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Presented at the PPSA Seminar on 16th of November 2011
Marcliffe Hotel, Pitfodels, Aberdeen, UK
What is so difficult about the inspection of flexible riser pipe?

- **Material is not homogeneous through the thickness of the wall**
- **Electrically conductive and insulating material is present**
- **Ferromagnetic and stainless steel (or duplex) is present**
- **Every pipe is different in its structure**
- **There is a pronounced anisotropy due to the helical winding**
Layers of a flexible riser

Carcass (Stainless or Duplex)
Pressure Sheath (Polymer)
Pressure Armour (Carbon Steel)
Inner Tensile Armour (Carbon Steel)
Outer Tensile Armour (Carbon Steel)
Outer Sheath (Polymer)
UT pig internal measurement of a flexible riser

Courtesy of NDT Systems & Services AG

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Experience in pigging flexible riser with MFL?

- Potential problem are remaining ferritic particles in stainless steel carcass.
- Particles from previous inspection (Rust) or magnetic steel bristles.
- Can lead to corrosion in the carcass.
- Cleaning pigs adapt bristle material.
Magnetically Biased Eddy Current (SLOFEC™)

Diagram:
- Test piece
- Magnetic field lines
- Magnetic circuit
- Eddy current sensors
- Eddy current probe field
- Defect
- Increased magnetic flux level
Anisotropy in magnetisation

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The gap between the wires

In the graph, the signal strength is plotted against the angle of scanning. The x-axis represents the angle of scanning in degrees, ranging from 90 to 0, while the y-axis represents the signal strength in arbitrary units, ranging from 18 to 0.

The graph shows a downward trend, indicating that as the angle of scanning decreases, the signal strength increases. The shaded area corresponds to a typical range for flexible pipe, where the gap between strings increases.

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Switchable Permanent Magnet

- Adjust to ideal magnetisation level
- No electrical power required
- Fail safe

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Additional Hall Sensors to monitor the flux level

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Optimum magnetisation level

- Compare open and closed circuit to obtain below curve
Flexible Riser Pipe Testing

05/11/2009

Innospection
Flexible Riser Pipe
Lighter Option for ROV deployment

- Scanning up/down in several steps to achieve full coverage
- Light for ROV deployment
- In cooperation with Fugro

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Flexible Riser Pipe

Test results

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Radiography by Oceaneering

Scans using MEC-FIT

Signal from unlocked Zeta-Wire

Two gaps in armourd wires (probably top layer)
In cooperation with PPSA Seminar, Aberdeen November 16th 2011
Spin-offs
Crawler with UT Sensor

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