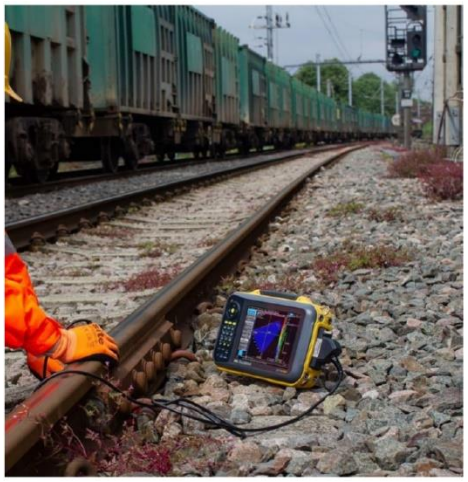
Introduction

Inspection of bolt holes in rail is a common task required by rail standards that detects cracking caused by expansion and vibration. Crack in bolt holes gradually expand and can cause a whole section of the rail to become separated from the whole, this has the potential to cause derailment and in turn loss of life. Because of this risk, bolt holes are monitored regularly for developing defects.

Historically the most commonly used method for this inspection is conventional ultrasound with shear wave angled transducers, the inspector must use a variety of angled transducers to cover the bolt hole fully, and a different offset position for each hole.



This application note highlights the use of phased array ultrasonics to reliably perform the bolt hole inspection in a repeatable and more time efficient manner. Phased array also offers additional ways to view the data allowing for quicker defect identification and more accurate sizing.

Figure 1 – Phased array inspection of bolt holes (PRISMA)

Industries

- Rail Sector
- Mining Sector
- Construction and Infrastructure

Application

- Casting / Forging Inspection
- Asset Integrity
- Rail and Axle inspection
- Flaw Detection and Evaluation

Typical Parts

- Steel Rail Tracks (Trains)
- Steel Rail Tracks (Crane)

Inspection Techniques

- Manual UT
- Phased Array C-Scan

Features and Benefits

- Fast and easy inspection inspections of rail components.
- More visual aids to inspection and defect detection.
- Data files are recorded and can be used to compare to future inspections for comparison.

Figure 2 shows a typical scan plan, detailing how the inspector uses ½ and full skip methods from both side of the bolt hole to achieve full coverage of the hole circumference.

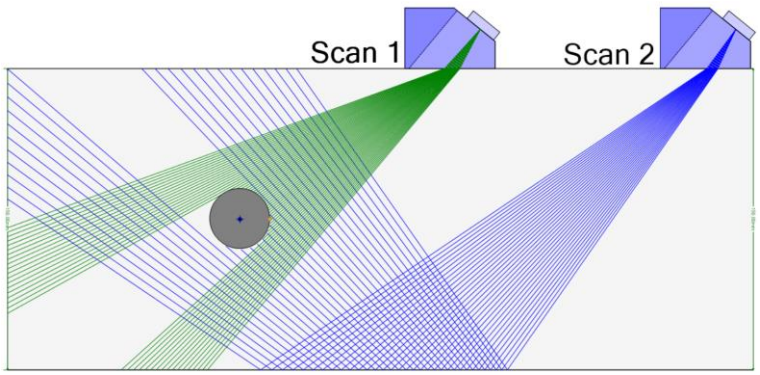


Figure 2 – Scan plan example of ½ skip (scan 1) and full skip (scan 2) methods for coverage of the bolt hole.

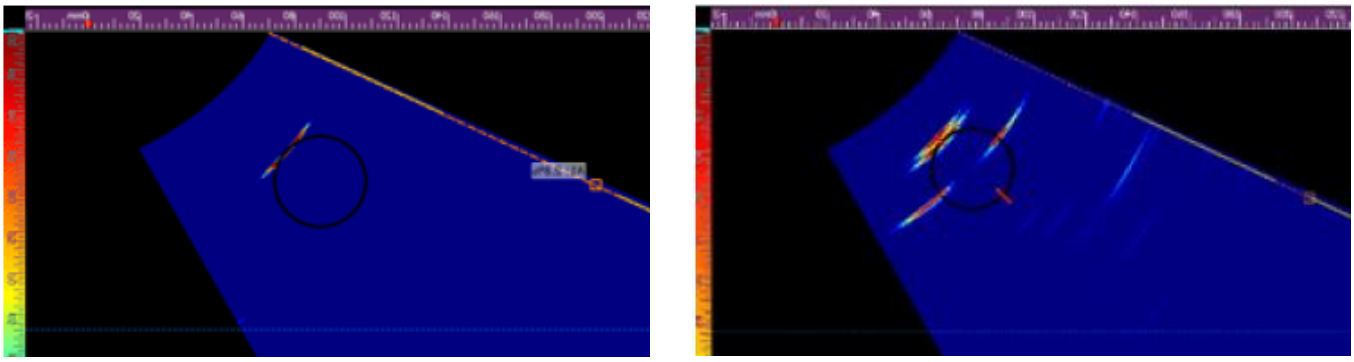


Figure 3 – ½ skip inspection, Left image shows a bolt hole with no defects, Right image shows a bolt hole with cracking on both sides

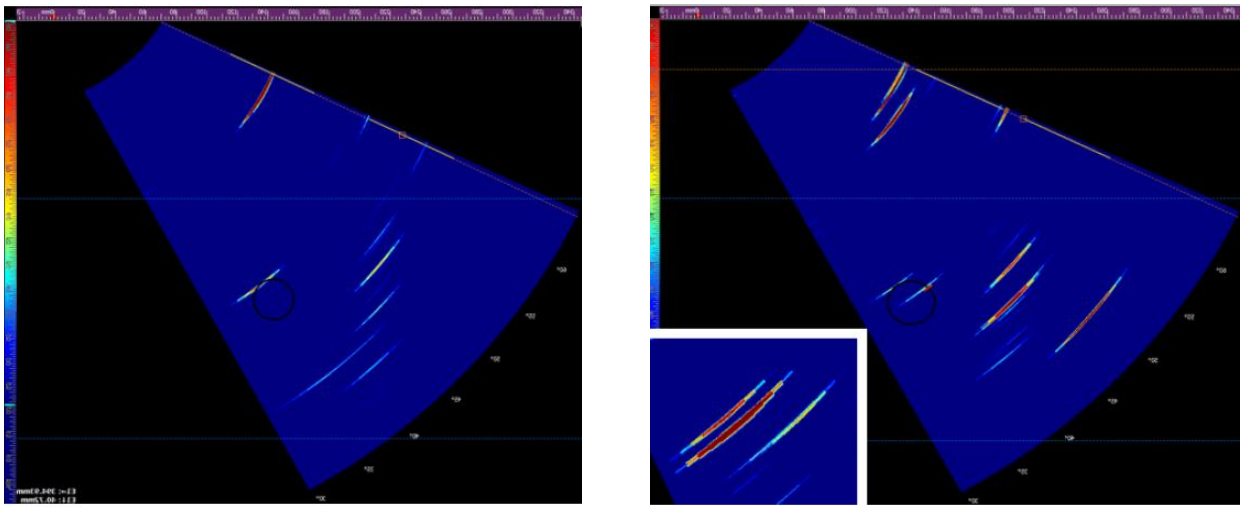


Figure 4 – full skip inspection, Left image shows a bolt hole with no defects, Right image shows a bolt hole with multiple cracks.

The four images above show the bolt hole with and without defects,

Fig 3 – Left image shows the response going direct onto the bolt hole, this produces one reflection from the hole. Figure 3 Right image shows the same direct scan, this time hitting 3 or 4 defects around the hole, it is possible to differentiate the top response as a defect rather than geometry because its two separate reflections close together.

Figures 4 shows the scan images of the bottom side of the bolt hole, this time skipping is needed as shown in Figure 2, when the sound is reflected up from the bottom of the track in order to get full coverage. Figure 4 Left image shows the response with no defect, whereas figure 4 Right image shows the hole with two defects, the zoomed in image shows the two reflections from the right had signal.

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

Recommended Tool Package

Category	Part #	Description
Acquisition Unit	VEO3 / PRISMA data Acquisition units	
Probe	X5A Range of deep penetration PA transducers and accompanied wedges	
Encoder	AXYS Encoder	

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