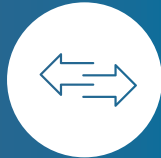


TOFD – In-line Inspection Service for Cracking

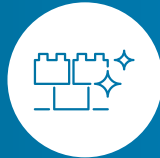
Detection and Sizing of Axial and Circumferential Cracks



Accurate and precise feature classification and sizing



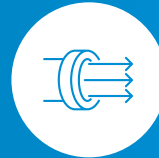
Remotely controlled crawler module with bidirectional motion



The inspection system allows for combining technologies



Unlimited power and real-time data through a single cable connection



Economical in-service inspection with a single entry/exit point

Cracking in pipelines can occur in any stage of its lifecycle, during manufacturing or operation. To manage these threats most pipelines can be inspected using off-the-shelf in-line inspection (ILI) solutions, for example with UT crack-detection tools. However, there are pipelines that are not designed or operated for the use of a conventional ILI tool. They can be classified as “challenging” (“unpiggable”) for various reasons, including single access and limited pumping abilities. Modification of these pipelines to enable standard ILI procedures can be both expensive and technically complicated.



Solution

The inspection of these pipelines is made possible using ROSEN's UT bi-directional self-propelled tethered inspection unit, which specifically addresses the challenges of single access and limited pumping abilities.

The tether, robotic crawler and sensor carrier come together to allow the unit to travel both forward and backward through bends for up to 24 km (14.9 mi), consistently showing valuable high-resolution data to the operator in real time.

The bi-directional capability is achieved through adapting the sensor-carrier, electronics and data-storage modules into lightweight low-friction modules on wheels and combining them with a powerful wheel-driven crawler. The tether supplies electrical power to the tool, bringing the collected data to the control unit at the launching site, allows for remote steering of the crawler and acts as a means for recovery in emergencies. The Time-of-Flight-Diffraction UT technology for this solution can be calibrated for axial and circumferential feature detection

and is performed by ASNT qualified personnel and ATEX Zone 2 certified equipment. Using the valuable data, certified data analysts provide a final report according to POF, API 1163 and agreed boundary conditions.

Advantages of the System

- Accurate and precise feature classification and quantitative sizing by ultrasonic measurement
- Two sets of data (on both the inbound and outbound run) mean 200% coverage
- Real-time data availability and preliminary report on-site, followed by a thoroughly reviewed final report
- Economical in-service inspection with single entry/exit point and no pumping required
- Unique tool configurations addressing individual operational requirements

Standard Services

- $\geq 9"$ (dual-/multi-diameter on request)
- Geometry and wall thickness inspection, crack-detection

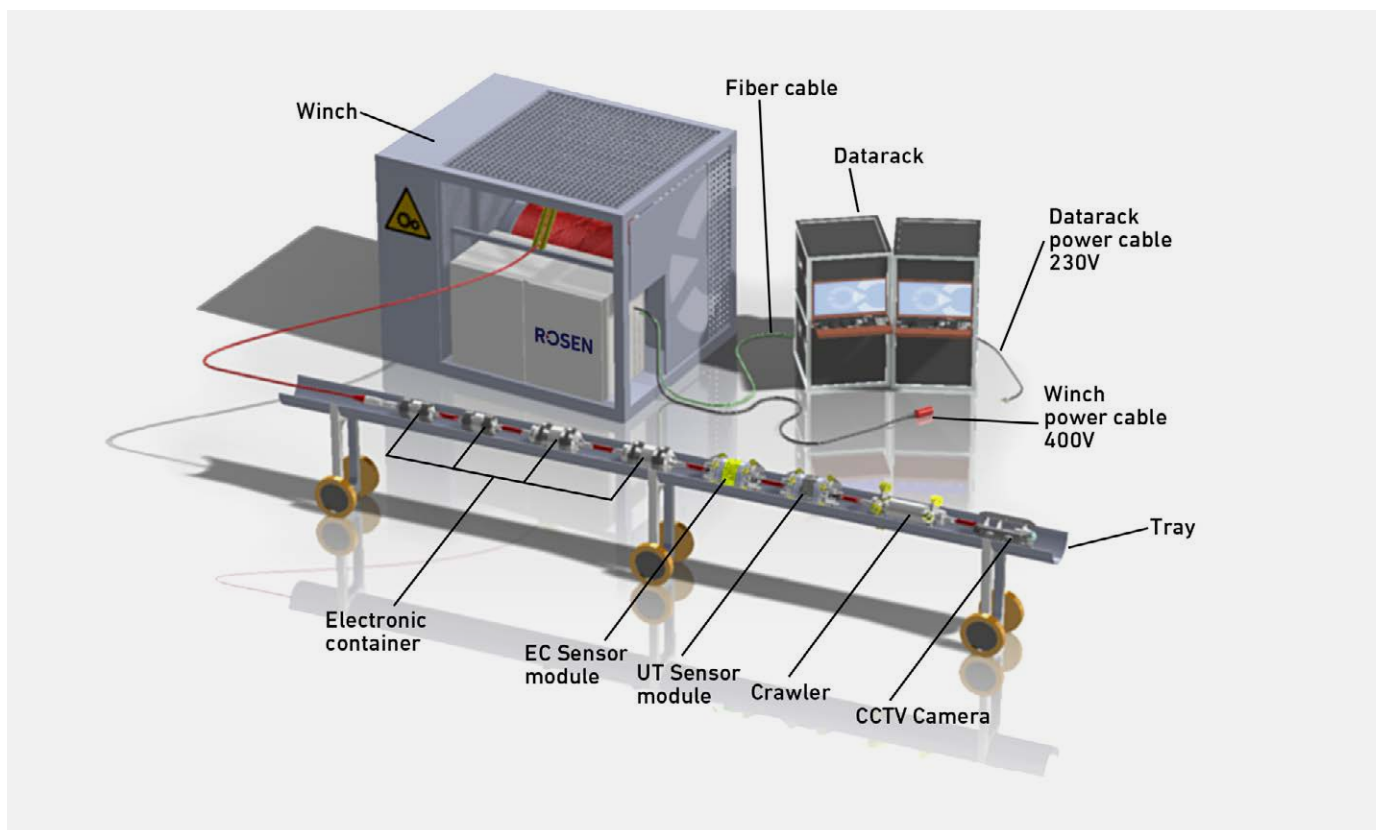
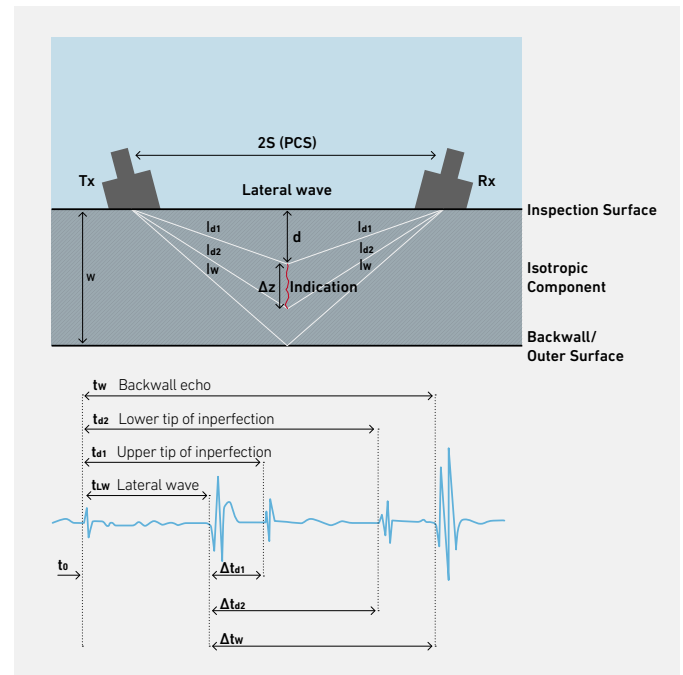
Optional Services

- Post-ILI – data alignment and combined evaluation
- Integrity assessments – RBI, FFP, CGA
- Easy-to-use visualization software
- On-board camera (for use in clear product)
- Grinding machine
- Crack-detection (shearwave)

Remarks and Features

- Other tool sizes available on request
- Tailored solutions with different specifications available
- API 1163 certified services
- CE and ATEX certification available (winches)
- Specifications subject to change according to specific requirements and tool configurations
- Contact ROSEN for more detailed information about the presented service
- Reporting according to latest POF standard

Principle of Time-of-Flight-Diffraction (TOFD):



Technical Specifications

Standard Operating Specifications

Tool sizes available	9"–48" (56")
Pipeline product	Liquids
Product temperature range	up to 140°F (60°C)
Maximum operating pressure	12 MPA (1740 psi) depending on tool, typical pipeline out of operation
Operating speed range	Up 0.1m/s (0.22 mph), stops for scanning
Wall thickness range	0.120" – 2.40" (3 mm – 60 mm), project specific-sensor
Configuration	1.5D
Minimum pipeline bend radius	1.5D for $\geq 16'$, else 3D
Maximum operating time	Unlimited

Note: Contact ROSEN for more detailed information.

Location and Orientation Capabilities

Axial position from closest weld	$\pm 4"$ (± 0.1 m)
Circumferential position accuracy	$\pm 5^\circ$ for $d \geq 20"$, else $\pm 10^\circ$

Note: Inspection tool capabilities depending on client request. Unless the performance specification can be deviated from a project with similar materials, welding procedures etc., the performance specification must be deviated from a validation trial. Hence, any performance specification associated with this technology must be considered as project specific. (Variable are the number of probes, sensor parameters, probe separation and resolution).

Identification of Features

	External surface breaking (mm)	Internal surface breaking (mm)	Mid-wall (mm)
POI = Depth of POD = 90%	0.5	2.5	0.2
POI = Depth sizing accuracy at 95% confidence	± 0.2	± 1.5	± 0.2
POI = Width sizing accuracy at 95% confidence	$\pm 1.5-3.0$	$\pm 1.5-3.0$	$\pm 1.5-3.0$
POI = Length sizing accuracy at 95% confidence	$\pm 1.5-3.0$	$\pm 1.5-3.0$	$\pm 1.5-3.0$

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