

RoCombo MFL-A / IEC Service

In-line Complementary Combined Metal Loss Detection and Sizing

The increasing requirement for higher operational pressure in the offshore industry is typically met by extra heavy wall pipelines. For these assets it is important to identify any complex corrosion at a very early stage to adapt the operational strategy, e.g. by applying inhibitors, dewatering or inline cleaning. Our RoCombo MFL-A/IEC service provides reliable and accurate detection and sizing of complex corrosion as a proactive basis for a successful and effective pipeline integrity management.



Increased probability of detection (POD)



Increased probability of identification (POI)



Superior defect sizing accuracy

The Solution

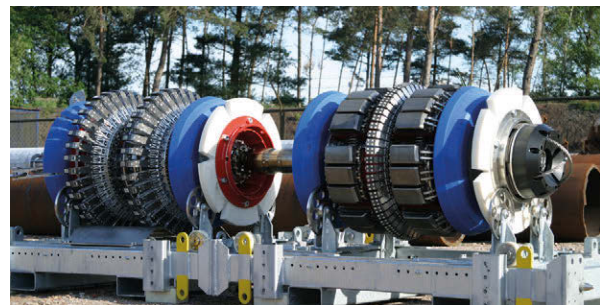
To enhance the measurement performance in heavy walled pipelines, a combination of Magnetic Flux Leakage (MFL) and Eddy Current is utilized on one tool. The two technologies are well-established within the industry and represent a robust inspection method with high sensitivity and accuracy. The unique approach ensures not only high sensitivity and precision when scanning the inner pipe for metal loss anomalies with the Eddy Current technology, but it also provides comprehensive geometry inspection data. Besides that, the simultaneous utilization of MFL provides reliably additional data for mid-wall and external features. The modular tool design allows a quick adaptation to current needs in terms of tailored solutions.

Recent advances in capabilities of the inspection tools have furthermore extended the application range to pipelines that were used to be classified as 'unpiggable'. Among those are not only multi-diameter pipeline configurations which were not inspectable previously, but also pipelines with high wall thicknesses and uncommon operating conditions.

Service Options

All aspects from the inspection request to the final report are covered with the flexibility to choose from various service options.

- Cleaning – operational and pre inspection
- Speed Control – inspection at high flow rates
- GEO – geometry mapping available on MFL-A/IEC tool
- XYZ – route mapping and strain assessment
- Multi-Diameter – pipelines with varying diameter
- Offshore – long distance and high pressure
- Post-ILI – data alignment and combined evaluation
- Integrity Assessments – RBI, FFP, CGA
- NIMA – versatile asset integrity software suite



Key Advantages

- Accurate and precise detection and sizing of shallow internal corrosion by high density of eddy current sensors and high sampling rates combined with accurate and precise feature classification and sizing by magnetic saturation, high sensor density, high sampling rates and triaxial magnetic field analysis
- Lifetime integrity management supported by full recording of the complete inspection raw data
- Largest tool fleet on the market ensuring global tool availability and flexibility
- High quality service with certified processes (API 1163), personnel qualification (ASNT) and equipment (CE, ATEX)

Remarks and Features

- API 1163 compliant services
- CE and ATEX certification available
- Tailored solutions with different specifications upon request: multiple tool sizes or multi-diameter tools, higher pressure rating
- Specifications are subjected to change according to specific requirements or tool configurations

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Technical Specifications

Standard Operating Specifications

Tool sizes available	6"-56"
Pipeline product	Gas or liquids
Product temperature range	0 °C-65 °C (32 °F-149 °F)
Maximum operating pressure	15 MPa (2175 psi) 25 MPa (3625 psi) optional
Operating speed range	Up to 3.0 m/s (6.7 mph)
Minimum pipeline bend radius	1.5D
Maximum operating time	400 hours
Maximum inspection length	800 km (500 miles)

Location and Orientation Capabilities

Axial position accuracy from reference marker 1 m on 1000 m (1 ft on 1000 ft) marker distance	1:1000
Axial position from closest weld	±0.1 m (±4")
Circumferential position accuracy	±5°

Long distances are determined based on direct measurements by an odometer system on the tool. Further corrections e.g. using marker locations may apply. The axial positioning accuracy is given at 90 % certainty and is based on following conditions:

- Distance between upstream (u/s) and downstream (d/s) marker/reference point < 2,000 m (6,500 ft.).
- Actual aboveground distance to both u/s and d/s marker/reference points have been measured and correlated.
- Marker points are placed correctly according to respective ROSEN marker specification.

	General metal loss ¹	Pitting ²	Axial Grooving ²	Circumf. Grooving ²	Circumf. Slotting ³
Depth at POD = 90 % 1.5 mm ⁴	1.5 mm ⁴ (0.06")	1.5 mm ⁴ (0.07")	1.5 mm ⁴ (0.07")	1.5 mm ⁴ (0.06")	0.15t
Depth sizing accuracy at 80 % certainty	±1.3 mm (±0.05")	±1.5 mm (±0.06")	±1.5 mm (±0.06")	±1.3 mm (±0.05")	±0.10t
Width sizing accuracy at 80 % certainty	±5.0 mm (±0.20")	±3.5 mm (±0.12")	±3.5 mm (±0.12")	±5.0 mm (±0.20")	±15.0 mm (±0.59")
Length sizing accuracy at 80 % certainty	±6.0 mm (±0.24")	±3.0 mm (±0.12")	±3.0 mm (±0.12")	±6.0 mm (±0.24")	±10.0 mm (±0.39")
Depth sizing accuracy at 90 % certainty	±1.6 mm ⁵ (±0.06")	±1.9 mm ⁵ (±0.08")	±1.9 mm ⁵ (±0.08")	±1.6 mm ⁵ (±0.06")	±0.13t
Width sizing accuracy at 90 % certainty	±6.5 mm (±0.26")	±4.5 mm (±0.18")	±4.5 mm (±0.18")	±6.5 mm (±0.26")	±19.0 mm (±0.75")
Length sizing accuracy at 90 % certainty	±7.5 mm (±0.30")	±4.0 mm (±0.16")	±4.0 mm (±0.16")	±7.5 mm (±0.30")	±13.0 mm (±0.51")

¹ General metal loss and other classes, if width > 30 mm (1.2")

³ Min (length, width) ≥ A/2

⁵ Or 0.13t, whichever value is smaller

² For width = length < 30 mm (1.2") and A > 15 mm (0.6")

⁴ Or 0.10t, whichever value is smaller

⁶ Or 0.20t, whichever value is smaller

	Pinhole L = W ≥ 10 mm (0.39")	Circumferential slotting
Depth at POD = 90 %	≥ 1.0 mm (≥ 0.04")	≥ 1.0 mm (≥ 0.04")

Note: Depending on the length and width dimensions of the defects the depth sizing maximum can be calculated according to $D_{max} = 10 \text{ mm (0.39")}$, $0.3 \times L$ or $0.3 \times W$ (whichever is the smallest). Anomalies deeper than this value are sized as per specifications for non-internal anomalies.

Metal Loss Feature Classification

All reported metal loss features are classified according to the dimensions shown in the following Pipeline Operators' Forum (POF) specification graph.

A = wall thickness or 10 mm (0.39"), whichever value is greater

Wall Thickness Detection

±1 mm (± 0.04") or ±0.1t, whichever value is greater at 80 % certainty t = wall thickness

