



## Deepwater Swivel Joint Inspection using ACFM®

### The Challenge:

Swivel joints are an integral part of subsea water injection systems, installed to be used as part of the extraction mechanism in subsea oil fields. In this case this system was on a field serviced by a tethered FPSO in 1100m of water. The swivel and pipeline welds are made of a corrosion resistant alloy to avoid excessive corrosion. Some of these joints were identified as “leaking”, causing a reduction in productivity of the well. Information and data on the exact nature of the failures was needed in order to schedule a repair and maintenance programme.

### The Solution:

TSC’s ACFM® inspection technology has been developed to detect and size fatigue cracks in metal structures, with great accuracy, producing instant repeatable and auditable measurement data. The ACFM® technique is tolerant of lift-off and misalignment; and as such is suitable for the deployment by ROV techniques in an underwater environment. ACFM® was used to inspect the identified swivel joints to determine if there were fatigue defects present, as detected leakage could be a result of cracking. ACFM® inspection was able to accurately size the known defects but also to determine if there was further cracking in the other swivels that could lead to failure in the short term. Automated UT provided by Sonomatic was also used to check the inside surface of the pipe for corrosion.



**Figure 1** (above) ACFM® scanning pipeline at 1100m depth.

TSC’s ACFM® equipment is rated for deep water work up to 2000m depth. A scanner was designed and built in-house to work around the specified swivel joint geometry. This scanning system also enabled full circumferential inspection of the pipe/swivel weld.

The scanner is shown in figure 1 being deployed by work class ROV on to the pipe weld. The scanner is attached to the pipe by magnets and moves around the pipe guided by wheels in contact with the pipe surface.

The ACFM® probe is sprung to maintain contact with the weld being inspected to minimise lift-off for optimum sensitivity and as the ACFM® inspection technique works through coatings, the epoxy surface preparation did not hinder the inspection.

The workscope was completed successfully and it was confirmed that there were no further fatigue cracks present. There were, however, corroded areas were identified on the inside surface of the pipe. Clamps were fitted to seal the leaking sections to improve productivity of the well. Further IRM activities are now being scheduled.



### U31™ Features

- Reliable crack detection, full data storage.
- Accurate sizing (length and depth).
- Reduced cleaning requirements.
- Designed to operate in depths up to 2000m.
- Detection in duplex or non-magnetic materials.

### Approvals

The ACFM® technique has received approvals from various organisations including DNV, Bureau Veritas, Lloyds Register and ABS. Standard practice documents covering ACFM® have been issued by ASTM (E2261-03), ASME V and COFREND; and training schemes are available under CSWIP, PCN and ASNT.

### Advantages of ACFM®

Feature	ACFM®	MPI	Conventional Eddy Current
Reduced dependence on operator competence. <ul style="list-style-type: none"> <li>• Detection reliability and repeatability</li> <li>• Confidence in integrity data</li> </ul>	✓	✗	✗
Detection through coatings. <ul style="list-style-type: none"> <li>• Avoids cost and disruption of coating removal</li> </ul>	✓	✗	✓
Detection in normal ambient light. No pollutants used.	✓	✗	✓
Detection in non-magnetic materials.	✓	✗	✓
Can be remotely deployed. <ul style="list-style-type: none"> <li>• Enables hazardous zone deployment</li> </ul>	✓	✗	✗
Provides accurate and auditable inspection records. <ul style="list-style-type: none"> <li>• Enables effective integrity and risk management</li> <li>• Supports regulator verification and audits</li> </ul>	✓	✗	✗
Determines crack length and depth without calibration. <ul style="list-style-type: none"> <li>• Allows crack criticality assessment</li> </ul>	✓	✗	✗
High POD and low false call rate. <ul style="list-style-type: none"> <li>• Avoids cost of unnecessary repairs and rework</li> </ul>	✓	✗	✗

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