The crack depth sizing revolution

NDT Global’s Dr Thomas Hennig discusses enhanced sizing, the crack depth sizing capability that has broken through the 4 mm depth sizing threshold. The new capability extends the use of UT detection, considered a highly accurate and reliable crack detection method.

Operators can now access more precise assessments of deep cracks and accurately size crack depths to 100 per cent wall thickness. Armed with a complete picture of potential threats posed by cracks and crack-like anomalies, operators are better equipped to make more informed decisions to maintain pipeline integrity.

ASSESSING CRACK DEPTH

Detecting potentially hazardous cracks and anomalies before they cause permanent damage is central to preventing pipeline failure. Using crack detection tools that employ ultrasonic technology (UT) – which emit high frequency waves and monitor the reflections to receive a surface and crack echo – to inspect variations in wall thickness has proven to be highly accurate.

UT detection methodology is also the most reliable method of sizing crack depths. However, until recently, it hasn’t offered operators a comprehensive crack detection solution that makes it possible to size the depth of the crack in absolute values through the entire wall.

The reason for this is because, in addition to material properties, such as yield strength, tensile strength and toughness, crack assessment relies upon crack size (namely depth and length), which is based on corresponding ultrasonic indications.

Crack analysis depth is based on recorded amplitudes from the corner reflection. When certain characteristics – such as the influence of tilt angle, skew angle, and pressure and temperature – are inaccessible, it is not possible to accurately size crack depth.

Although the advent of absolute tolerance values in 2011 went a long way to reduce industry-wide uncertainty about accurately sizing crack depth, sizing depths exceeding 4 mm (0.16 inch) remained a frustrating unknown.

PIONEERING THE FUTURE

Determined to break through this barrier, NDT Global began reassessing the existing data gathered on behalf of its customers with a view to developing a reliable crack depth sizing solution. The company embarked on a program of rigorous large- and small-scale testing of enhanced sizing methodology in accordance with API 1163.

Confident in its ability to reliably size the depth of features in absolute values throughout the entire wall thickness, NDT Global introduced enhanced sizing to its UT crack inspection service in March 2017.

The benefits of enhanced sizing are striking. To illustrate this, previous UT detection tools
were limited to sizing depths of less than 4 mm. As a result, a defect reported in depths greater than 4 mm could be any size, representing a completely open interval.

The enhanced sizing method makes it possible to access depths greater than 4 mm. For example, it is possible to report a defect with 5.5 mm ± 1.3 mm (0.21 inch ± 0.051 inch) sizing tolerance. Defects reported in this area can now be accurately sized, rather than a matter of pure speculation.

STEP CHANGE

This development signals a step change, not only for the pipeline inspection industry, but for pipeline integrity management.

“For the first time, the entire pipe wall can be thoroughly inspected, revealing much greater detailed insight into threats posed by cracks and emerging anomalies,” NDT Global’s Global Manager of UC Data Analysis Rogelio Guajardo says.

“Gone are the days of formulating integrity management programs based on inspection data that was not truly comprehensive because the inspection technology was not yet capable of sizing crack depths greater than 4 mm. Enhanced sizing is poised to set the standard for all crack depth assessment: a precise, comprehensive picture of all cracks and crack anomalies throughout 100 per cent wall thickness.”

FIELD VERIFICATION RESULTS

Since introducing enhanced sizing in early 2017, NDT Global has analysed previous inspection data and applied the methodology for selected inspections, providing additional information regarding the depth of the features to customers. These analyses were performed for customers, proving the advantages of enhanced sizing.

The unity plot seen in Figure 2 reflects the comparison between field measurements and inline inspection depths when applying the enhanced sizing methodology.

The lighter area in the top right area shows where the method demonstrates major benefits, as the 4 mm depth boundary from conventional pulse-echo depth sizing is removed. The plot reflects the ability to size features greater than 4 mm without physically modifying the tools.

MARKET REACTION

NDT Global says operators seeking greater detail to form the basis of their integrity management programs have welcomed enhanced sizing. In North America, the NDT Global team has also been using enhanced sizing methodology to further investigate certain features in pipelines that may be deeper than previously reported before enhanced sizing became available.

With plans to begin offering enhanced sizing as a standard element of its crack depth inspection service on the horizon, NDT Global anticipates that response will be positive and immediate. The ability to size crack depths beyond 4 mm by introducing this methodology is a significant step towards eradicating pipeline failure caused by cracking.

FIGURE 3: A plot illustrating how enhanced sizing removes uncertainty beyond the 4 mm threshold.