

**ECHOGRAPH-SNUS**  
Ultrasonic Inspection of HSAW-Pipes

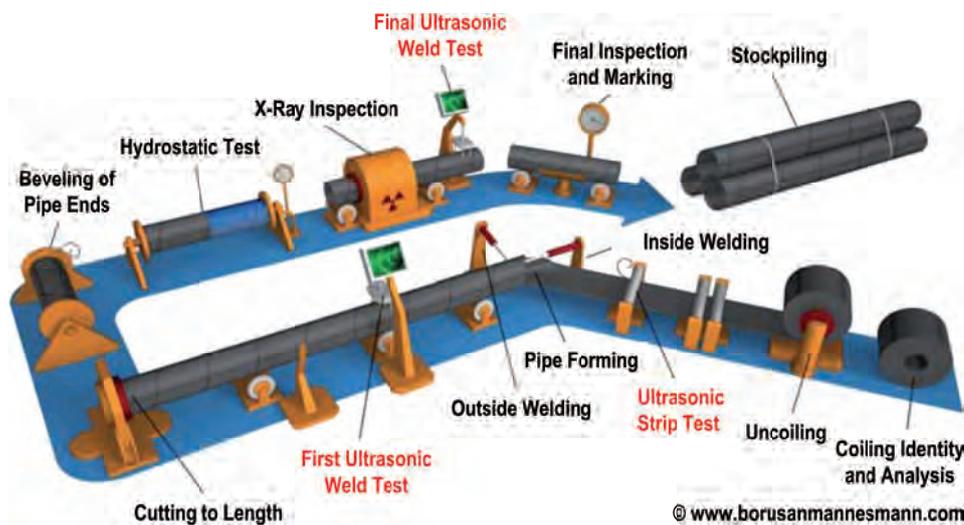
**KARL DEUTSCH**

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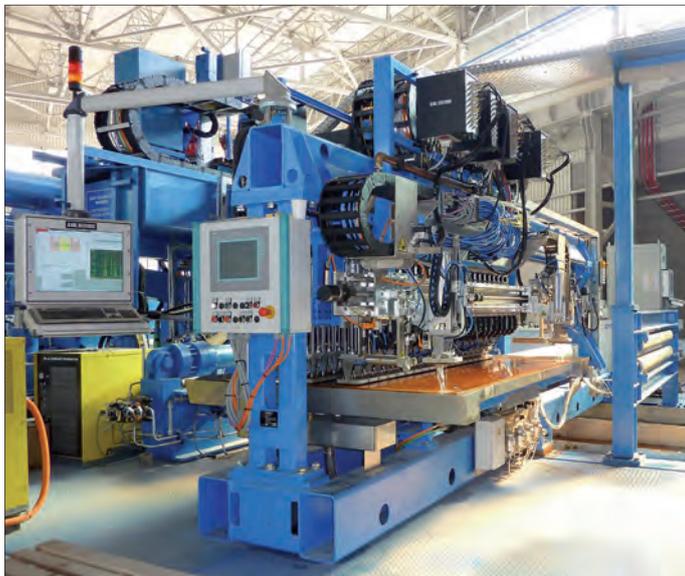
## Ultrasonic Inspection of HSAW-Pipes

Three stages of ultrasonic test systems are typically installed in the production line of helically submerged arc welded pipes (HSAW) intended to be used for oil or gas pipelines. The raw base material comes as flat metal sheets supplied in coil form. Testing is done prior to welding on the flat strip or after welding on the finished pipe. The surface coverage depends on the number of ultrasonic probes and whether an oscillating probe movement is added. In recent years, solutions with 100% surface coverage were presented for strip testing systems. Second stage is the ultrasonic testing of the weld seam on-line directly after welding (on the virtually "endless" pipe). Thus, the weld quality can be checked in an early production stage. After cutting the pipes to their specified length and after undergoing the hydrostatic test, a final ultrasonic test is performed. Laminations within the pipe body, the heat-affected zones besides the weld and the pipe ends are tested with straight beam ultrasonic incidence (TR-probes). Additional angle beam incidence detects longitudinal and transverse defects in the helical weld. A special feature to avoid complex setups is the on-bead probe pair for transverse defect detection using the squirter coupling technique.

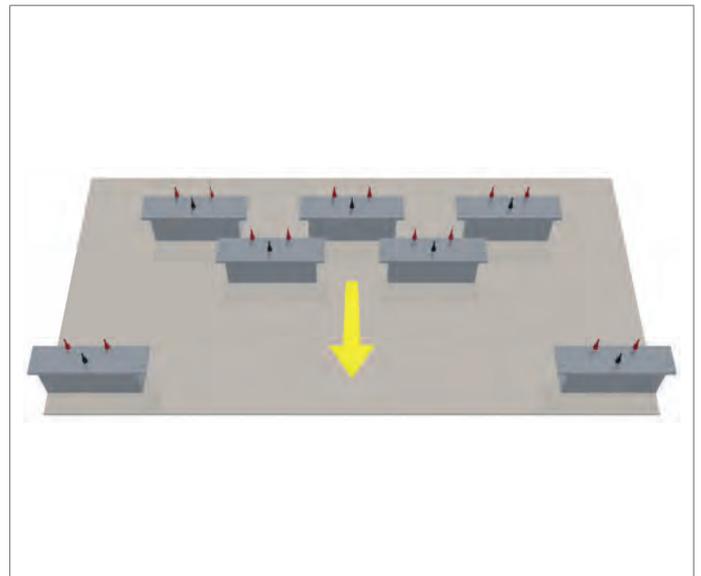
**KARL DEUTSCH has more than 60 years experience in developing ultrasonic testing equipment. Many improvements of the ECHOGRAPH electronics, the robust testing mechanics and the ultrasonic probes have led to our current state-of-the-art. All components are developed and assembled in-house. KARL DEUTSCH maintains a strict quality management system according to DIN EN ISO 9001.**



Production chart for helically (spirally) welded SAW-pipes (courtesy of Borusan Mannesmann Turkey): After uncoiling the steel strip, an ultrasonic strip test is executed. Then the pipe is formed and welded, followed by an on-line ultrasonic weld test. At the end of the line, the pipes are cut to their final length, then undergo a hydrostatic test, an X-ray inspection and the final ultrasonic weld test.



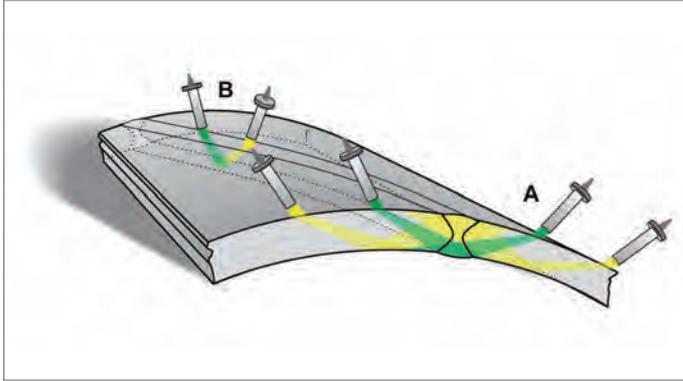
A strip test machine consists of a test bridge which is twice as wide as the steel strip width. The probe holders can be moved between test position (online) and calibration position (offline, see picture). For further details see our brochure ECHOGRAPH-BAPS.



Testing of the flat metal sheet before welding with 100% coverage: The strip centre is covered by overlapping probes in two rows. Separate probe holders are used for the strip edges. They are guided along the edges by steel rollers.

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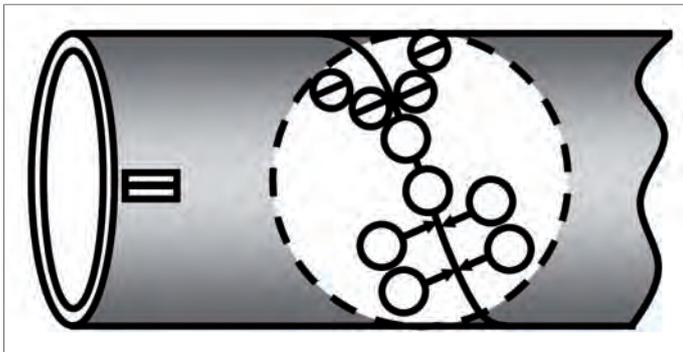
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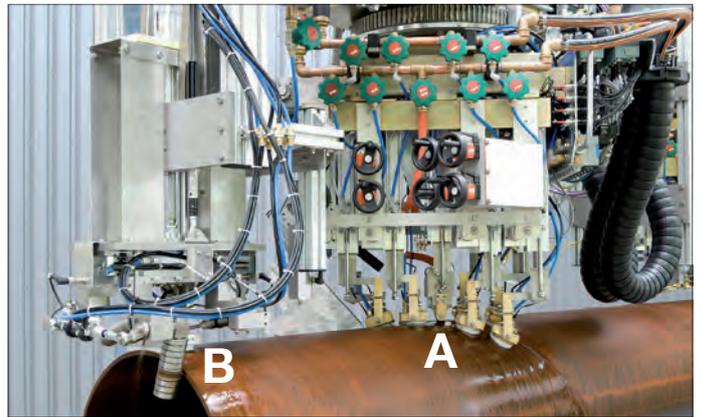
Online ultrasonic weld testing with six probes: A) two probes for external longitudinal defects, two probes for internal longitudinal defects; B) two on-bead probes for transverse defects.



Six ultrasonic probes follow the weld crown which is monitored by a laser-optical seam tracker (A). The distance of the longitudinal probes with respect to the weld (skip distance) can be comfortably adjusted. The on-bead transverse probes are mounted into one common probe holder (B).



Schematic drawing of the probe configuration for online ultrasonic weld testing with 6 angle beam incidences for longitudinal and transverse defects and 4 straight beam incidences for detection of laminations within the pipe body and the heat-affected zones beside the weld.



Due to the compact design of the probe holders, all required probes can be mounted into one test frame (A). The separate pipe end probe holder is seen on the left side (B).



The pipe end testing uses a paintbrush probe with a 50 mm test track. Perfect guidance along the pipe end is achieved by a set of steel rollers. The same probe holder is used for both pipe ends (second set of steel rollers here in idle state).



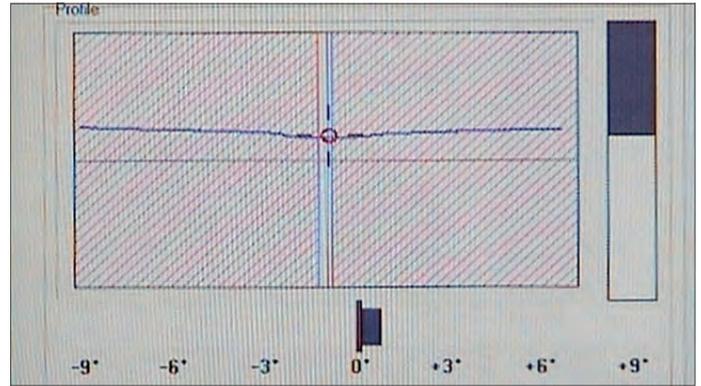
The pipe body can also be tested after welding (instead of testing the strip). The number of probes is chosen accordingly to the required surface coverage and the welding speed. The coverage can be further increased with an oscillating probe movement.

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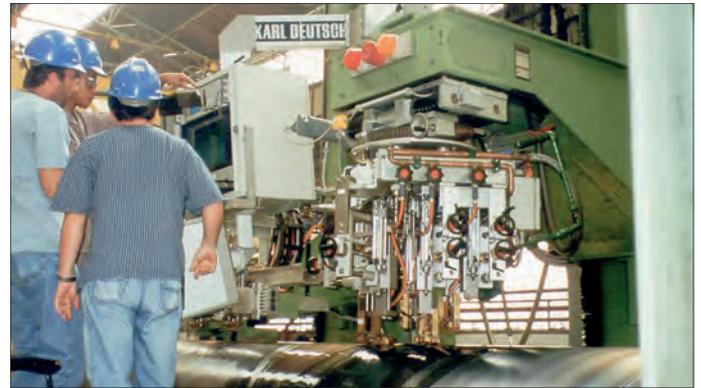
Close-up view of the weld crown monitoring by a laser optical tracking system



The result of the seam tracking system is always visible on the screen of the operating panel. Here, the probe pairs are perfectly centred with respect to the weld.



The pipe is handled by means of a pipe carriage. Linear and rotational feeding must be perfectly synchronised (picture courtesy of Borusan Mannesmann Turkey).



The weld testing mechanics is mounted to a height adjustable boom. Due to the large pipe diameter range, an operator's platform is often required.

### Specimens and typical project data

#### Helical SAW-Tubes

Base material	hot rolled flat metal sheets (in coil form)
Diameter	300 - 3600 mm
Wall thickness	3 - 30 mm
Strip width	200 - 2000 mm
Width of weld seam	8 - 30 mm
Testing task	<ul style="list-style-type: none"> <li>detection of longitudinal and transverse defects in the weld seam; option: oblique defects</li> <li>laminar defects beside the seam; options: laminar defects in the pipe body / pipe end testing</li> </ul>
Specifications	API, DNV, ISO (others like Shell, Ghost etc. on request)

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