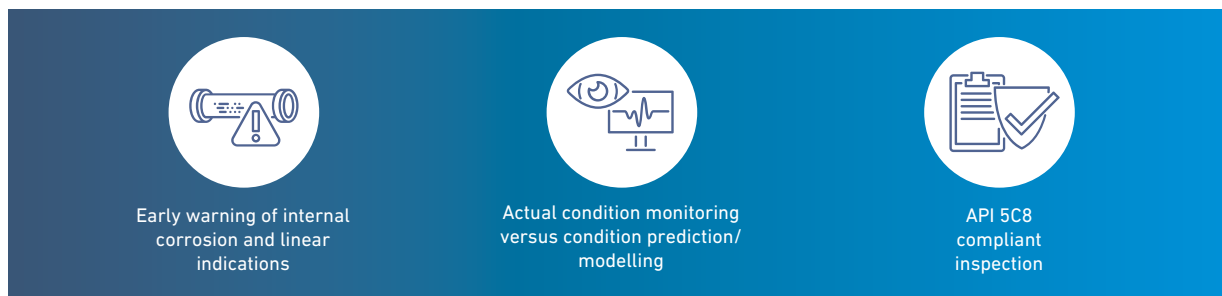


# Coiled Tubing Inspection Services

## Automatic Coiled Tubing Integrity Monitoring (ACIM)

Coiled tubing is a fast growing technology, providing an alternative to jointed pipe in a wide range of oil and gas well operations. Failures of the tubing can significantly impact operations and in a worst case can lead to the loss of a well. Our ACIM service is a reliable and effective means of managing the integrity of coiled tubing during on and offshore operations, and helps to minimize downtime and operational losses.



### The Solution

ROSEN's ACIM is a sophisticated tool designed to identify critical defects before failure with a high probability of detection.

It monitors the tubing condition in real time and provides a clear, unambiguous and comprehensive analysis of the inspection data in an easy-to-read report. Corrective actions can then be scheduled, thus increasing operational efficiency. The resultant inspection data can be used to inform risk-based integrity decisions and more realistic remaining life assessments. It can also be integrated with other data sources.



ACIM inspection head clamped on coiled tubing during offshore operations

### Key Advantages

- Confidence that coiled tubing is safe for operation
- Accurate and reliable detection of metal loss and ovalities
- Highly sensitive to even smallest defects, such as pinhole corrosion and mechanical damage
- Real-time monitoring delivering immediate results on wall thickness, diameter, speed and depth
- Designed for hazardous environments, including ATEX zone 1 for onshore and offshore operations

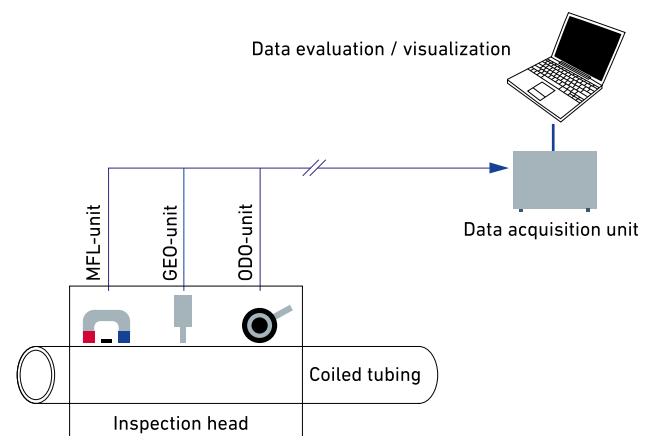
- Cost savings and improved operating efficiency through avoidance of unscheduled downtime
- Provision of vital input data for subsequent assessments, such as fatigue and remaining life assessments

### Measurement Principle

ACIM is based on Magnetic Flux Leakage (MFL) technology, a nondestructive testing method that can detect metal loss in coiled tubing. The wall of the tube is magnetized and the magnetic field leaks from areas where there is metal loss. This leakage field is then detected and assessed in real time.

The ACIM inspection unit contains:

- A circumferential array of up to 54 integrated magnetic flux sensing hall elements
- 12 GEO sensors for measuring tube geometry (ovality)
- An odometer for logging the position of detected features.



ACIM tool components

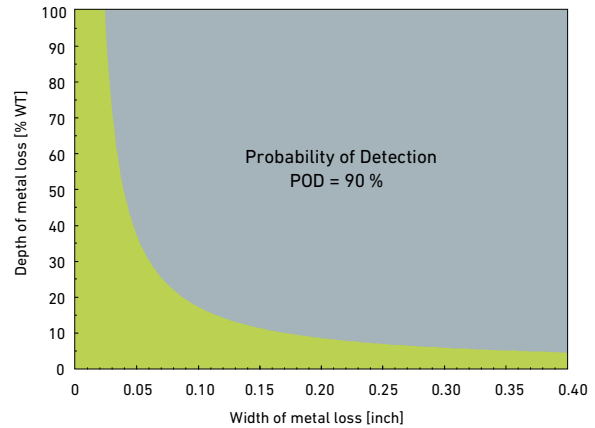
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### Probability of Detection

Figure 1 shows the minimum depth of surface flaws (as a % of wall thickness) vs. the width of metal loss that can be detected automatically. The shaded area represents a probability of detection (POD) at 90% certainty. The ACIM system magnetizes the tubing in the axial direction.

The system can automatically detect transverse flaws and three dimensional defects such as cracks, cuts and general corrosion. Corrosion in the longitudinal direction will be detected if the defect has a sufficient transverse component to cause a detectable change in magnetic field.



### Technical Specifications

<b>Tool Specification</b>	Diameter Range	1.250", 1.500", 1.750", 2.000", 2.375" & 2.875"
	Principle	High-resolution MFL technology
	Analysis method	Signal-based
	Sample rate	every 1/32" (1mm)
	WT ranges	0.109" till 0.224" (2,76mm-5,68mm)
	No. of Sensors	36/45/54*
<b>Detection threshold</b>		see POD table above
	Min. transverse Notch Detection (L×W×D)	6,35mm [0.25"] × 0.5mm [0.02"] × 10%
	Thinning (L×W×D)	30mm [1.2"] × 25mm [1"] × 1,5mm [0.01"]
<b>Steel</b>	Principle	High-resolution MFL technology
	Steel Type	ferror magnetic steel (ferretic alloys). Duplex alloys (limited **)
<b>Attainable accuracy</b>	Tool speed	max 3.2ft/s (1m/s) min "no limit"
	Depth/Length	<±1.0%
	Outer Diameter	±0.005" (±127µm)
	Ovality	calculated
	Wall thickness	±0.005" (±127µm)

\* for the tool sizes 1.250" => 36 Sensors  
for the tool sizes 1.500" & 1.750" => 45 Sensors  
for the tool sizes 2.000", 2.375" & 2.875" => 54 Sensors

\*\* it is depended on the ferrite portion and a trail shall be performed to ensure detectibility of metal loss flaws.

Note: Contact ROSEN for more detailed information.