Pulsed Eddy-Current

Detecting corrosion under insulation

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 to all markets worldwide and is under development from TÜV Rheinland.

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>
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<tbody>
<tr>
<td>Based on electromagnetics.</td>
<td>Based on high frequency sound.</td>
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<tr>
<td>Averages over a footprint area.</td>
<td>Point measurement.</td>
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<tr>
<td>Measures percentage variation in wall thickness on the same object (relative) – needs calibration.</td>
<td>Measures thickness in millimetres (inches) – absolute.</td>
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<tr>
<td>No contact or surface preparation required – measures through insulation, concrete or corrosion.</td>
<td>Contact required and often surface preparation required.</td>
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<td>Probe alignment is not critical.</td>
<td>Correct placement of sensor is critical.</td>
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<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>
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</tbody>
</table>
AREAS FOR APPLICATION

- 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

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.

ABOUT TÜV RHEINLAND

Founded more than 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.

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