ULTRASONIC INTELLIGENT SENSORS

ClampOn CUI Detector
Corrosion Under Insulation

DIGITAL SIGNAL PROCESSING

Corrosion Under Insulation Detector

ADVANTAGES

- **Permanently installed antenna arrays**
- **No need to remove insulation**
- **Long distance, ~200 meter range**
- **Works around bends**
- **Cost effective**
- **Early detection**
- **Proven concept**
- **Lightweight**
- **Rapid measurements (less than one minute)**

BACKGROUND

Corrosion under insulation is a huge challenge on lots of top-side insulated pipework. If the outer metal sheet fails and water seeps in to the insulating material, the pipe will soon suffer from corrosion. Traditional inspection of insulated pipework is time consuming and expensive as the outer metal sheet and insulation must be removed to gain access, and refitted again after inspection. ClampOn's CUI metering solution allows operators to measure water ingress in the insulation and corrosion along the pipe using permanent microwave antenna arrays installed strategically along the pipeline. Portable data analysers are connected to the permanent antenna arrays for periodic metering and trending. This solution provides accurate, effective, and quick measurement of water ingress and corrosion residue along the pipework. It also provides information about the location of the ingress and corrosion along the pipeline.

Figure 1: Corrosion under insulation

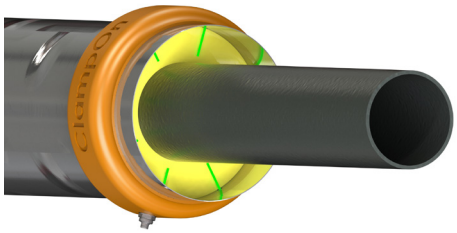

Figure 2: Insulated pipe, antenna arrays installed along the pipeline.

WORKING PRINCIPLE

Each antenna array emits microwaves, which pass through the insulating material without reflection. When there is water or corrosion residue in the insulation, the microwaves are reflected and bounce back to the antenna array. Time of flight determines the distance from the antenna array to the area of the ingress or corrosion, and the level of amplitude indicates the extent of the ingress or presence of corroded material. The pipe with insulation and outer metal sheet acts as a signal conductor similar to a coaxial cable and is ideal for carrying high frequency microwaves.

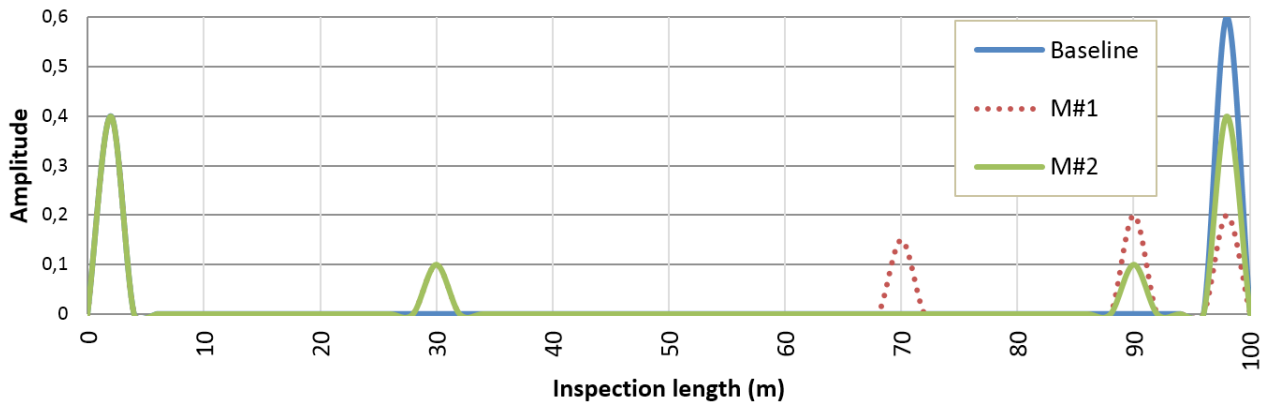

Figure 3 - Baseline, measurement #1 and measurement #2

DATA INTERPRETATION

The above echograms illustrate how the signal changes from dry to wet insulation. The blue baseline shows the reflection without water or corrosion residue present. The dotted red line is the first measurement, and shows a reflection due to water at 70 and 90 metres distance. The green line is the second measurement, and tells us that water is present at 30 and 90 metres, but that at 70 metres it has dried up. At 90 metres there is still water present or corrosive residue in the insulation. The spikes on the far right (100m) of the echogram show the reflection from the installed reflector for the neighbouring antenna array. Note that this reflection is smaller when there is water or corrosion residue present.

Figure 4: Portable data logger

KEY SPECIFICATIONS

• Measurement principle	RF (Microwaves)
• Type of insulating material	Mineral wool, polyrethane & other non RF absorbing materials
• Processing	External (Vector network analyser)
• Measurement length	Up to 200 metres
• Weight	Less than 3 kg
• Hazardoues area	Zone 0, 1, 2
• Signal interface	Analogue RF
• Material	SS 316L

QUALITY SYSTEM CERTIFICATION DNV·GL ISO 9001

CLAMPON®
ULTRASONIC INTELLIGENT SENSORS

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