

TIME OF FLIGHT DIFFRACTION (TOFD)

RELIABLE WELDING INSPECTIONS WITH HIGH DETECTION RATE

The ability to accurately size and monitor pre-existing or growing in-service discontinuities becomes more and more important in chemical and refining plants especially when a risk based inspection (RBI) approach is used. With the industry's growing need for more reliable, simpler, accurate and cost effective techniques, Time of Flight

Diffraction (TOFD), which was originally developed for crack-sizing in nuclear applications, established itself as a widely used tool for flaws detection in welds.

This unique ultrasonic technique has big advantages in speed, detection of defects and is the most accurate defect sizing technique in general use.

One of the important advantages of using TOFD for weld inspection is the absence of radiation.

Furthermore, in several validation projects TOFD has proved itself to be a technique, which combines a high detection rate with a very high reliability in pre-service and in-service inspections.

IS RELIABILITY IMPORTANT FOR YOU?

ADVANCED INSPECTION TECHNIQUE

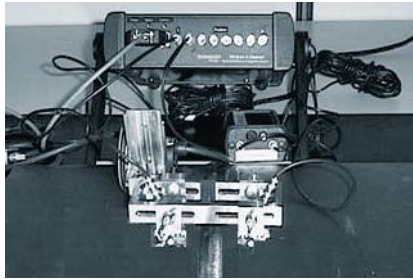
Time of Flight Diffraction (ToFD) does not rely on the reflectivity of the flaw but uses the diffracted sound initiating from the flaw tips. This means it can detect flaws irrespective of their type or orientation.

In a TOFD system, a pair of probes sits on opposite sides of a weld. One of the probes emits an ultrasonic pulse that is picked up by the probe on the other side. In undamaged pipe, the signals picked up by the receiver probe are from two waves: one that travels along the surface and one that reflects off the far wall. When a crack is present, there is a diffraction of the ultrasonic wave from the tip(s) of the crack. Using the measured time of flight of the pulse, the depth of a crack tip can be calculated automatically by simple trigonometry.



This principle has several advantages compared to the pulse-echo technique and/or radiography, such as

- Detection of gas, lack of fusion and binding defects, slag inclusions and cracks independent of defect orientation
- Very accurate sizing of defects ($\pm 0.5 - 1.0$ mm)
- Nearly independent of fluctuation in surface conditions



- Digital data storage (evaluation afterwards/high reproducibility)
- High inspection rates achievable
- No interruptions or delays in other operations because of lack of radiation
- Inspection rate is nearly independent of the wall thickness of the object under examination

As a "stand alone" inspection TOFD has the highest reliability with respect to defect detection and excluding false-calls. Besides, TOFD has turned out to be the most accurate and effective NDT technique in determining defect height.

The TOFD technique is a fully computerized system able to scan, store, and evaluate indications in terms of height, length, and position with a grade of accuracy never achieved by other ultrasonic techniques. The TOFD inspection system can be operated on a 12 Volts battery as well as on 110 to 240 Volts AC and is very compact, making it suitable for inspections at almost every location.

APPLICATION

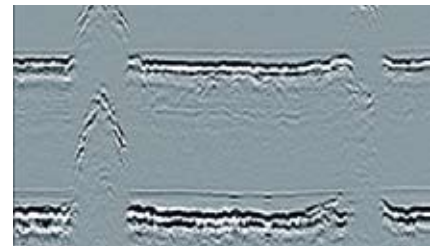
Two primary groups of applications can be distinguished

- Pre-service inspections
 - Weld inspection of vessels, pipelines and plates
- In-service inspections
 - Weld inspection of vessels, pipelines and plates

- Detection of corrosion underneath reinforcement rings of nozzles
- Cladding thickness measurement
- Determining depth of cracks

THE SGS EXPERTS

SGS Industrial Services has the knowledge, expertise and experience to perform conventional and advanced NDT inspections around the world using our unique network. Our service offer varies from Guided Wave and the conventional NDT techniques to Risk Based Inspection (RBI/AIM), Time of Flight Diffraction (TOFD), Corroscan, Positive Material Identification (PMI), Magnetic Flux Leakage (MFL), ACFM, Leak Testing, Thermography, Electromagnetic Testing (ET), (ET), RFEC, IRIS, Digital Radiography, Radiation detection RVI and Endoscopy inspections.



We are pleased to inform you anywhere around the world about how SGS can help you in improving the reliability of your processes and assets.

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