

# Ultrasonic Weld Inspection Solutions



- Fast Weld Scanning
- Instant Inspection Results
- Eliminate the Hazards of Radiography Testing
- Code Compliant
- Complete Data Storage
- Minimal Downtime

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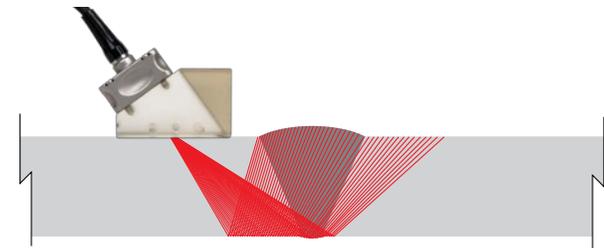
The OmniScan® flaw detector delivers reliable and cost-effective phased array (PA) weld inspections as an alternative to radiography. Olympus ultrasonic weld inspection solutions provide an affordable means to inspect welds in compliance with major code and manufacturing requirements. With portable and 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.

Olympus 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



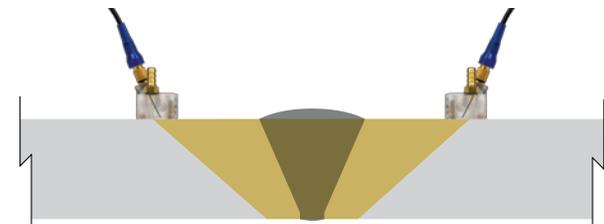
### Phased Array Pulse-Echo Technique

The phased array technique is based on the capacity to electronically modify ultrasonic beams generated by probes that contain multiple small elements. When these elements are excited using different time delays (focal laws), the beams are steered at different angles and focused at specific depths.



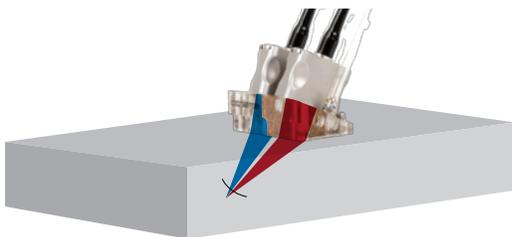
### Conventional UT Pulse-Echo Technique

This technique uses a single element transducer to generate an acoustic beam at a fixed angle. The echo coming back to the transducer is interpreted by the instrument to provide information on size and position.



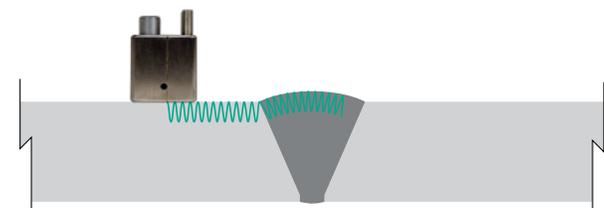
### Time-of-Flight Diffraction (TOFD) Technique

Time-of-flight diffraction (TOFD) is an ultrasonic technique that relies on the reflective property of defects, such as cracks. The defects diffract energy from their tips back to the receiver probe when they are impinged by ultrasonic beams generated by the transmitter probe. TOFD uses a wide beam that provides good coverage and is independent of a defect's orientation.



### Transmit-Receive Longitudinal Wave (TRL)

This technique uses separate transmit and receive probes to generate a refracted longitudinal wave. The use of separate probes minimizes vulnerability to noisy material, which is especially beneficial for inspecting coarse-grained alloys, such as austenitic steel and nickel.



### Surface Wave Technique

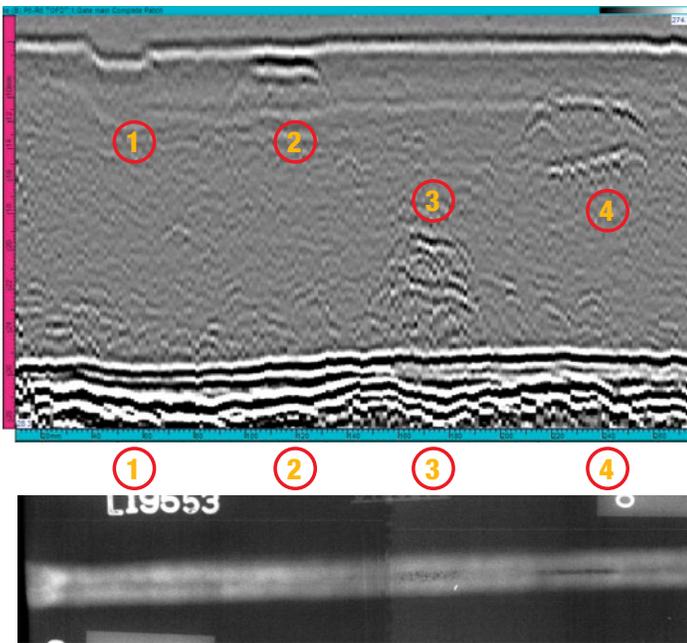
The surface wave (creeping) technique is an ultrasonic test in which discontinuities are detected by the return of a creeping wave that tracks the surface of the component being tested.

## 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. Olympus 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, Olympus ultrasonic weld inspection solutions offer multiple benefits:

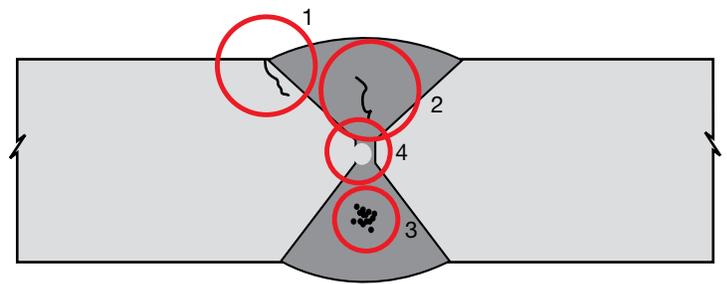
- No radiation safety hazards
- Helps eliminate work area disruption
- Real-time digital archiving of inspection data
- No need to archive films
- Improved productivity
- Improved probability of detection (POD)

### 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 Olympus 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 MX2 16:64 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 flaw detector is 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.

Olympus 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

This Olympus **phased array** solution uses low-profile A15 phased array probes 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 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

Olympus' 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.



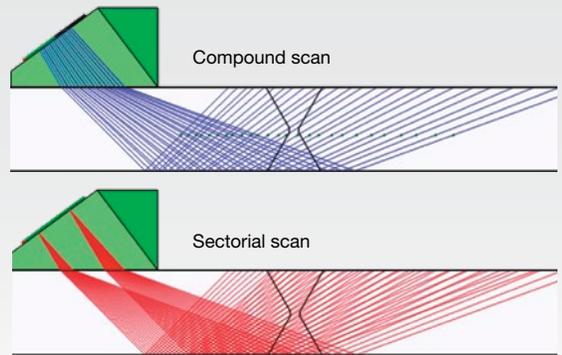
This solution also includes different scanning methods for accurate defect positioning and sizing. The stability and encoding capability offered by scanners results in better data quality and enables code compliant inspections. Different scanners are used for manual, manual-encoded, semiautomated, or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

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

## Compound Scan

Olympus' NDT SetupBuilder software offers the capability to perform compound scan beams. This innovative inspection strategy consists of a mix between sectorial and linear beams and offers many advantages:

- Higher probability of detection
- Inspection of thicker material
- Higher inspection speed
- Shorter setup and calibration time
- Faster data analysis



A single-group compound scan offers coverage that is similar to two sectorial scans.

## 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 Olympus Mini-Wheel™ encoder is available upon request. This option enables the inspection of parts with a surface temperature up to 150 °C.



## Scanning Methods

The Olympus carbon steel weld solution can be used with different scanning options.

### Manual and Manual Encoded

The weld can be scanned manually using one PA probe that can be encoded by attaching a Mini-Wheel encoder or by using a VersaMOUSE™ hand scanner.



### Automated

The Olympus WeldROVER™ scanner is an automated scanning option for inspection of carbon steel welds using one pair of PA probes and up to three pairs of TOFD probes. It provides a faster and more stable movement of the probes for a higher, more accurate data acquisition rate.



### Semiautomated

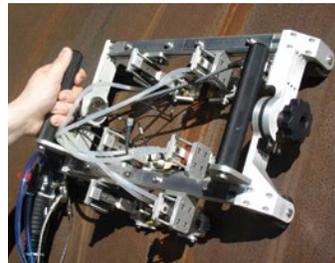
The HST-Lite scanner is used for weld inspection with one pair of TOFD probes.



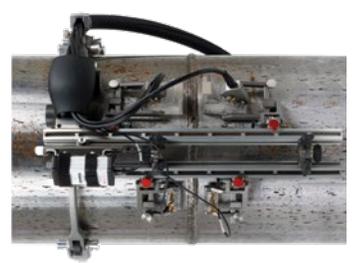
The HSMT-Compact™ scanner is used for weld inspection with one pair of PA probes plus one pair of TOFD probes.



The HSMT-Flex™ scanner is used for weld inspection with one pair of PA probes plus up to three pairs of TOFD probes.



The ChainSCANNER™ instrument is used for weld inspection with one pair of PA probes and can be fitted with one pair of TOFD probes with an optional kit.



## Techniques

**The 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 compliment each other for excellent imaging, a good probability of detection, and flaw characterization.

## Applications

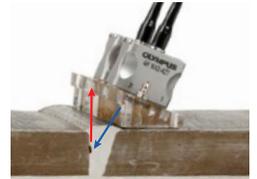
- ✓ In-service weld inspection
- ✓ Pressure vessel and piping construction
- ✓ Structural construction welding
- ✓ Wind tower construction

# Austenitic, Nickel, and Other Coarse-Grained Alloys Corrosion-Resistant and Cladded Materials

The use of coarse-grained corrosion-resistant materials, such as austenitic alloys for welds, base material, or cladding can make weld inspection difficult with standard pulse-echo shear wave techniques. These alloys cause beam skewing and beam scattering, resulting in a poor signal-to-noise ratio (SNR). To address these challenges, Olympus has developed dual matrix array (DMA) and dual linear array (DLA) probe and wedge series. These probes are used in tandem configuration to generate transmit-receive longitudinal waves (TRL). This technique is less affected by beam degradation and offers significant SNR improvement. In addition, when performing high angle beam steering, the DMA /DLA probes are capable of generating surface waves for the detection of shallow defects. This is particularly helpful in the presence of cladding or highly attenuative weld material when it is not possible to skip on the bottom of the part.

## Dual Array Probes (DMA/DLA)

Dual array 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.



	A17	A25	A27
<b>Frequency</b>	2 MHz	5 MHz	4 MHz
<b>Probe aperture (Matrix)</b>	19 mm x 12 mm (Matrix)	12 mm x 5 mm (Linear)	16 mm x 6 mm (Matrix)
<b>General characteristics</b>	Optimized for the most attenuative coarse-grained materials	Compatible with the COBRA® scanner for the inspection of small-diameter pipes	General purpose with excellent overall performance and optimum near-surface resolution

## Dual UT (TRL) A27 Probes

Dual conventional UT probes can be used for surface wave inspection or, in conjunction with DMA probes, for full weld coverage. The detachable wedges enable more versatility for different pipe diameters and stability.



## Wedges

The probes are mounted in tandem on a wedge that features an acoustically insulated transmitter and receiver. The wedges are offered in the following series:

**SA17-DN55L0:** Excellent coverage of attenuative materials.

**SA27-DN55L-FD15:** General purpose model with excellent overall performance.

**SA27-DNCR:** Optimized for A27 dual UT probes for surface wave (creeping) detection.

**SA25-DN70L:** Compatible with the COBRA scanner for pipe diameters from 0.85 in. to 4.5 in.

These wedge series all include irrigation, scanner holes, and are offered in different predefined standard AOD curvatures to adapt to standard pipe diameters.

## NDT SetupBuilder

DMA / DLA probes and standard AOD wedges from this solution are all available in the latest NDT SetupBuilder software version. A complete setup with beam representation can be created; the resulting file can then be imported directly into the OmniScan® flaw detector.



## Applications

✓ Austenitic

✓ Nickel alloys

✓ Clad (A27 series)

✓ Dissimilar welds

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