

MAPS Integrity Management and T Insert for Flow Induced Vibration

SUT Technical Evening - Advancements in Mooring & Riser Technology

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How the Technology Works

What MAPS measures

- Measures the stress in the wires
- Total stress is measured (residual and applied)
- Cannot determine a break from a single measurement

How do we detect wire breaks

- Multiple inspection scans at varying applied loads (eg varying pressure or tension)
- Compare output to detect breaks
- If no breaks, plot will be identical but displaced
- A break is indicated if the plot does not displace, as the applied stress does not change



Wire Break Detection

Different frequencies are used to inspect the two tensile layers

- Mid range frequency for the inner tensile (FT1)
- High range frequency for the outer tensile (FT2)

Flextensile 1 Plot

- Clearly see the two breaks in the FT1 layer
- Does not show the FT2 breaks

Flextensile 2 Plot

- Clearly see the breaks in FT2 layer
- Is not affected by the breaks in the FT1 layer







Key Capabilities





Deployment

- Installed on the outer sheath; no compromise to riser integrity
- Suitable for new build or retro-fit onto existing risers

Monitor or inspection mode

• Independent of pipe manufacturer

Wire break detection

- Extended range; from termination to splash zone
- Resolution to individual wire
- Not reliant on transient signals
- Links to both outer and inner tensile armours



Value Proposition



- Avoid unplanned shutdowns; baseline condition data for predictive action
- Life extension; part of an asset life extension programme
- Asset re-use; provision of data to support cases for pipe re-purposing
- **Regulatory compliance;** alignment with stakeholders to satisfy internal, HSE and regulator obligations

To date: has been used to inspect 50+ risers across a range of locations including the North Sea, offshore Africa and Brazil





FlexInsert[™] for Flow Induced Vibration

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Introduction to Flow Induced Vibration

Problem Definition

- Dry gas through roughbore flexible pipe
- Vortex shedding and pressure pulsations
- Onset velocity influenced by
 - Carcass geometry
 - Fluid properties
 - Pipework topside and subsea
- Vibrations can cause failure in topside and subsea structures





BHGE's Anti-FLIP Solution

FlexInsert™ Technology

- Tee shaped spiral insert into the carcass layer
- Tee shape is formed from a flat strip of stainless steel
- Shape of the tee optimized to not affect the bending of the pipe
- Static solution is non-welded
- Dynamic solution the top join of the tee is welded





How it Works

FlexInsert[™] covers the spiral cavity inside of carcass; making the pipe behave similar to a smooth bore

- Increases critical flow velocity
- Reduces pressure drop







Increased Critical Flow Velocity

- Onset of FIP in conventional carcass ~2m/s
- Non-Welded Flexinsert increase in FIP onset velocity to ~10 – 15m/s
- Welded Flexinsert will be an even further improvement, with onset velocities over 25m/s







Reduced Pressure Drop

- The smoother internal surface with the FlexInsert[™] reduces the pressure drop
- Pipe ID can be reduced by ~10% to achieve the same pressure drop in large diameter pipes
- Reduction in pipe ID results in cheaper product, logistics, installation etc.





Pipe Specification

Qualification of the FlexInsert[™] technology is aimed at following specification:

Pipe Diameter ID	10-16 inch ID (Using 82 x 2.0 mm Carcass Strip)
Internal Fluid	Dry gas
Design Pressure	No restriction on pipe operating pressure
Service Temperature	No restriction on pipe design temperatures
MBR	No restriction on pipe MBR

Qualification Pipes - Two Pipes - 16 inch ID and 11.5 inch ID



Manufacturing – Non-Welded Solution

- The T-Winder can run independently
- Controlled to defined tolerances
- Placed in front of the carcass rollers and rotates with the machine









Manufacturing - Welded Solution

Separate production line for the welded solution, currently being implemented into the factory



Machine due to be installed and commissioned Q4 2019



T-winder tooling face station:

Wax box Sensors

Flat strip spool Gearbox/roller set

Summary of Qualification

Qualification completed

- Non-Welded FlexInsert[™] for static service technical qualification complete
- Documentation IVA certified
- Welded FlexInsert[™] for dynamic service technical qualification complete
- Documentation IVA certified

Qualification ongoing

- Full industrialization of the static and dynamic FlexInsert[™] solutions are ongoing
- Installation of machines, producing pipe samples and finalizing testing
- Due for completion Q2 2020





Questions?

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