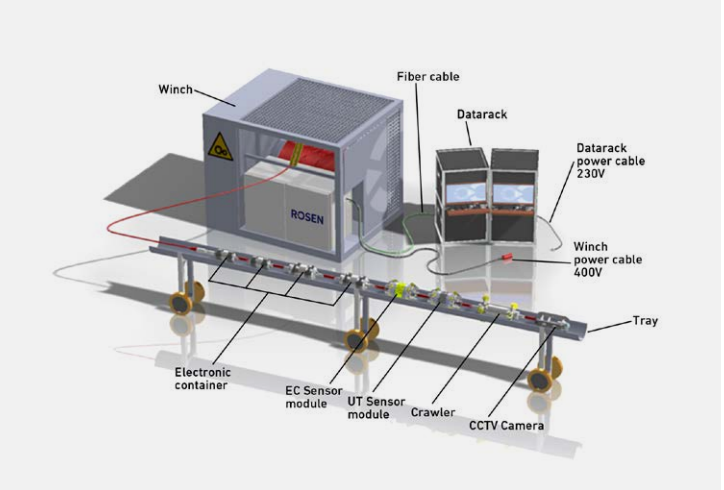
# Ultrasonic Robotic In-line Inspection Solution

## High-Resolution Metal Loss Detection and Defect Sizing

- 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

**Nearly all pipelines are affected by metal loss, due to corrosion, erosion, etc. Generally, this can be detected and thus managed using standard in-line inspection (ILI) solutions. Unfortunately, some of these pipelines are classified as challenging, or "unpiggable," for various reasons, including single access and limited pumping abilities. Modification of these pipelines to enable standard procedures can be expensive and technically complicated. However, the data collected from ILI remains invaluable for the proper integrity management of any pipeline, especially challenging ones.**




## Solution

The inspection of these pipelines is made possible using a bi-directional robotic inspection unit, which specifically addresses the challenges of single access and limited pumping abilities. The robotic crawler is powered and connected via a tether, allowing it to travel both forward and backward through bends for up to 24 km (14.9 mi), consistently showing valuable high-resolution data in real time to the operator. 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. This solution offers unprecedented bend passing capabilities, making it even more suitable for pipelines with challenging routes.

Certified data analysts on-site can see metal loss and other defects during the inspection in real time and provide a preliminary report.

A final report is delivered upon completion of a detailed review of the inspection data. On-site operations are performed by ASNT qualified personnel and ATEX Zone 2 certified equipment.

## Advantages of the System

- Accurate and precise feature classification and sizing by quantitative ultrasonic measurement
- Two sets of data (on both the inbound and outbound run) mean double coverage
- Economical in-service inspection with single entry/exit point and no pumping required
- Unique tool configurations addressing individual operational requirements



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# Standard Services

- ≥ 6" (4" in preparation), dual/multi diameter on request
- Geometry and wall thickness inspection
- Post-ILI – data alignment and combined evaluation

# Optional Services

- Integrity assessments – RBI, FFP, CGA
- Easy-to-use visualization software
- Grinding machine
- Camera (for use in clear product)

# Remarks and Features

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

# Technical Specifications

## Standard Operating Specifications

| | |
|---|---|
| **Tool sizes available** | 6"–48" (56") |
| **Pipeline product** | Liquids |
| **Product temperature range** | Up to 60°C (140 °F) |
| **Maximum operating pressure** | 12 MPa (1740 psi)<br>Typical out of operation |
| **Operating speed range** | Up to 0.1 m/s (0.22 mph) |
| **Wall thickness range** | 5 mm–22 mm (0.19–0.87") |
| **Minimum pipeline bend radius** | 1.5D |

Note: Contact ROSEN for more detailed information.

## Location and Orientation Capabilities

| | |
|---|---|
| **Axial position accuracy from reference marker 1 m on 1000 m (1 ft on 1000 ft) marker distance** | 1:1000 |
| **Circumferential position accuracy** | ±5° for<br>d ≥ 20", else ±10° |

The axial positioning accuracy is given at 90 % certainty and is based on following conditions:
1. Distance between upstream (u/s) and downstream (d/s) marker/reference point < 2,000 m (1.2 mi).
2. Actual aboveground distance to both u/s and d/s marker/reference points have been measured and correlated.
3. Negligible difference between pipeline and soil contour.

## Performance Specifications

| | | |
|---|---|---|
| **Axial sampling distance** | | 1 mm (0.04") |
| **Discrimination int./ext.** | | Yes |
| **Detection of metal loss at POD = 90 %** | Minimum diameter<br>Minimum depth | 8 mm (0.31")<br>0.8 mm (0.03") |
| **Detection + sizing of metal loss at POD 90%** | Minimum diameter<br>Minimum depth | 16 mm (0.62")<br>1.0 mm (0.06") |
| **Depth sizing accuracy** | At 90 % certainty | ±0.4 mm (±0.016") |
| **Length sizing accuracy** | At 90 % certainty | ±4 mm (±0.15") |
| **Width sizing accuracy** | At 90 % certainty | ±8 mm (±0.31") |
| **Accuracy of wall thickness measurement** | At 90 % certainty | ±0.2 mm (±0.008") |

## Other Features with POI > 90 %

| | | |
|---|---|---|
| **Mid-wall features** | Laminations and inclusions minimum diameter | 8 mm (0.31") |
| **Deformations** | Dents, wrinkles | Yes |
| **Weld detection** | Girth weld, spiral weld, longitudinal weld | Yes |
| **Installations** | Minimum diameter | 25 mm (1.0") |
| **Bends** | Bend radius < 5D/90° | Yes |
| **Repair areas (welded)** | Sleeves, patches, attachments | Yes |

ROSEN Swiss AG
Obere Spichermatt 14 · 6370 Stans · Switzerland

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

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