

Time of Flight Diffraction Inspection for Weld Flaw Detection and Sizing



Initially the Time-of-Flight Diffraction technique (TOFD) was developed as a method of accurately sizing and monitoring the through-wall height of in-service flaws in the nuclear industry. TOFD has now been independently validated as the most effective technique for the location and sizing of flaws in ferritic welds. TOFD does not rely on the reflectivity of the flaw but uses the diffracted sound initiating from the flaw tips for location. This means that the technique can detect flaws irrespective of their type or orientation.

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

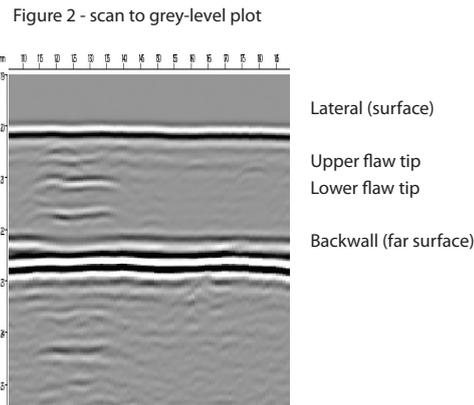
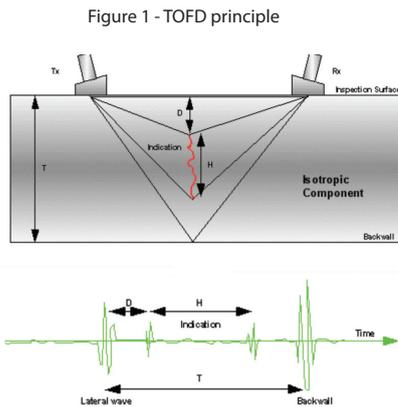
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Sonomatic has offices in strategic global locations so we can respond quickly to customers' requirements wherever they may be situated. Our high quality products are matched only by our customer service. In addition to our field services, we offer training and consultancy at our sites in the UK or at clients' premises anywhere in the world.

Sonomatic is committed to improving asset performance through applied and innovative technology; to delivering these benefits to our customers in the products and services that we provide; and to working with our customers, as value-added partners, to realise the maximum benefits of inspection technology.

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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 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.



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

Benefits

- Compliant to ASME Code Case 2235.
- Detection is independent of type and orientation of flaws.
- Reproducibility and accuracy is proven <0.5 mm.
- Consistent results between pre- and post-heat treatment and pre- and in-service inspections.
- Permanent records with graphic images.
- TOFD is the most accurate technique for sizing defects, especially for internal defects.
- TOFD is one of the most accurate methods available for measuring the growth of flaws.
- TOFD has a high probability of detection.
- Data is collected in B- or D-scan format, improving the detection of flaws in the presence of signals from geometric features
- Most welds can be rapidly screened by TOFD and demonstrated that they are free of significant flaws.

- Correctly used TOFD is a powerful technique, not only for accurate depth sizing of defects but also for detection in routine inspections.
- Various evaluation projects 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 on many different components, including complex geometry.

Advantages

- TOFD has a through-wall sizing accuracy of ± 1 mm and a crack growth monitoring capability of ± 0.3 mm
- Efficient detection of defects of all orientations
- Permanent digital record of the inspection data with images of the weld quality.



QA and HS&E

It is Sonomatic's ongoing commitment to supply services and products, through the application of technical and engineering excellence, which complement both the customer's and our own QA and HS&E requirements.

Sonomatic's commitment to quality is maintained through continuous assessment and review of our Quality Management Systems to BS EN ISO 9001:2008. Sonomatic actively promotes the development, implementation and improvement of our QMS as a part of our ongoing drive to enhance customer satisfaction by meeting or exceeding customer requirements. In 2009 Sonomatic achieved UKAS accreditation as an Inspection Body to BS EN ISO/IEC 17020 (UKAS IB4276).