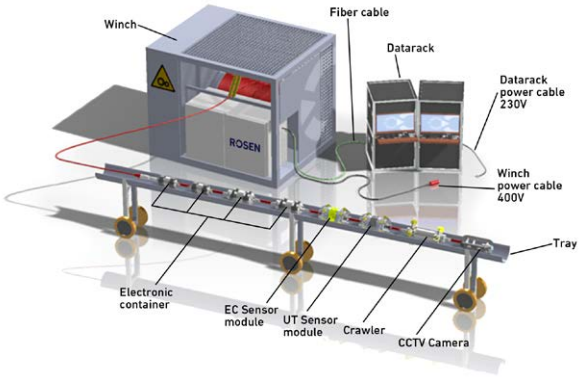
TOFD Robotic In-line Inspection Service

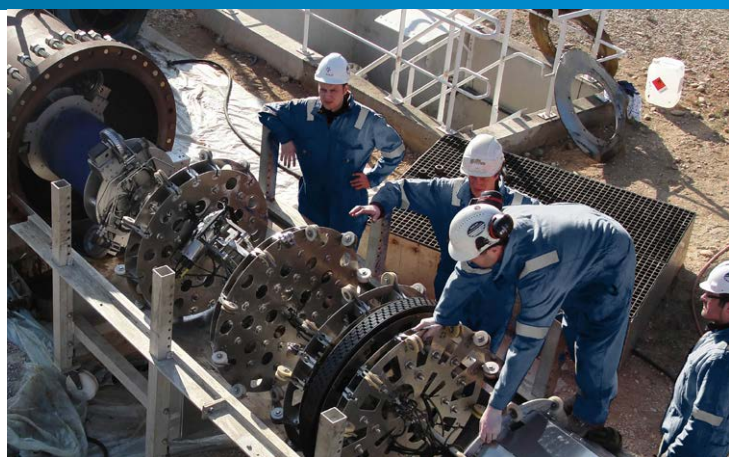
Detection and Sizing of Axial and Circumferential Cracks

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

Cracking can occur at any stage of a pipeline's lifecycle, from manufacturing to operation. While most pipelines can be inspected using standard in-line inspection (ILI) tools, some are considered "challenging" or "unpiggable" due to factors such as single access points or limited pumping capabilities. Modifying these pipelines for conventional ILI can be costly and technically complex.

Our ultrasonic robotic inspection solutions specifically address the challenges of single access and limited pumping abilities. The tethered robotic crawler and sensor carrier allow the tool 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 bidirectional 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 control of the crawler and acts as a fail-safe mechanism. The Time-of-Flight-Diffraction (TOFD) 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.





Standard Services

- >9" (smaller and dual-/multi-diameter on request)
- Combination with pulse echo (PE)/shear wave crack inspection for optimum performance – highest sensitivity (PE) and highest accuracy (TOFD)

Optional Services

- Geometry and wall thickness inspection
- 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

ROSEN
empowered by technology

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	12MPA (1740psi) depending on tool, typical pipeline out of operation
Operating speed range	Up 0.1m/s (0.22mph), stops for scanning
Wall thickness range	0.120" – 2.40" (3mm – 60mm), project specific-sensor
Configuration	1.5D
Minimum pipeline bend radius	1.5D for ≥16", else 3D

Note: Contact ROSEN for more detailed information.

Measurement Performance

	External surface breaking	**Near inner surface & internal surface breaking**	**Mid-wall**
Crack depth (dc) at POD = 90%	1mm (0.04")	2.5mm (0.10") 1mm (0.04")*	1mm (0.04")
Crack depth (dc) sizing accuracy at 95% confidence	±1mm (0.04")	±1.5mm (0.06")	±1mm (0.04")
Crack length sizing accuracy at 95% confidence	±1.5mm – 3.0mm (0.06" – 0.12")	±1.5mm – 3.0mm (0.06" – 0.12")	±1.5mm – 3.0mm (0.06" – 0.12")

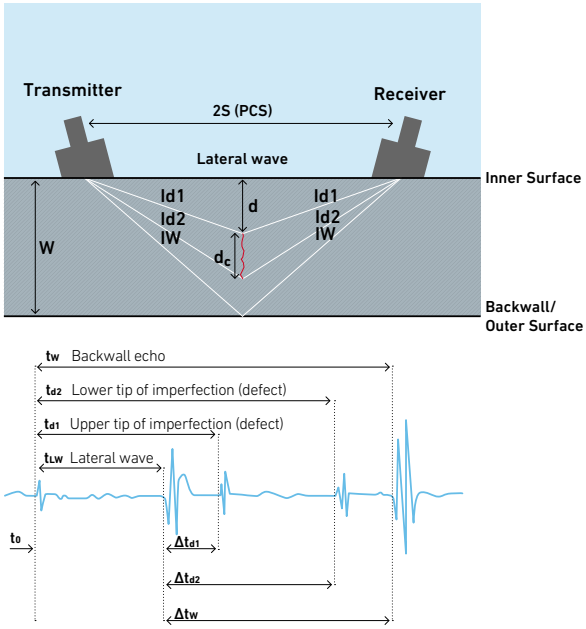
*In combination with ultrasonic pulse echo (PE)/shear wave technology

Location and Orientation Capabilities

Axial position from closest weld	±4" (±0.1 m)
Circumferential position accuracy	±5° for d ≥ 20", else ±10°

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 derived from a qualification test on a representative test sample 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).

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



The defect position, that is the depth (d) of the lower crack tip, and the crack depth (d_c) are calculated from the time of flight (t) of the various wave paths, the respective travel lengths (l) and the sound wave speed. This method allows for a highly accurate positioning and sizing of weld cracks.

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
- Reporting according to latest POF standard
- Contact ROSEN for more detailed information about the presented service

ROSEN Swiss AG
Obere Spichermatt 14 · 6370 Stans · Switzerland

Phone: +41-41-618-0300
info@rosen-group.com
www.rosen-group.com

ROSEN-Group_Serviceflyer_TUM_CD_TOFD_v1-3_2024