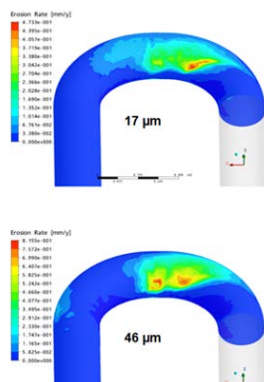


Subsea Ultrasonic erosion monitoring solution

FORCE Guide Bend- scanner



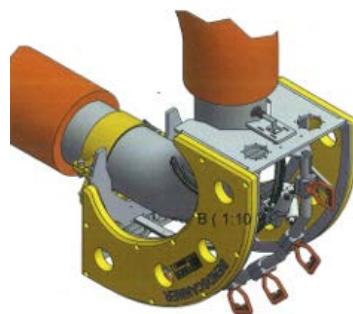
Description of the Inspection Tool

Erosion simulations is a highly theoretical exercise and provides only indication of area and severity of predicted erosion impact

The Guided Bend Scanner inspection tool is developed by Force Technology to replace the need for installation of unreliable erosion monitoring equipment. The solution with preinstalled guide posts ensures that comparisons is made on the exact same location every time and captures a larger area μm for data collection.

Key features

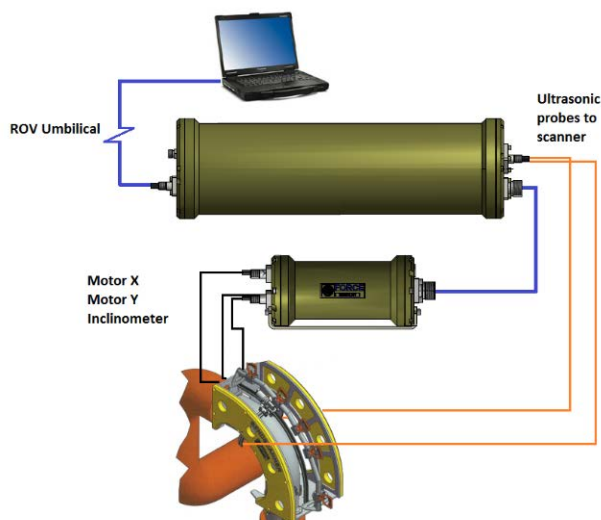
- Accurate measurements performed on exact same location provides reliable monitoring solutions and the ability to determine and predict erosion rate
- Data collection performed on larger area, not on theoretically predicted local erosion spots
- Installing scanner on preinstalled guide pins reduces valuable vessel operation time
- Same tool and setup is used for baseline measurements
- FAT/SIT of inspection tooling is performed on actual subsea hardware
- The solution can be applied to any bend size and radius



Force pipe scan inspection setup

The tool is handled by ROV, and the setup is as illustrated

- Laptop, subsea computer, motor controller and accurate motors, ultrasonic transducers and cables
- The system is controlled topside by a laptop
- Guide posts and possibility of suction pump, hydraulic clamps or magnets



Method

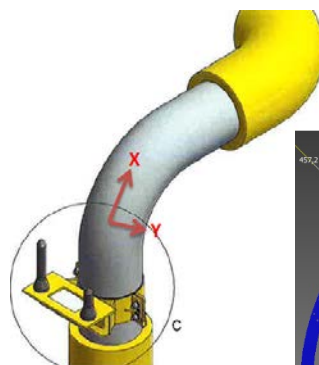
Ultrasonic immersion technique

For accurate measurements, FORCE utilize ultrasonic immersion technique. The technique is good for thickness measuring and corrosion mapping, where the requirements to the distance between probe and surface are not strict. The uniform coupling between transducer and surfaces allows for rapid scan speed, and the transducer is placed in a holder that moves in contact with the surface keeping the propagating soundwave perfectly perpendicular to the material, ensuring good ultrasonic signals.

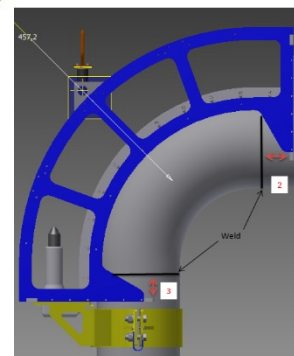
Setup for F-Bend Subsea Inspection System using Guide posts

Guide posts

The erosion monitoring solution using preinstalled guide posts is developed for monitoring thickness variations in bends. To ensure that offshore follow-up measurements of bends is on the exact same location as the baseline inspection, guide posts are installed. The use of preinstalled guides eases future operations, and any consideration necessary to ensure access can be taken in early stages of design of the template.



Bend with installed guide post



Bend Scanner installed on guide post

Surface requirements

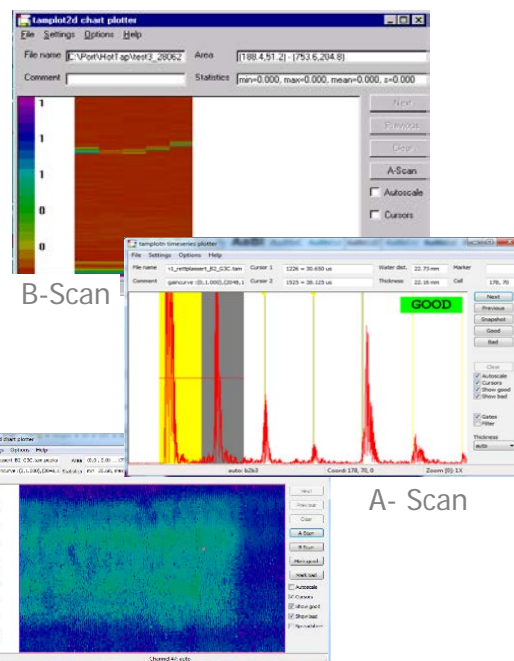
To ensure good quality scans the pipe surface must be free from marine growth and other remains that will prevent the ultrasound from reaching the steel wall.

Ultra software

The designed software is a generic FORCE X-Y software, enabling motor control of axial and radial movement for the scanner, calibration of ultrasonic time base, a multitude control, raw data acquisition and raw data analyse, excel/csv dump of triggered thickness values etc

Scanning and data analysis

When scanning a B-scan is made. Each cell in the B-scan can be altered to check the A-scan for that particular measurement.



C-scan for analysis

Data presentation

- The corrosion data/thickness measurements are presented as a C-scan
- Each pixel in the C-scan represents a csv-value for excel dump to our clients

Technical Specifications

- Operational depth: 2000m
- F-pipe Scanner: 55kg
- Weight dacos: 20kg
- Weight motor controller: 7.5kg
- Power req.: 110VAC,
- Communication: Ethernet/RS232/RS485
- Hydraulics: Min. 20 bar
- Channels: 2 Ultrasound channels
- Cable length: 5-10 m (scanner-dacos/controller)
- Mapex pump: 20kg

Ultra-hardware

- Gain: -10 - 40dB in 1dB steps
 - Pulse width: 0.02 - 2µs
 - PRF: 0.1 – 50Hz
 - Bandwidth: 0.5 – 25MHz at 2 dB
 - Pulse voltage: 10V – 250V pulse out
 - Max sample freq.: 80MHz
 - Max samples: 10 – 4096
- Samples/windows

Transducers

- Probe type: HQSonic Immersion, Longwave, 0°L4-300Bar
- Frequency: 4MHz (3.82MHz center frequency)
- Element size: Ø9.5mm(Composite)
- Housing: 30.4x19.8x19.3mm
- Connector: O'Brien