Welded T-Joint Inspection Using The WAVE

Introduction

A T-joint consists of two plates welded at 90° to each other in the form of a 'T'. Commonly used in the structural industry, T- joints generally use fillet or groove type welds on each side of the vertical plate, these welds can be ‘part’ or ‘full’ penetration welds, each presenting their own challenges.

Due to the complex geometry of the part, in an A-Scan only view, signals can be difficult to interpret. small inaccuracies in probe positioning or the angle of reflection may place a signal as a defect in the weld when in fact it is it is a reflection from the internal wall. situations like this can lead to false calls and unnecessary repairs.

By utilizing the WAVE's unique scan plan and live ray tracing ability, the inspector is able to see exactly where a signal is positioned and give the inspector greater confidence in their result. the ability to screenshot the scan plan also enables more detailed reporting, giving clear and precise images of where any defect indication is positioned within the weld area.

This unique feature makes Wave an ideal instrument for T-joint inspection

Typical Defects in T-joints

The most common defects in T-joint welds are cracks, lack of fusion and lamellar tearing all of which can be inspected with conventional ultrasonic methods.

Lack of fusion or Penetration

A lack of fusion occurs when the base metal is not melted during welding, resulting in a lack of cohesion. For T-joints, in a “part penetration” weld there is an area of intentional lack of fusion between the two plates, in “full penetration” welds this area should be fused. This area is inspected to detect and lack of fusion in full penetration welds and measure the size of the unfused area in part penetration welds. The optimal way to detect such defects is utilising a straight beam configuration on the lower flange of the joint. However, this may not always be accessible.

Industries

- Chemical & Petrochemical Sector
- Oil & Gas Sector
- Nuclear Energy Sector
- Wind Power Renewables Sector
- Transport Network Infrastructure
- Maritime Shipping Industries
- Mining Sector
- Construction and Infrastructure
- NDT Service Providers

Application

- Weld Inspection
- Storage Vessel Inspection
- Asset Integrity
- Flaw Detection and Evaluation

Typical Parts

- Bridge deck joints
- 90° Nozzle joints
- Welded I beams
- Structural welds

Inspection Techniques

- Manual UT

Features and Benefits

- Straightforward parametrisation of the weld and T-joint
- Optimal visualisation of the sound path in the weld, caps and parent material.
- Mitigation of false calls
- Enhanced flaw localisation with interactive scan plan.
- Advanced reporting with accurate representation of the weld and sound path.

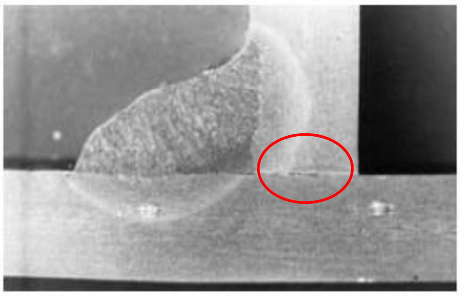


Figure 1 – showing the WAVE scan plan for detection of the unfused land in a T-Joint as highlighted in the right image

Lamellar Tearing

Lamellar tearing occurs when there is a weld contraction combined with low ductility of the base metal. This generates a very high stress concentration, located in the base metal, outside or close of the heat affected zone (HAZ). The tearing is generally parallel to the weld fusion surface.

Unfortunately, T-joints as well as corner joints are susceptible to this type of defect due to high through thickness strain.

Lamellar tearing can be easily detected by an inspection from the lateral web of the joint because of its predictable orientation.(see figure 2)

Figure 2 – Images showing the WAVE detection of lamellar tearing on the left and a diagram showing the location of lamellar tearing in a T-Joint on the right

Cracking

A crack is a combination of metallurgical and mechanical failures. It usually occurs due to pre-existing stresses, generally caused by thermal expansion, solidification, shrinkage or both. For example, aluminium alloys have a high thermal expansion coefficient and solidification shrinkage.

On a T-Joint with fillet welds on both sides, the second side is more restrained mechanically. Hence, this side will be more susceptible to cracks, (as seen figure 3)

It is difficult to correctly predict the orientation of cracks, as they can be detected from many inspection angles based on the sample geometrical aspects.

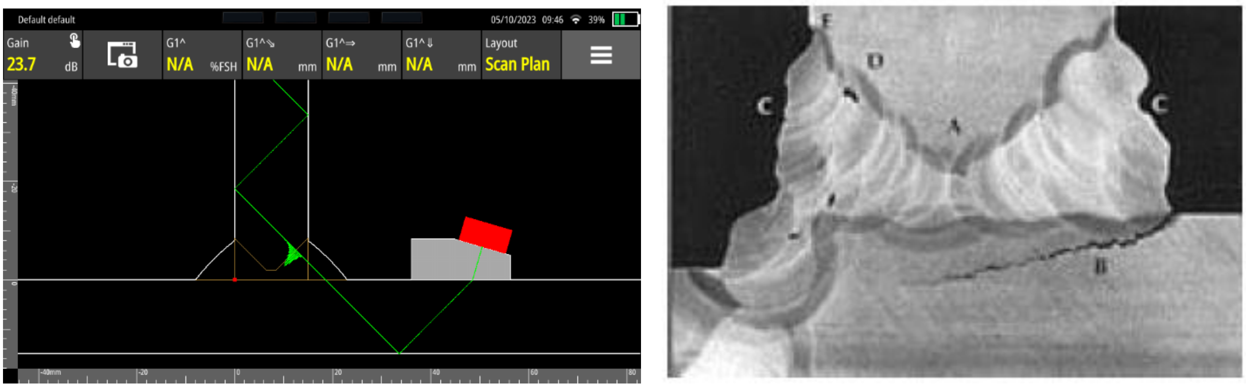


Figure 3 - showing toe crack detection on the WAVE and an example of toe cracking of a T-Joint,

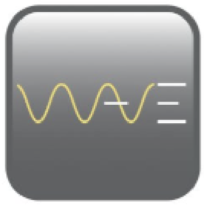
CODES & STANDARDS

Welded structures have to meet applicable codes and standards related to their intended use. The welding process, inspection technique and acceptance criteria vary.

For structural welding inspection to the American Welding Standard (AWS), the most important measurements are the indication level, reference level, attenuation factor and the indication rating. The Sonatest Wave has a built-in single touch application for inspecting to AWS requirements. Hence, after an AWS calibration, the user is able to select the AWS measurements associated with the corresponding gate. In addition, the indication rating is automatically calculated, which improves the reporting efficiency.

For further information or support, please contact the Sonatest Applications Team: applications@sonatest.com

Recommended Tool Package

Category	Part #	Description
Acquisition Unit	WAVE digital flaw detector	
Probe	Shear and transvers wave transducers available for any material and thickness requirements.	
Calibration Block	Sonatest Companion Software	

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