DATA SHEET

VERTICAL CAN PUMP CASING INSPECTION

SONOMATIC

THE PURPOSE

This document is composed to assist our clients and the supply chain with a high-level understanding of the benefits and services associated with Vertical Can Pump Casing Inspection.

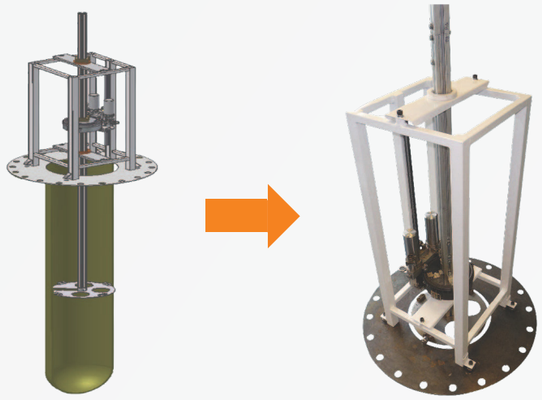
VERTICAL CAN PUMP CASING INSPECTION

Vertical can pumps are commonly used to pump hydrocarbon liquids and with onshore facilities, the pump casing is often installed below ground level.

External coatings are typically applied before installation but they can break down through long-term use and the casing exterior is then potentially exposed to ground water. External corrosion has been observed on a number of pumps and should be considered as a potential threat to integrity. Internal corrosion should, depending on the fluids being pumped, also be considered as a potential degradation mechanism. Pump casings can fail by corrosion leading to release of hydrocarbons with severe safety, environmental and business consequences. Assurance of integrity of pump casings relies on inspection with techniques that provide a high probability of detection for both internal and external wall loss associated with corrosion.

Access to the exterior of the casing for inspection is not possible with below ground installations and the height of typical casings, together with limited accessibility, means that automated systems are necessary. Sonomatic has developed and proven an automated ultrasonic inspection approach specifically for Vertical Can Pump Casings. This uses purpose-built scanners, with Sonomatic's established Nautilus automated inspection system providing the drive control for accurate deployment of the ultrasonic data collection, presentation and analysis.

FIGURE 1 - SCANNER DEPLOYMENT SCHEMATIC.

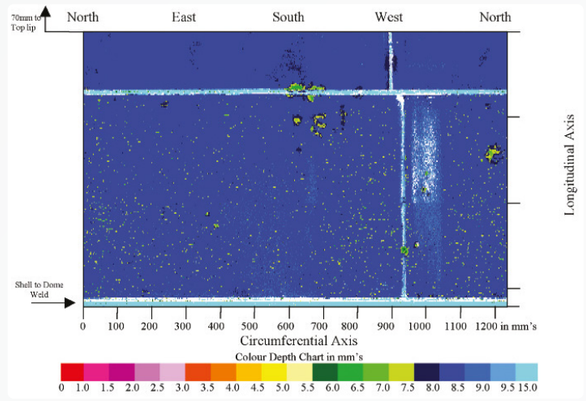


The inspection involves lifting and removing the pump drive motor and discharge barrel to expose the interior of the casing. The casing is then filled with water before the scanner is attached to the pump motor mounting flange, as shown in Firgure 1.

The ultrasonic inspection then takes place with the probes immersed in water, using transducers designed for subsea deployment. The inspection employs two techniques:

- 0 degree ultrasonic corrosion mapping for areas of pipe/plate.
- Time of Flight Diffraction (TOFD) for welds.

FIGURE 2 - STANDARD RESOLUTION CORROSION MAP OVER PUMP CASING.



Corrosion mapping is carried out initially on a fine increment, typically 1mm in the circumferential direction and 4mm in the longitudinal (vertical) direction. The data is provided in the form of a colour-graphic corrosion map which allows evidence of wall loss to be readily identified. Areas of localised wall loss can be investigated further at an even smaller scan increment - a 1mm by 1mm increment would typically be used for additional investigation to quantify areas of degradation. Figure 2 shows a corrosion map (at standard resolution) collected from a pump casing with localised external corrosion. Figure 3 shows a high resolution scan over areas of pitting.

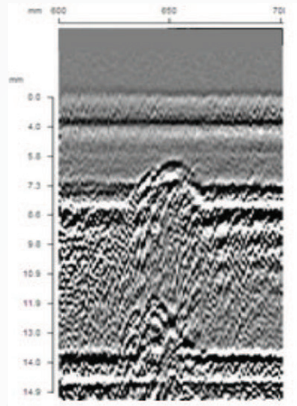
FIGURE 3 - ADDITIONAL CORROSION MAP COLLECTED AT HIGH RESOLUTION OVER AN AREA OF PITTING.

Time of Flight Difraction is used to inspect the welds. This is a twin probe technique allowing the minimum thickness in the weld to be determined accurately. The ultrasonic data is collected at 1mm intervals along the length of each weld to provide an accurate definition of the wall thickness profile. Typical TOFD data over a pump casing weld with external corrosion is shown in Figure 4.

The inspection approach developed allows 100% coverage of the pump casing cylinder, from the end cap weld to the mounting flange weld, and also allows 100% inspection of the welds by TOFD. The inspection system is suitable for a wide range of pump casing sizes, the only restriction being that the diameter should be >4ins.

Where degradation is found, Sonomatic can assist with a fitness for service and life assessment based on detailed analysis of the data collected. Sonomatic can also recommend approaches to monitoring future corrosion and provide advice on corrosion management.

FIGURE 4 - TOFD DATA OVER EXTERNAL CORROSION



QA AND HS&E

Sonomatic operate under an integrated QHSE management system and are committed to the highest quality and safety of service provision | ISO 9001: 2015: 00007140 | ISO 14001:2015:00037371 | ISO 45001:2018:00037372 | ISO 17020: 2012: 4276 | Achilles FPAL Verified: 076712 | SEQual 1988 | British Safety Council Member: S0388440 |

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