting and even corrosion products.

It is a very useful characteristic that also enables high temperature non-destructive testing (NDT) inspections.

**Inspection approach**

The PEC instrument probe is placed against the metal weather sheeting (non-ferrous) of the insulated pipe or vessel. The geometry of the test object should be simple. A magnetic field is created by placing an electrical current in the transmitting coil of the probe. This field penetrates through the weather sheeting and magnetizes the pipe wall. The electrical current in the transmission coil is then switched off, causing a sudden drop in the magnetic field.

As a result of electromagnetic induction, eddy-currents will be generated in the pipe wall. The eddy-currents diffuse inwards and decrease in strength. The rate of decrease of the eddy currents is monitored by the PEC probe and is used to determine the wall thickness.

**Comparison with ultrasound wall thickness measurement**

Both pulsed eddy-current and ultrasound wall thickness measurement have strong and weak points. The relevance of these strengths and weaknesses varies greatly from application to application.

<table>
<thead>
<tr>
<th>Pulsed Eddy-Current</th>
<th>Ultrasound Wall Thickness Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Based on electromagnetics.</td>
<td>Based on high frequency sound.</td>
</tr>
<tr>
<td>Averages over a footprint area.</td>
<td>Point measurement.</td>
</tr>
<tr>
<td>Measures percentage variation in wall thickness on the same object (relative) – needs calibration.</td>
<td>Measures thickness in millimetres (inches) – absolute.</td>
</tr>
<tr>
<td>No contact or surface preparation required – measures through insulation, concrete or corrosion.</td>
<td>Contact required and often surface preparation required.</td>
</tr>
<tr>
<td>Probe alignment is not critical.</td>
<td>Correct placement of sensor is critical.</td>
</tr>
<tr>
<td>Highly repeatable – is well suited for wall thickness monitoring.</td>
<td>Difficult to use ultrasound for accurate wall thickness monitoring.</td>
</tr>
<tr>
<td>Easy to apply at very high temperatures – tested to 550°C (1030 °F).</td>
<td>Difficult to apply at high temperatures.</td>
</tr>
</tbody>
</table>
Benefits at a glance

- No loss of production, as inspection can take place while the inspection object is in service.
- Reduced inspection costs, as insulation material does not need to be removed.
- Significantly lowered costs for underwater inspections.
- Speedy inspection, as surfaces do not require any preparation.
- Good reproducibility of PEC readings at the same locations.
- Plus minus 10% accuracy for corrosion detection under insulation and only plus minus 0.2% accuracy for corrosion monitoring.
- Inspections within a temperature range from -100°C to 550°C (-150°F to 1000°F).
- Inspection of objects with a wall thickness of 3 to 35 millimeter.
- Inspection of objects with a pipe diameter above 75 millimeter.

Areas for application

Pulsed eddy-current can be effectively applied for corrosion monitoring and detection on pipes and vessels made of carbon steel or low-alloy steel without making contact with the steel surface itself.

- Insulated and/or coated equipments
- Objects under high temperature conditions
- Heavy corroded equipments
- Offshore risers and caissons
- Objects behind concrete fireproofing
- Laminations
- Annular rings
- Bridges

About TÜV Rheinland:

Founded over 140 years ago, TÜV Rheinland is a global leader in independent inspection services, ensuring quality and safety for people, the environment, and technology in nearly all aspects of life.

Our experience - your benefit

TÜV Rheinland Sonovation has over twenty five years of experience with advanced non-destructive testing methods. Our inspection team is one of the best-resourced in the world. Our involvement in equipment development, inspection solutions and accredited training courses demonstrate our commitment to these techniques.

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