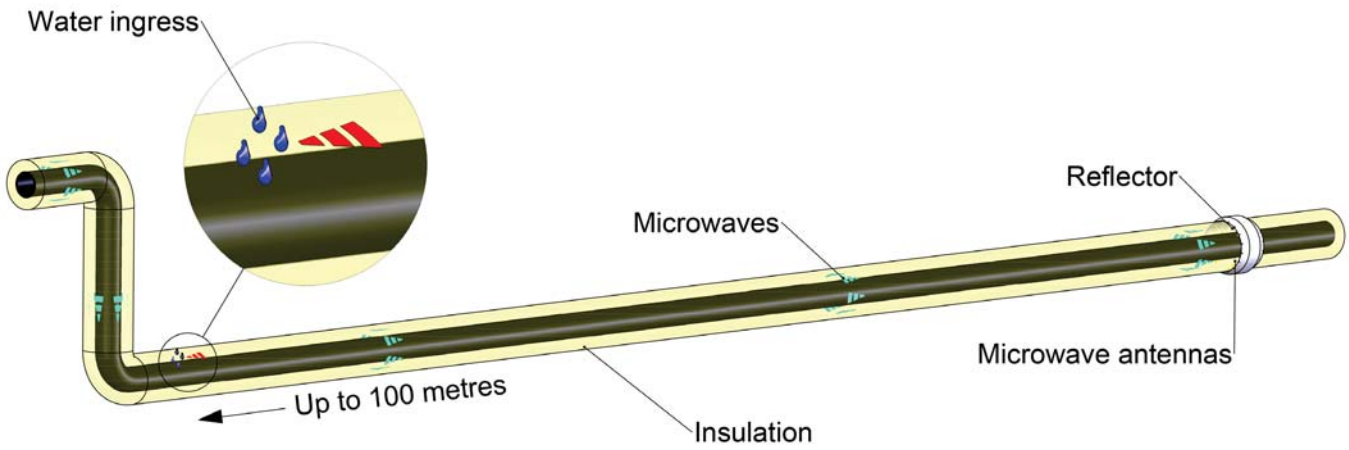
ULTRASONIC INTELLIGENT SENSORS

ClampOn CUI Detector
Corrosion Under Insulation

DIGITAL SIGNAL PROCESSING



Monitoring Corrosion Under Insulation

ADVANTAGES

- **No need to remove insulation**
- **Long distance, ~100 meter range**
- **Works around bends**
- **Cost effective**
- **Early detection**
- **Proven concept**
- **Lightweight**
- **Rapid measurements (less than one minute)**
- **Accurate location of defects**

BACKGROUND

Corrosion under insulation is a huge challenge on many topside insulated pipework. If the outer metal sheet fails, water may seep in to the insulating material. If this moisture becomes trapped, the pipe will soon begin to corrode or crack. 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 effective and accurate measurement of water ingress and corrosion residue, and information about its location along the pipework.

Figure 1: Corrosion under insulation

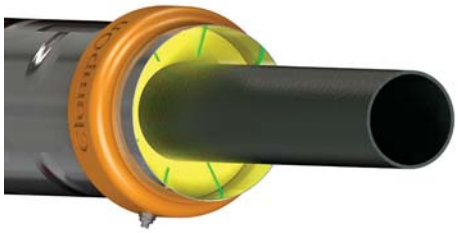


Figure 2: Insulated pipe, antenna arrays installed along the pipeline.

WORKING PRINCIPLE

Each antenna array emits guided 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 micro-waves. A reflector is used to optimise the sensitivity of the CUI system.

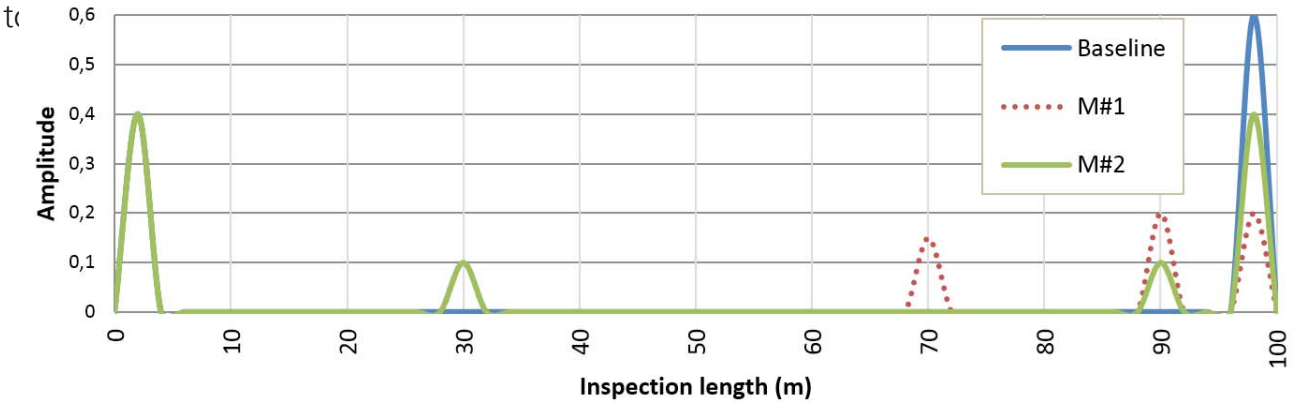


Figure 3 - Baseline, measurement #1 and measurement #2

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 100 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

April 2017

Norway: ClampOn AS, Vaagsgaten 10, NO-5160 Laksevaag, Bergen, Norway, Phone: +47 5594 8850, e-mail: mail@clampon.com
USA: ClampOn, Inc., 15720 Park Row, Ste. 300 (77084), Houston, TX, USA, Phone: +1 281 492 9805, email: infoinc@clampon.com
www.clampon.com