



INSPECTING IN-SERVICE ERW PIPELINES WITH TFM WITHOUT SLOWING DOWN

Electric Resistance Welding (ERW) has been used for decades to make reliable pipelines with clean bond lines. However, ERW is not a magical process, and it comes as no surprise to see that the axial seam is typically the most critical area on aging pipes. Inspection of in-service pipelines is often conducted using in-line inspection (ILI) tools, sophisticated devices also referred to as “smart pigs”.

In general, ILI tools are excellent for detecting defects and can often quantify the severity, but further assessment is typically required which means that miles and miles of pipelines need to be excavated and examined. Considering the effort involved, industry seeks a non-destructive testing (NDT) solution that reduces risk while minimizing downtime.

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THE CHALLENGE

Find a more efficient solution for the assessment of shallow cracking in long seam welds on the difficult curved surface of pipelines.

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THE SOLUTION

Advanced data acquisition and analysis software helps inspectors account for pipe radius and COD for the axial scan probe configuration used for scanning ERW seams.

3

THE BENEFITS

Single pass for full thickness range enables faster inspections and trusted data results resilient to misalignment thanks to Total Focusing Method.

The Challenge

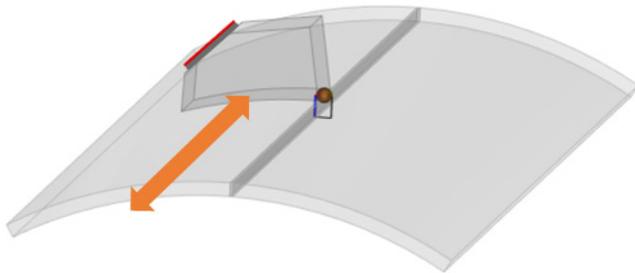
Integrity management requirements for pipelines – especially in high consequence areas – calls for a thorough examination of ERW seams. Given the critical nature of this infrastructure, understanding the structural integrity of pipelines including their damage mechanisms like evidence of cracking and welding defects is paramount. Indeed, minor hiccups happening during manufacturing of pipes can go undetected even in the presence of proper NDT. For example, minute non-metallic inclusions at the weld interface can morph into hook cracks once the pipeline is subjected to tensile hoop stress after being pressurized in service. And although hydrostatic testing is a method that has been used ex-

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tensively to perform validation of ERW pipelines, it requires taking the pipe offline, with obvious operational consequences. The challenge is therefore to find the most rapid and efficient ultrasonic NDT method to evaluate long lengths of seam welds, looking for shallow cracking. How can one obtain the best imaging possible with adequate defect positioning, while having to deal with small cracks and the pipe’s curved surface during axial scanning?

The Solution

Total Focusing Method (TFM) has been around for over a decade but the availability of portable units like the M2M Gekko® has made TFM a reality in the field. TFM is an ultrasonic technique which is used to synthetically focus data from an array transducer at every point of a region of interest. Compared to Phased Array UT (PAUT), it provides higher spatial resolution images that are easier to interpret thanks to a more intuitive representation of the geometry being inspected. Capture™, developed by Eddyfi Technologies, is the operating software of the M2M Mantis™ and Gekko portable flaw detectors. On top of UT, PAUT and Time-of-Flight-Diffraction (TOFD), these flaw detectors offer the most advanced TFM available, with the fastest scanning speed.



COD wedge configuration for axial scanning of ERW pipe welds

Thanks to Capture, technicians can easily account for the pipe radius and the circumferential outside diameter (COD) for the axial scan probe configuration used when scanning ERW seams. The combination of a high-resolution imaging method and advanced onboard software results in easy-to-interpret scans for not only defect detection, but also characterization. TFM imaging has been tested on ERW piping with both shear waves and longitudinal waves. Inspection procedures requiring only one pass for full volumetric inspection (ID to OD) have been implemented and successfully tested on reference samples.



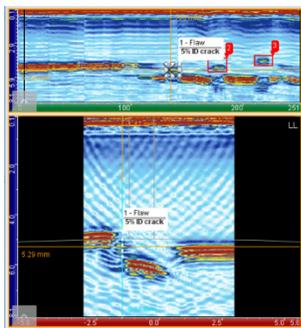
The Benefits

With TFM and hybrid methods implemented on Mantis and Gekko instruments, operators can optimize their ultrasonic testing settings for the best inspection results, even on shallow cracking to the order of 0.5 millimeters (0.020 inches). All the calibration assistants [wedge delay, Time Corrected Gain (TCG)...] are available for COD wedges further reducing configuration time and enhancing the precision one can achieve on small hook cracks, for example.

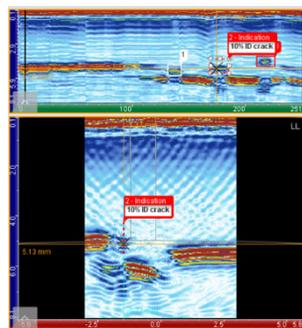
Ultimately, advanced equipment allows ERW seams to be scanned with TFM in a single pass for some configurations, with

full thickness coverage providing complete high-resolution data rapidly thanks to an impressive scanning speed in the range of 75 millimeters (3 inches) per second. It is also worth noting that both Gekko and Mantis are compatible with most commercially available scanners to provide 3D renderings of inspection data directly on the portable instruments.

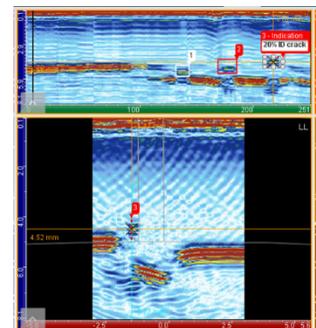
TFM has more tolerance to misalignment, delivering a sharp image and high-quality data. Finally, the obvious overall benefit is more reliable volumetric inspections.



5% OD Crack



10% OD Crack



20% OD Crack

Long-seam scan of ERW pipe weld using TFM

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