Ultrasonic Weld Inspection Solutions

EVIDENT

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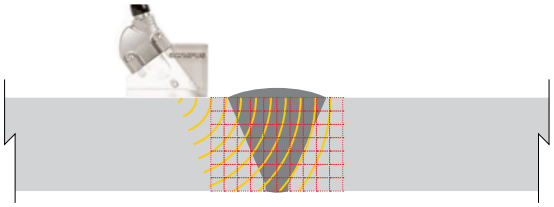
OmniScan™ series flaw detectors deliver reliable and cost-effective phased array (PA) weld inspections as an alternative to radiography. Evident's ultrasonic weld inspection solutions provide an affordable means to inspect welds in compliance with major code and manufacturing requirements. With portable and easy-to-use acquisition units, scanners, encoders, and software, these solutions can be put to work virtually anywhere. Intuitive software makes the inspection of welds even easier, enabling you to complete your entire workflow more efficiently.

Our weld inspection solutions also work on welds made of carbon steel, austenitic material, or corrosion-resistant alloys.

Benefits:

- Quickly inspect welds with different diameters, thicknesses, and materials
- 100% volumetric weld coverage
- Adaptable to butt welds, circumferential welds, long seams, one-sided access configuration, and most common weld profiles
- Portable for in-house and field inspections

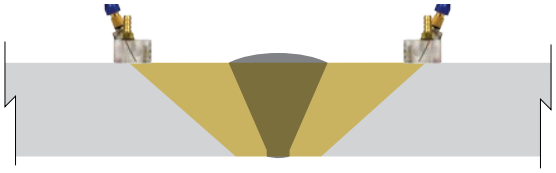
Combine Techniques for Full Weld Coverage and Improved Efficiency



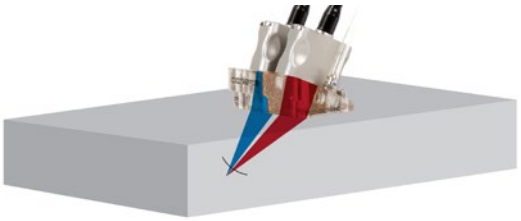
Full Matrix Capture (FMC)/Total Focusing Method (TFM)
FMC is a data-acquisition process where each element in a phased array probe is fired successively, and all the elements are used as receivers for each transmitted pulse. TFM processes the FMC data, reconstructing it so the signals are synthetically focused at every point within the zone.

Phased Array Pulse-Echo Technique
The individual elements of a multielement probe are excited using time delays (focal laws), electronically steering the beams at different angles and focusing them at specific depths.

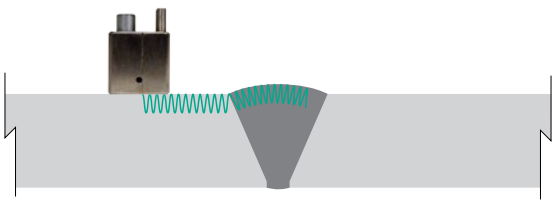
Conventional UT Pulse-Echo Technique
A single element transducer is used to generate an acoustic beam at a fixed angle. The echo is received by the same transducer and interpreted by the instrument.



Time-of-Flight Diffraction (TOFD) Technique
A single element transmitter transducer sends ultrasound into the part and a second one receives the diffraction signals generated by the tips of the defects.



Transmit-Receive Longitudinal Wave (TRL)
Separate transmit and receive probes generate a refracted longitudinal wave. Dual array probes (DLA/DMA) help maintain a good signal-to-noise ratio (SNR) in applications requiring higher gain.



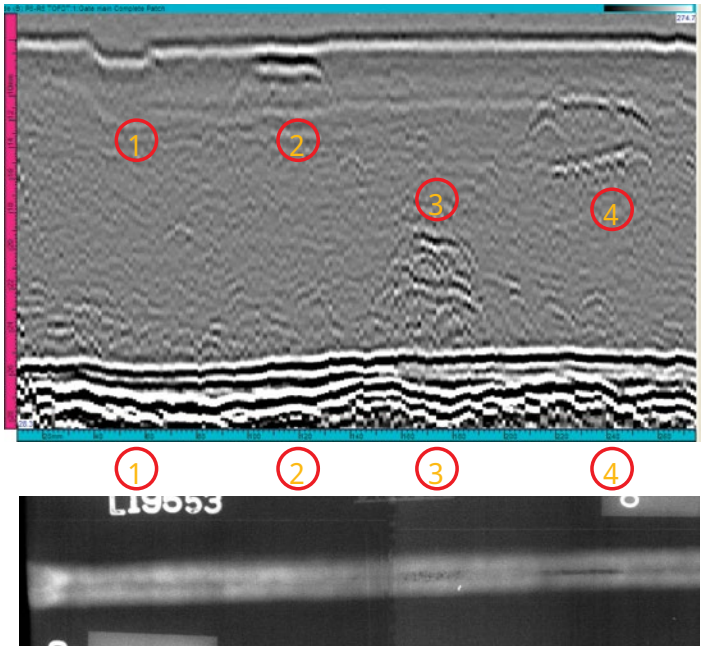
Surface Wave Technique
When ultrasound beams are generated at a high angle into a part, some of the energy tends to follow a path near the surface, enabling the detection of shallow defects.

Automated Ultrasonic Testing (AUT) in Lieu of Radiography Testing (RT)

Ultrasonic testing in lieu of radiography has proven very effective for pressure vessels, tanks, piping, and other weld configurations. Evident ultrasonic weld inspection solutions comply with ASME, API, and other radiography replacement code requirements, such as full raw data collection and the use of an encoder. Compared to conventional radiography, our ultrasonic weld inspection solutions offer multiple benefits:

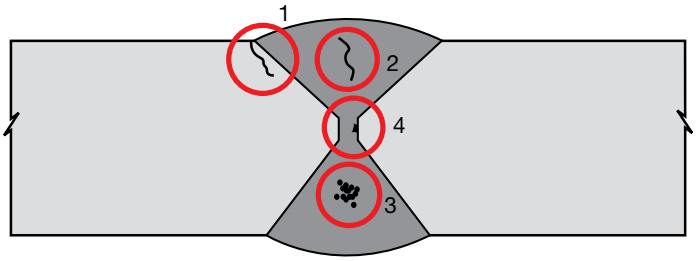
- No radiation safety hazards
- Helps eliminate work area disruption
- Real-time digital archiving of inspection data
- No need to archive films
- Improved productivity
- Improved probability of detection (POD)

Comparing the Indications



A surface-breaking crack in a 50 mm thick weld, undetected with radiography

Analysis of weld inspection results produced by ultrasonic and radiographic testing shows that ultrasonic methods provide both depth and height information, in addition to being more sensitive to planar-type defects.



Measurement Capabilities

ID	Type of Defect	Automated Ultrasound (AUT)	Radiography (RT)
1	Toe crack	Position X, Y, and Z Length sizing Height sizing	Position X and Y Length sizing
2	Centerline crack	Position X, Y, and Z Length sizing Height sizing	No detection
3	Porosity	Position X, Y, and Z Length sizing	Position X and Y Length sizing
4	Incomplete root penetration	Position X, Y, and Z Length sizing Height sizing	Position X and Y Length sizing

Benefits of Evident Ultrasonic Weld Inspection Solutions

	Olympus Ultrasonic Solutions	Radiography (RT)
Absence of radiation hazard	Yes	No
Absence of restricted area	Yes	No
Easy to deploy on site	Yes	No
Probability of detection (POD) (Planar defects, such as cracks and lack of fusion)	Very good	Poor
Inspection throughput	Very good	Good
Depth sizing capability	High accuracy	Poor
Length sizing capability	High accuracy	Good accuracy

Small-Diameter Pipes

The COBRA™ manual scanner, combined with the OmniScan™ phased array (PA) flaw detector, is used to perform circumferential weld inspections on small-diameter pipes. The COBRA scanner holds up to two PA probes for inspections on pipes with outside diameters ranging from 0.84 in. to 4.5 in. (21 mm to 114 mm).

With its very slim design, this manual scanner is used to inspect pipes in limited-access areas where minimal clearance is required. Adjacent obstructions, such as piping, supports, and structures, can be as close as 12 mm (0.5 in.).

This scanner uses multiple links to quickly adapt to various pipe diameters (simply add or remove links). In addition, the retention mechanism is spring-loaded, enabling the scanner to securely clasp pipes. This unique feature also enables the scanner to be installed and operated from one side of a row of pipes when access from both sides is impractical.

The COBRA scanner is characterized by its smooth-rolling encoded movement, which enables accurate data acquisition. The COBRA scanner ensures stable, constant, and strong pressure, providing good UT signals and precise encoding around the full circumference of the pipe.

The COBRA scanner on a 0.84 in. OD pipe with two A15 PA probes with an OmniScan X3 flaw detector displaying two PA groups with sectorial scans and C-scans.

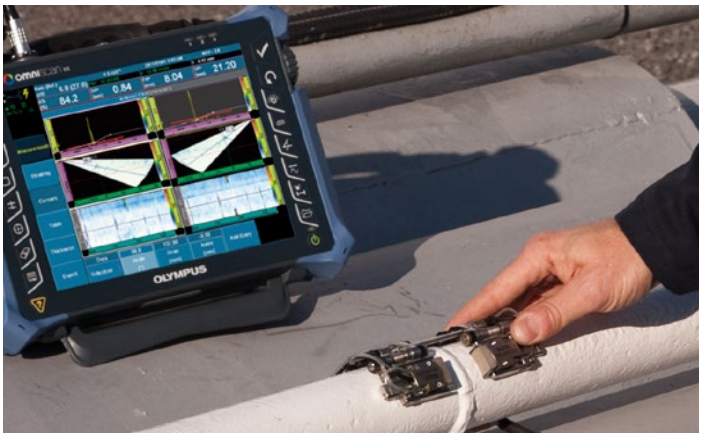
Applications

✔ Boiler tube
✔ Small-diameter process pipe
✔ Austenitic

Scanning Methods

Two-Sided Inspection

The COBRA™ scanner with the OmniScan™ MX2 and X3 flaw detectors are capable of two-sided inspection to cover both sides of the weld with only one pass for greater productivity. For these inspections, the scanner holds two phased array probes placed on either side of the weld; the distance between the probes can be adjusted to quickly adapt to different weld thicknesses.



One-Sided Inspection

For pipe-to-component inspections, the scanner can be configured to perform one-sided inspections using a single probe.

Evident also offers a more affordable COBRA package that can be used with the single-group OmniScan SX flaw detector. This package requires two passes to inspect a weld.

Techniques

Our phased array solution uses low-profile A15 phased array probes in pulse echo mode with optimized elevation focusing, which enhances the detection of small defects in thin-walled pipes. Specially designed low-profile wedges that fit each pipe diameter covered by the scanner are available for a complete solution.

The A25 Dual Linear Array™ probe (DLA)* series is designed to inspect austenitic material (in TRL mode) that cannot be otherwise inspected using an A15 probe in pulse echo. The A25 probe features an innovative system that enables the two arrays to conform to the wedge roof angle. The latter is optimized according to the diameter of the pipe being inspected.

The COBRA scanner is compatible with conventional UT probes with 3 mm diameter elements and a specially designed wedge to perform TOFD* inspection.

*When using TOFD and a DLA probe, the height clearance is increased.

Pipes and Plates

Our versatile solution for weld inspections uses a variety of techniques to achieve a productive and efficient inspection on plates and pipes from 4.5 in. OD and up. Phased array, time-of-flight diffraction, and conventional ultrasonic techniques can be used alone or in combination to achieve full coverage of a weld with a high probability of detection.

This solution also includes different scanning methods for accurate defect positioning and sizing. The stability and encoding capability offered by scanners results in better data quality and enables code compliant inspections. Different scanners are used for manual, manual-encoded, semiautomated, or automated data collection methods.

Evident's carbon steel weld inspection solution brings together our acquisition units, scanners, probes, and software tailored to your needs. The solution enables length and depth sizing for code acceptance/rejection.

Passive-Axis Focusing (PAF) Wedges

Our patented passive-axis focusing wedge series helps compensate for beam divergence in the passive direction for pipe girth weld inspection. The smaller beam width enables the sizing of shorter flaws on the scan axis, helping lower rejection rates. Also, because the beam energy is focused, the signal-to-noise ratio (SNR) is improved, leading to sharper images of the defects.

Weld Series PA Probes and Wedges

The A31 and A32 phased array probes and wedges offer unique features for a new level of performance.

- Improved signal-to-noise ratio (SNR)
- Ergonomic design
- Improved coupling
- Compatible with compound scan

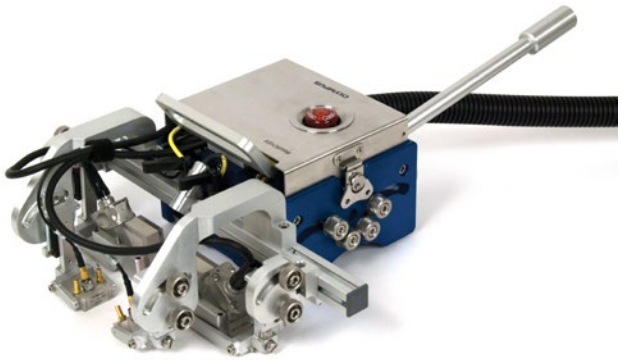
High-Temperature Inspection

A high-temperature wedge option compatible with the A31 and A32 phased array probes and Mini-Wheel™ encoder is available on request. This option enables the inspection of parts with a surface temperature up to 150 °C (302 °F).

Scanning Methods

Automated

The WeldROVER™ scanner is used for circumferential weld inspection of carbon steel pipes from 4.5 in. OD up to flat.



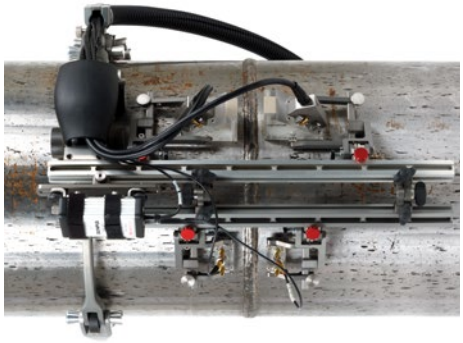
longitudinal weld inspection on carbon steel pipes from 12 in. OD up to flat as well as tank walls.

Semiautomated

The HSMT-Lite (2 probes), HSMT-Compact (4 probes), and HSMT-Flex (up to 8 probes) scanners are used for circumferential weld inspection of carbon steel pipes from 4.5 in. and up.

The AxSEAM™ scanner can be used for longitudinal weld inspection of carbon steel pipes from 6 in. OD and up.

The ChainSCANNER™ is installed on the pipe using chain links, enabling it to be used on nonferromagnetic materials.



Techniques

The pulse echo phased array technique enables multiple beam angles, beam types, and beam offsets to be generated electronically. This facilitates greater flexibility for easy adaptation to different types of welds.

The conventional UT technique is an alternative to phased array when very high speed is required or when cost is preferred over flexibility.

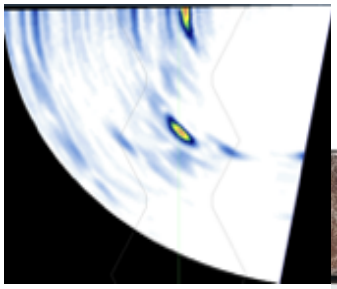
TOFD can be used alone for fast and simple inspection or as a complementary technique to pulse echo.

Combining phased array and TOFD techniques offers the best performance for most carbon steel weld inspections. Both techniques complement each other for excellent imaging, a good probability of detection, and flaw characterization.

Applications

- ✔ In-service weld inspection
- ✔ Pressure vessel and piping construction
- ✔ Structural construction welding
- ✔ Wind tower construction

Austenitic Steels and Nickel-Based Alloy Welds
Corrosion-Resistant and Cladded Materials



Austenitic and nickel-based alloy weld metals and other coarse-grained anisotropic materials affect ultrasound propagation causing beam distortion, beam scatter, mode conversions, and significantly increased attenuation resulting in a poor signal-to-noise ratio (SNR) as compared to shear wave inspections in low-alloy carbon steels. Inspection of these materials requires the use of dual phased array probes with TRL (transmit-receive longitudinal) wedge designs that acoustically insulate the transmitter and receiver beams for improved defect SNR and elimination of wedge echoes. Our Dual Linear Array (DLA) and Dual Matrix Array™ (DMA) probes are used with removeable wedges to combine different inspection techniques, such as direct L-wave, creeping wave, RTT (round trip tandem), and other multimode techniques, into a single phased array S-scan image for full volumetric weld inspection.

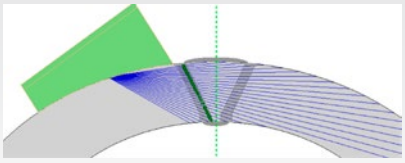
Dual Array Probes (DMA/DLA)

Dual arrays consist of two phased array probes wired to the same connector. They can be either matrix or linear arrays. One probe performs a sectorial scan and the echoes coming back from the defect are captured using the second probe.

	A25	A27	A26	A36
Frequency	5 MHz	4 MHz	2.25 and 4 MHz	2.25 and 4 MHz
Configuration	Dual 16 (Linear)	Dual 32 (16 × 2 Matrix)	Dual 32 (Linear)	Dual 64 (Linear)
Aperture	12 mm × 5 mm	16 mm × 6 mm	32 mm × 12 mm	64 mm × 12 mm
Recommanded Wedge Series	SA25-DN70L-IH	SA27-DN55L-FD15-IHC	SA26-DN55L-FD40-IHC	SA36-DN55L-FD200-IHC
Characteristics	Compatible with the COBRA® scanner for the inspection of small-diameter pipes (<10 mm thick)	General purpose with excellent overall performance and near-surface resolution (10<40 mm thick)	Optimized for very thick materials (40<80 mm)	Optimized for extra thick materials (>80 mm)
Minimum Instrumentation Requirement	16:64PR (one probe) 32:128PR (two probes)	32:128PR (two probes)	32:128PR (two probes)	64:128PR (one probe)

Onboard DMA and DLA Creation and Beam Setup

The OmniScan™ X3 enables you to create custom Dual Linear Array (DLA) or Dual Matrix Array (DMA) probes and wedges. In addition to creating phased array (PA) focal laws, you can also use the scan plan to set up total focusing method (TFM) and phase coherence imaging (PCI) groups. The scan plan accommodates a wide range of geometries, including COD configurations.



Applications

✔ Austenitic ✔ Nickel alloys ✔ Clad ✔ Dissimilar welds

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