Safeguarding industries…

Pioneering inspection technologies for industrial sprinkler systems

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The reliability of industrial sprinkler systems is a paramount concern, as these systems stand as the first line of defense against devastating fires. Yet, beneath the surface of their apparent functionality lies a silent and persistent menace: corrosion. Generalised corrosion and microbiologically influenced corrosion (MIC) silently eat away at sprinkler pipes, rendering them vulnerable to catastrophic failure. Shockingly, over 70% of dry sprinkler systems require pipe replacement within just 12 years of installation, despite their intended lifespan of 30 to 50 years.

While some preventative measures like nitrogen-filled systems, galvanized steel, and biocides have been employed to deter corrosion growth, they fall short in preventing the insidious onset of corrosion itself.

The inspection challenge: inadequacies of current methods

The issue becomes even more concerning when we consider the limitations of current inspection protocols. According to BS EN 12485, periodic inspection of pipework and supports is mandatory. However, this inspection primarily relies on visible assessments, leaving inaccessible sections of pipework unchecked and potentially compromised. Even when visible, these inspections may miss subtle signs of corrosion, putting the entire system at risk. A weekly check for water line pressure is required but offers limited insights, mainly identifying pinhole leaks rather than addressing incipient corrosion within the sprinkler pipework.

Recognising the urgency of this situation, there is an evident market need for a practical and rapid solution to evaluate the corrosion status of particularly inaccessible and non-visible segments of sprinkler pipework, all before catastrophic through-wall defects materialize.

Enter two non-destructive testing (NDT) methods developed by Eddyfi Technologies, poised to revolutionise the inspection of such pipework.

Guided wave testing: precision meets efficiency

The first method harnesses guided wave ultrasonic testing with the innovative Sonyks instrument, enabling a comprehensive inspection of each pipe section without the need for constant probe movement. Unlike conventional ultrasonic testing, which operates in the MHz frequency range and primarily focuses on remaining wall thickness checks, guided wave testing (GWT) harnesses low-frequency ultrasound in the range of 20-150kHz. This distinctive frequency range allows GWT to cast ultrasound waves away from the tool and propagate them axially along the pipe.

When these broadcasted ultrasound waves encounter variations in cross-section, the resulting change in acoustic impedance triggers echoes that return to the tool for precise detection. By utilising reference points like welds or pipe ends for calibration and comparing signal amplitudes to these markers, GWT can not only detect corrosion but also gauge its severity.

Traditionally, guided wave testing has primarily been employed for long-range ultrasonic testing (LRUT) in the energy industry. However, the real breakthrough lies in the application of guided waves for medium-range ultrasonic testing (MRUT) within the context of sprinkler systems. MRUT employs higher frequencies, exceeding 100kHz, resulting in shorter pulse lengths for the transmitted ultrasound. This leads to improved resolution, enhanced sensitivity, superior detectability, and precise defect positioning.

In essence, guided wave testing emerges as a transformative force in ensuring the reliability and safety of sprinkler systems, offering a potent blend of precision and efficiency previously unattainable with conventional inspection techniques.

Eddyfi Technologies' Sonyks: a game changer

In the realm of industrial technology, certain breakthroughs hold the promise of redefining the way we approach critical tasks. Among these, Eddyfi Technologies' Sonyks guided wave system has quietly emerged as a standout player, ushering in a new era in medium-range ultrasonic testing, particularly for the inspection of sprinkler systems.

Figure 1: The Sonyks Magneto-Tool for 4-inch diameter pipes at a 128kHz test frequency. This tool, characterised by its lightweight and low-profile design, can be swiftly installed using a standard torque wrench, simplifying the inspection process dramatically.

Central to this innovation are the magnetostrictive collars, unassuming in appearance but formidable in function. These collars incorporate a magnetic strip and an electromagnetic acoustic transducer (EMAT) coil, housed securely within a simple clamp. What makes them remarkable is their ability to induce ultrasound into pipes through a torque-driven mechanical coupling, all without fuss or complexity.

Eddyfi Technologies' Sonyks system is not merely a technological advancement; it represents a shift in how we approach MRUT.

By streamlining the detection of corrosion, it offers a pragmatic solution that contributes to enhanced safety and reliability in industrial fire suppression systems.

Innovations in inspection

A calibration pipe provided by an Eddyfi Technologies client for NDT inspection equipment pretesting featured the following specifications:
Diameter: 4.5 inches (114 millimeters)
Wall thickness: Schedule 80, measuring 0.337 inches (8.56 millimeters)
Length: 6 feet (1.83 meters)

Eight 1/16-inch (1.5 millimeters) diameter drilled holes, positioned at 45° angles with 3-inch (76 millimeters) spacing along the pipe.

A section of the pipe exhibited gradual thickness reduction, with a maximum thinning of 1/16 inch (1.5 millimeters) occurring over a 3-inch (76 millimeters) length.

For a visual representation of the calibration pipe, please refer to Figure 2, which includes both a schematic and a photograph for reference.

A close-up of the defects that were included in the pipe shows the diameter of the holes and the thinned area in Figure 3.

The MRUT 4-inch Magneto-tool, integrated with Sonyks software, played a pivotal role in conducting this inspection. Due to the relatively short length of the sample, the tool was strategically positioned at the

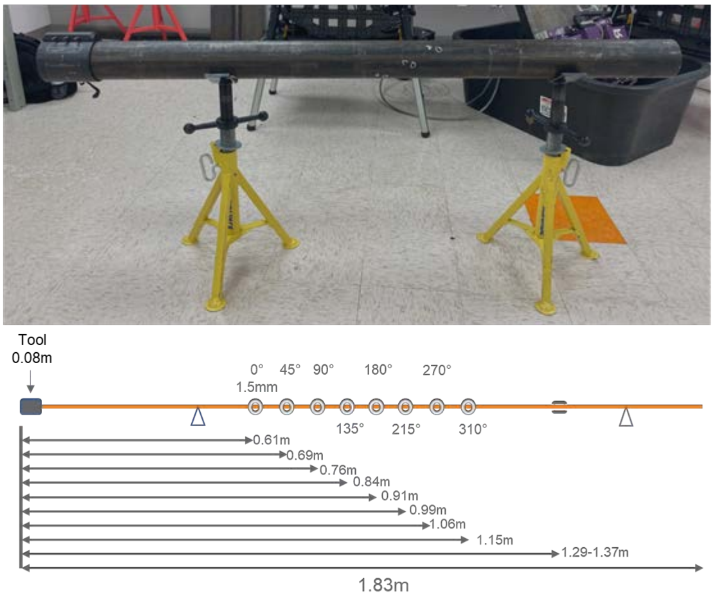

Figure 2: Diagram and schematic of the 4.5-inch (114mm) test pipe.

Figure 3: Close-up photographs of the drilled holes and the thinned areas requiring detection.

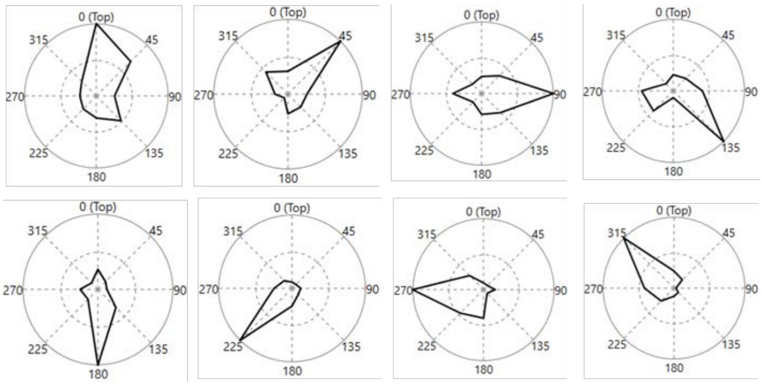

Figure 5: This figure displays the results of focusing efforts, showcasing the rotation of the defects along the entire circumference, ranging from 0° to 315°.

far end of the pipe. This positioning ensured that the pipe end would fall within the data's "dead zone," simplifying the interpretation process. In typical field scenarios with longer pipes, the tool would be situated closer to the midsection for inspection.

Upon interpretation, an exceptionally favorable signal-to-noise ratio was observed in this sample. Consequently, all defects within the sample were successfully detected. The resulting C-Scan image revealed six distinct coloured spots, corresponding to the locations of the eight defects present. Although the pulse length of the data collection fell just short of individually resolving all eight defects, a clear pattern emerged. These six spots consistently rotated around the pipe in alignment with the positions of the defects in the pipe. Furthermore, pipe thinning was detected between 5 feet and 5 feet, 3 inches (1.29-1.37 meters) from the pipe end. This thinning formed a circumferential band in the C-Scan. The data can be observed in Figure 4.

To gain further insights and enhance defect resolution, secondary focusing techniques were employed. By adjusting the focal length and focal distance of the data, each defect could be individually inspected and the rotation of all eight defects around the pipe, covering angles from 0° to 315°, was mapped. These focus plots are visualised in Figure 5.

Magnetic flux leakage for corrosion detection

The Eddyfi Technologies Pipescan HD solution has been meticulously engineered to optimise speed, reliability, and confidence in the detection of corrosion and pitting in ferrous pipes and surfaces. This innovative solution not only enhances the productivity of inspection teams but also

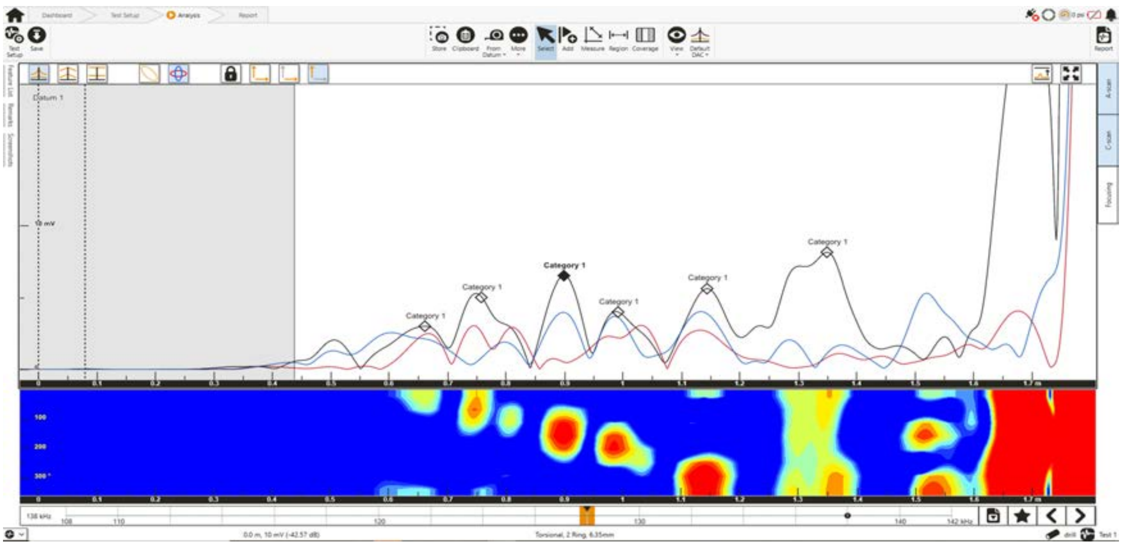

Figure 4: This figure presents an A-Scan and a colour map of the data, highlighting the defects within the pipe. The coloured spots on the map directly correspond to the defects, and their rotation closely matches the rotation of the actual defects on the pipe.

Figure 6: Pipescan HD deployment inspecting pipe for corrosion.

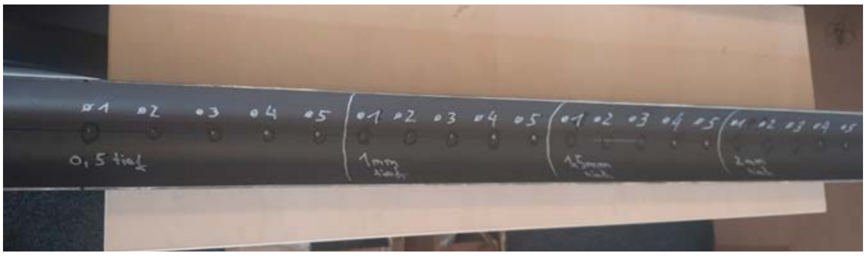

Figure 7: Sprinkler pipe section with simulated corrosion defects of various depths and diameters.

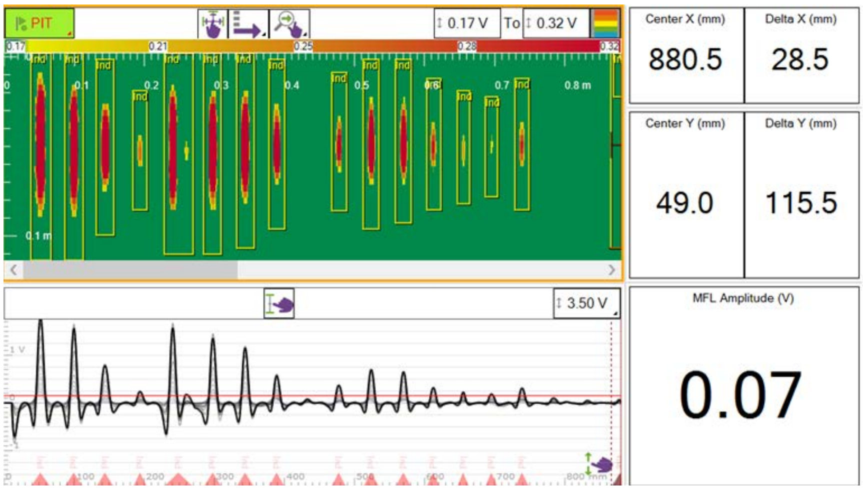

Figure 8: Software clearly displaying different corrosion defects within the pipe sample.

streamlines workflows by enabling on-the-spot reporting and furnishing asset owners with verifiable recorded data.

The Pipescan HD stands as the industry's highest-resolution magnetic flux leakage (MFL) scanner. With a remarkable probability of detection (PoD), it proves to be an effective and dependable solution for corrosion and pitting detection.

Deploying the Pipescan HD (as illustrated in Figure 6) is remarkably simple, thanks to its unique single curvature adjustment tool. This tool ensures swift inspection setup without the need for couplant or intricate gate settings. The process entails connecting the Pipescan HD to the data acquisition instrument, entering inspection details, and the system is ready for operation.

Moreover, all scanned data is automatically recorded, and reports can be generated on-site, providing asset owners with immediate insight into the condition of their assets and thereby enhancing productivity and efficiency.

MFL serves as a rapid, reliable, and robust corrosion screening technique. It operates by detecting the volume of missing magnetic material within the component under inspection. MFL necessitates minimal surface preparation and eliminates the need for couplant. Users require only minimal training, and with scanning speeds reaching up to one meter (3.2 feet) per second, MFL stands out as the ideal solution for fast, cost-effective corrosion detection.

In the same inspection challenge, the goal for MFL was to detect various defects within a section of a sprinkler pipe that had been halved to provide an indication of sensitivity. The half-pipe featured defects of different diameters and depths, including 0.5mm depth and diameters ranging from 1mm to 5mm, followed by a section with 1mm depth and diameters of 1mm to 5mm. You can view the sample in Figure 7.

Inspecting the half pipe was a straightforward one-pass process, taking approximately 15 minutes from setup to scan to report generation. Most defects were conspicuously visible, as demonstrated in Figure 8 of the software.

Conclusion: elevating sprinkler system inspection

Eddyfi Technologies presents cutting-edge inspection technologies tailored for sprinkler systems, combining corrosion sensitivity with user-friendly efficiency. The Sonyks guided wave testing system excels in inspecting extended lengths of sprinkler pipe from a single location without requiring tool movement, while demonstrating remarkable sensitivity to small corrosion anomalies, even as small as 1mm (about 0.04 in) through-wall holes. In contrast, the Pipescan HD equipment necessitates traversal across the inspection area but offers enhanced sensitivity, detecting wall losses of less than 1mm (about 0.04 in).

Both NDT equipment solutions prove to be viable options for efficiently inspecting extensive sprinkler pipework when uncertainty exists regarding potential corrosion locations and where to commence the inspection.

For more detailed information, please contact Eddyfi Technologies; info@eddyfi.com; www.eddyfitechnologies.com