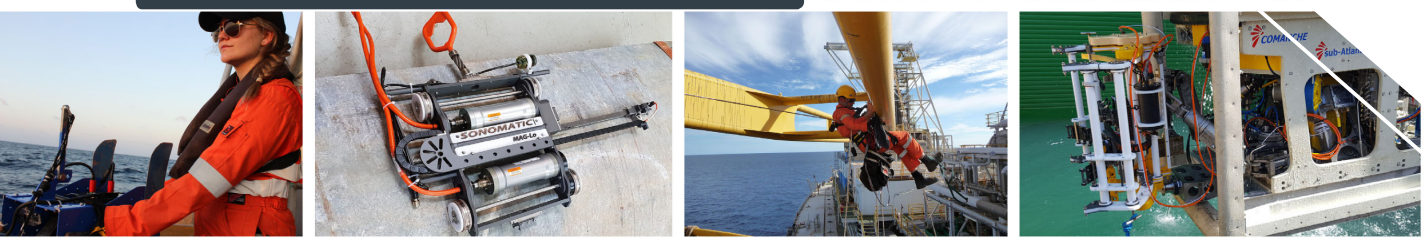
DATA SHEET

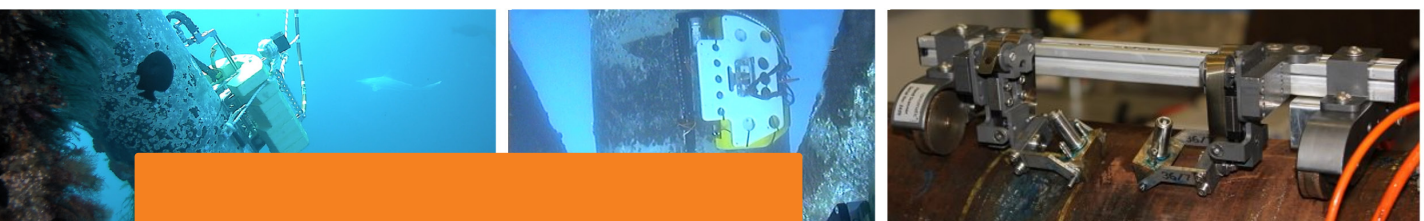
TIME OF FLIGHT DIFFRACTION INSPECTION FOR WELD FLAW DETECTION AND SIZING

SONOMATIC

THE PURPOSE

This document is composed to assist our clients and the supply chain with a high-level understanding of the benefits, services and specialist packages associated with Time of Flight Diffraction Inspection for the weld detection and sizing of fabrication flaws and in-service degradation.

TOFD INSPECTION FOR WELD FLAW DETECTION & SIZING

The Time-of-Flight Diffraction technique (TOFD) was initially developed as a method of accurately sizing and monitoring the through-wall height of service-induced flaws in the nuclear industry. TOFD has now been independently validated as the most versatile and effective technique for the location and sizing of flaws in ferritic welds. TOFD relies on both reflected and diffracted energy initiating from the flaw itself, or its extremities for location. This means that the technique can detect and size flaws irrespective of their type or tilt orientation. Both axial and transverse planar flaws can also be detected and sized.

When the TOFD technique is applied to welds, the transmitting and receiving probes are typically located equidistant from the weld centre and are scanned parallel with the weld. A single pass can often be sufficient to attain the required inspection coverage.

A pair of ultrasonic transducers are positioned on either side of the weld (Figure 1). One acting as an emitter of ultrasound, the other as a receiver. When the transducers are moved in a direction parallel or perpendicular to the weld centre line, any anomalies within the weld will cause reflected and /or diffracted signals to be generated. The resultant ultrasonic wave forms are digitised, stored and processed to generate an on line cross-sectional image of the weld for immediate interpretation and analysis (Figure 2). The image built up is, in effect, a through sectional view of the weld examined, and can be used for accurate sizing and future monitoring of indications.

FIGURE 1 - TOFD PRINCIPLE

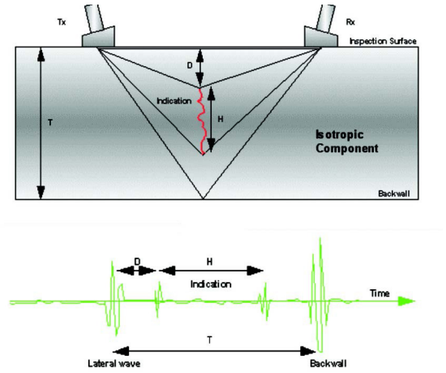
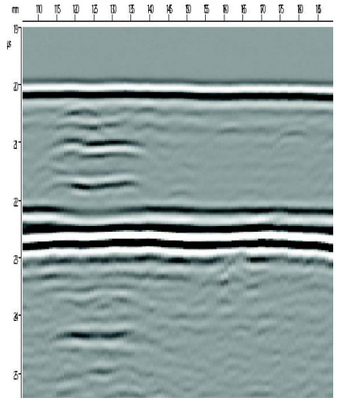


FIGURE 2- SCAN TO GREY-LEVEL PLOT



Lateral (surface)

Upper flaw tip
Lower flaw tip

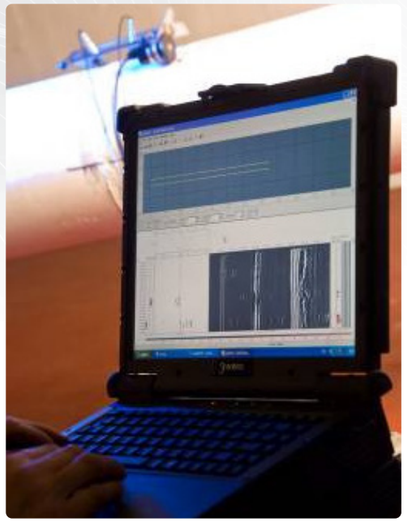
Backwall
(far surface)

The data is collected using a simple, single axis scanning frame with an encased optical encoder for positional feedback. The data can be replayed and subsequently analysed with specialist software routines on the Sonomatic Microplus ultrasonic imaging system.

CREDENTIALS

- Sonomatic Specialist Field Services division were the pioneers of TOFD for industrial applications dating back to the late 1970's, and remain at the forefront of this technology.
- The Sonomatic Microplus was developed specifically for TOFD applications. Dedicated software packages, pulser and amplifier characteristics are optimised to deliver the best performance.
- TOFD inspections are overseen by Snomatic Specialist Field Services' Technical Support Group, a panel of highly experienced Level 3's and Chartered Engineers to ensure optimal performance.

- TOFD is one of the most accurate methods available for measuring the growth of flaws between successive inspections.
- TOFD has a high probability of detection, especially when combined with complementary techniques.
- Data can be collected in B- or D-scan image format, improving the detection of flaws in the presence of signals from geometric features.
- Most welds can be rapidly screened by TOFD and demonstrated whether they are free of significant flaws. Correctly used, TOFD is a powerful technique, not only for accurate sizing of fabrication flaws, but also for detection in routine inspections.
- Various independent trials have demonstrated that the technique combines a high probability of detection with a low false call rate.
- The simplicity of its scanning concept enables TOFD to be applied quickly and efficiently on many different components.



ADVANTAGES

- TOFD has a through-wall sizing accuracy of ±0.3 mm and a crack or corrosion growth monitoring capability of ±0.1 mm under controlled conditions.
- Efficient detection of defects of all tilt orientations in addition to both axial and transverse flaws.
- Highly reproducible results between pre- and post-heat treatment and pre- and in- service inspections.
- Finely-tuned set-ups are effective for the detection and sizing of subtle features that can be challenging for other techniques. Examples include detection of the tips of inter-granular cracks, interfaces between changes in metallurgical conditions, and sizing of flaws with complex morphology.
- TOFD is fast. Often a single pass is all that is required for detection in the area of interest that includes weld volume, Heat Affected Zone, and adjacent parent material.
- Permanent digital record of the ultrasonic waveforms with images of the weld quality.

QA AND HS&E

Sonomatic operate under an integrated QHSE management system and are committed to the highest quality and safety of service provision | ISO9001: 2015: 00007140 | ISO17020: 2012: 4276 | Achilles FPAL Verified: 076712 | British Safety Council Member: S0388440

CONTACTS

EUROPE AND AFRICA

Graham Marshall
Subsea Project Manager
T: +44 (0) 1224 823 960
E: Graham.Marshall@sonomatic.com

Stuart Ley
Topside Project Manager
T: +44 (0) 1224 823 960
E: Stuart.Ley@sonomatic.com

Donna Stewart
Integrity Operations Coordinator
T: +44 (0) 1224 823 960
E: Donna.Stewart@sonomatic.com

Danielle Gunns
Project Delivery Manager (Warrington)
T: +44 (0) 1925 414 000
E: Danielle.Gunns@sonomatic.com

John Lilley
Senior Technical Consultant
T: +44 (0) 1925 414 000
E: John.Lilley@sonomatic.com

AUSTRALASIA

Jonathan Millen
Australia West Coast Project Manager
T: +61 415 850 346
E: Jon.Millen@sonomatic.com

Judd McCann
Australia East Coast Project Manager
T: +61 488 442 019
E: Judd.McCann@sonomatic.com

Zach McCann
South East Asia Regional Manager
T: +61 404 797 670
E: Zach.McCann@sonomatic.com

Alex Cesan
Australia & South East Asia General Manager
T: +61 498 442 666
E: Alex.Cesan@sonomatic.com

AMERICAS

Esteban Cesan
General Manager Americas
T: +1 832 977 0303
E: Esteban.Cesan@sonomatic.com

MIDDLE EAST

Gordon Reid
Regional Manager
T: +971 26 580 708
E: Gordon.Reid@sonomatic.com

SONOMATIC
www.sonomatic.com

CWL GROUP
www.cwl.group