Corrosion Testing Solution with a Dual Linear Array Probe

Common testing for pipeline corrosion includes magnetic flux leakage method, guided wave method, and ultrasonic point thickness measurement.

However, for sections of high-risk corrosion, such as elbows, tees, flanges and stress-concentrated welds with variable flow rates, the magnetic flux leakage method and the guided wave method have their disadvantages. Random points are taken in ultrasonic point thickness measurement, which may result in high miss rate and difficult to meet requirements for high detection rate and efficiency.
In addition, if the wall thickness is thin, the top end of the etch pit may be close to the upper surface of the workpiece, especially difficult to find small aperture of pitting that often extends to the near surface or even causes perforation. Conventional UT and phased array probes are not able to effectively detect such corrosion defects, due to the initial wave and near-field blind zone.

Problem

Most corrosion is at the bottom of the pipe.
Pitting with small aperture is difficult to find, which often extends to the near surface or even causes perforation.
Low near-surface resolution for thin walls.
Low resolution on inner wall surface corrosion and the bottom surface.
Corrosion defects on the outer and inner surfaces may be missed.
Conventional probes have initial waves and near-field blind zones.
Visible multiple interface echoes from 0° incidence may interfere detection.
The coupling adaptation to different curvature diameters shall be considered.
Inconvenient to install an effective crawler on a small or medium area with irregular shape.

Solution

For corrosion testing on a small or medium area, we recommend a low cost solution for manual primary corrosion testing: Corrosion Solution with a Dual Linear Array (DLA) Probe. The DLA probe combines the “pitch-catch” mode of a conventional dual thickness probe and element electronic control of a PA probe, which not only provides better near-surface resolution (near-surface 1mm testing performance), but ensures a 100% coverage scan. The combination also retain the "pseudo-focusing effect" of the conventional dual probe and electronic focusing of phased array, which concentrates sound field energy, provides better pitting testing capabilities, and also has great advantages for detecting coarse-grained and composite materials with severe attenuation.

“Pitch-catch”

“Pitch-catch” mode combined with array electronic control to provide better near-surface resolution and a large coverage scan.

Effectively eliminates the initial wave, weakens the interface echo and reduces the blind zone.

"Pseudo-focusing effect"

Combined with electronic focusing to get sound field energy concentrated and provide better pitting testing and resolution.

Irrigation water spray coupling

Enables water filled between the wedge and the workpiece surface.

Adjustable positioning strip

The bottom positioning strip is adjustable to allow the probe fit perfectly to the workpiece surface.

Beveled edge of wedge

Facilitates the water to enter the bottom of the wedge and reduces the interface wave.

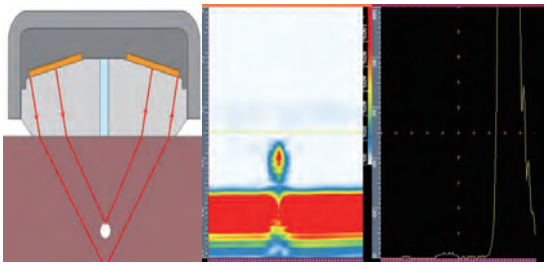
Simple & fast

Equipped with simple encoder wheels for a fast and easy manual corrosion testing solution.

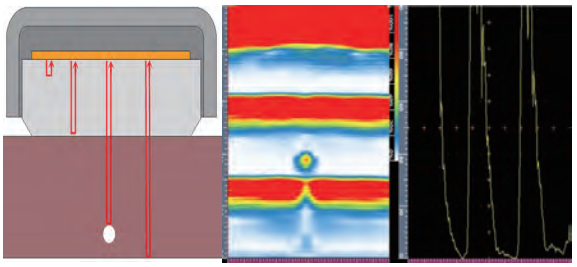
Suitable for

The first choice for testing high risk small and medium areas with smooth surface but irregular shape.

Array “Pitch-Catch" Technology



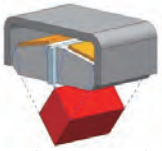
“Pitch-Catch"



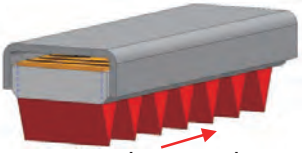
Pulse echo

A DLA probe divides the crystal into two groups for transmitting and receiving, which are respectively mounted on both sides of the roof corner of the delay wedge sandwiched with the sound insulating layer. Compared with the pulse echo probe, the “Pitch-Catch" mode eliminates the clutter between the transmitting crystal and the delay wedge, and avoids the initial pulse directly entering the amplifier, thereby overcoming the blockage and greatly reducing the blind zone, which provides favorable conditions for testing near-surface defects of thin-walled pipes.
Compared with ordinary pulse echo 0° incidence, the DLA probe uses small angle incidence with the sound insulation layer, which only generates minimal interface echoes at the wedge and workpiece interface to avoid hidden defects and missed detections.

Focusing Methods



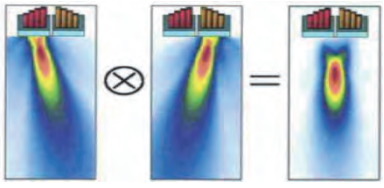
Dual UT probe

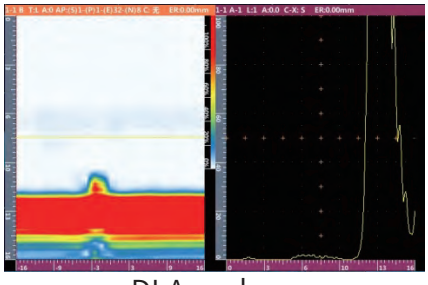


Normal PA probe

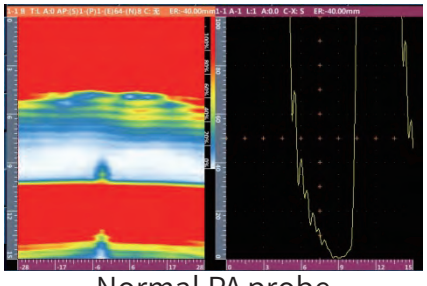
DLA probe

The "pseudo-focus effect" produced by the diamond-shaped overlapping region of the dual UT probe can produce a focusing effect, while the normal PA probe electronically controls the beam delay time, resulting in phase superposition to produce a focusing effect. The DLA probe perfectly adopts the electronic focusing in one direction and the “pseudo-focusing” effect of the dual UT probe in the other direction, which concentrates sound field energy and has better testing and resolution for the weak point reflector on the inner surface of pipeline. For example, the DLA probe still shows good resolution for detecting the Φ0.8 flat bottom hole, 1mm away from the bottom. The normal PA probe can detect it but with worse resolution and energy. The conventional UT probe without focusing cannot detect it.

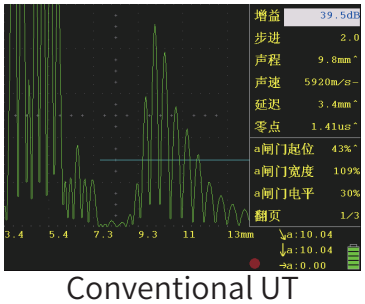




DLA probe



Normal PA probe



Conventional UT

Near-surface Resolution

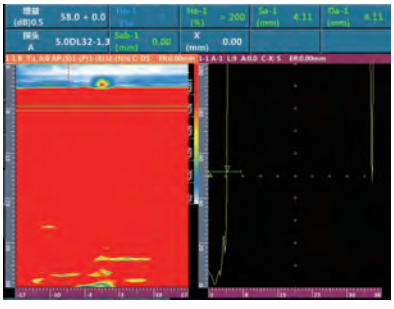
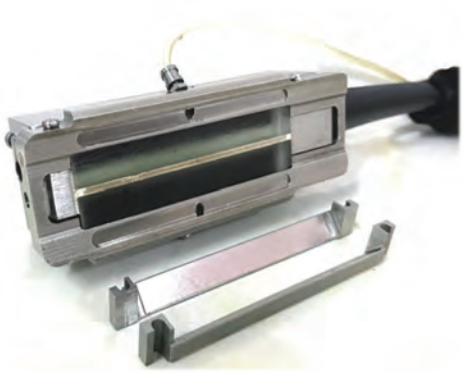


Image of Φ2 flat bottom hole, 1mm away from surface on wall thickness 4mm wp

Wall thickness of the thin-walled step test block is displayed in different colors

Probe Features



- Adapt to wall thickness: ⩾4mm
- Adapt to pipe diameter: ⩾20.3mm and flat materials
- 1mm testing performance near the surface
- Sound beam coverage width up to 30mm~40mm
- Carbide wear-resistant design to protect wedge
- Adjustable positioning strips for perfect fit on different curvatures or flat materials
- With a water injection frame for irrigation water spray coupling, the bottom of the wedge is always in good coupling with the surface of the workpiece.

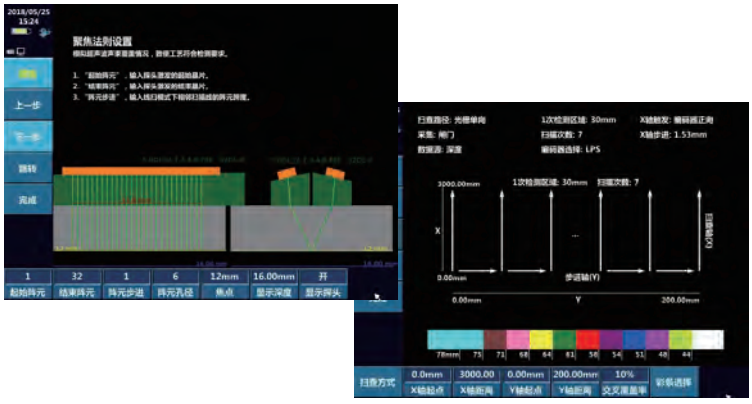
Software

Features of Data Acquisition Software

- Professional testing process wizard, allowing users to quickly get familiar with the testing process and perform quick setup and calibration.
- Workpiece simulation and simulating testing coverage for adjusting the testing process.
- Scanning strategy interface for the operator to understand the scanning plan of the entire workpiece before the scan.
- High-density depth C-scan, amplitude C-scan.
- Custom color bar according to user's needs, with wall thickness of test results in different colors.
- Permanent storage of scanned data and online report generation.

PC Offline Analysis

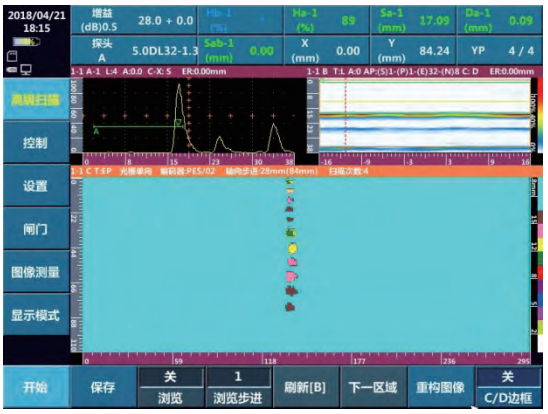
- Support image processing, defect measurement, positioning quantitative analysis.
- Double C view display.
- Automatic report generation.
- Permanent storage of scanned data.



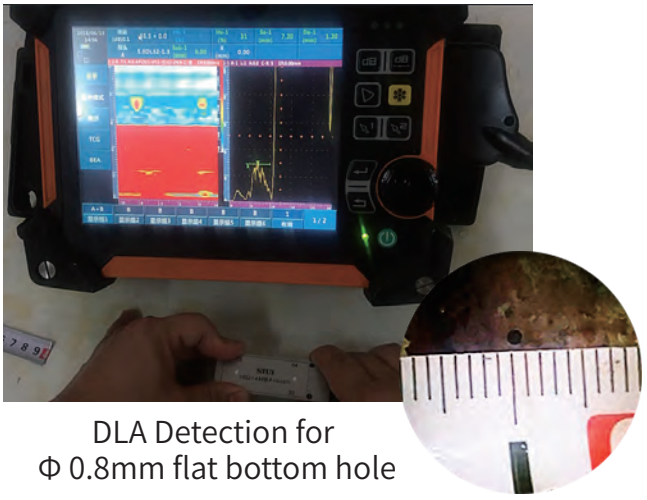
Testing and Verification

- Connecting standards, making comparative test blocks with wall thickness and pipe diameter similar to the actual situation on site to verify the testing process.
- Artificially design the simulated corrosion holes to have a certain aperture, spacing and depth, which is similar to the corrosion defects and arranged in rows.
- Φ1mm or Φ2mm flat bottom hole to simulate pitting corrosion, Φ5mm flat bottom hole to simulate common corrosion pit, hole spacing is designed to be minimum 2mm, flat bottom hole is 1mm minimum from bottom surface, and gradually increases.
- Use the corresponding calibration test block to set the reference sensitivity, increase 6dB as the scanning sensitivity, and perform coupling compensation, attenuation compensation and curved surface offset according to the actual situation.
- The simulated flat bottom hole on the designed test block is tested for parallel line scanning with 10% cross coverage. When scanning, the moving direction of the probe should be perpendicular to the sound insulation layer of the probe.

- The test results show that the DLA probe can clearly image a single flat bottom hole with a hole diameter ⩾1mm and ⩾1mm away from the inner and outer walls. The adjacent flat holes with adjacent spacing ⩾2mm and adjacent depth ⩾1mm can be well identified.



On-site Application



DLA Detection for
Φ 0.8mm flat bottom hole

DLA Detection for
thin-walled workpiece

Ordering Information

Description	Model	Quantity
PA ultrasonic flaw detector	SyncScan	1 unit
DLA probe	5.0DL32-1.3-4.8-F8E	1 pc
	7.5DL32-1.3-4.8-F8E	1 pc
	5.0DL32-1.0-4.8-F8E	1 pc
	7.5DL32-1.0-4.8-F8E	1 pc
Positioning strip	41N-WEAR-AODXX	1 pc
Water injection frame	41N-WEAR-I-AODXX	1 pc
Encoder wheel	PES-02	1 pc
Irrigation device	IH-05	1 set
Analysis software	SuporUp	1 set

See the future
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