

## **ECHOGRAPH-HRPR**

High-Speed Ultrasonic Inspection of Tubes

**KARL DEUTSCH**

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## High-Speed Ultrasonic Inspection of Tubes



View of the test table with sliding possibility and with two immersion test chambers. The shown system is designed for tube diameters up to 170 mm. Longitudinal defects are detected and the wall thickness is measured. 40 ultrasonic channels are used.

### High-Speed Ultrasonic Inspection of Tubes

High test speed and little mechanical wear are key features of the patented HRP-testing concept. No rotating mechanical components are used. HRP: Well-proven in the industry for more than 15 years !

For tube inspection with automated throughput at high test speed, special test chambers with exchangeable probe cassettes were designed. Non-contact ultrasonic coupling is carried out in immersion technique. The ultrasonic probes are mounted in probe cassettes. The cassettes are available in various sizes depending on the respective tube diameter. All probes are arranged around the tube axis with a fixed distance (sound path) to the tube surface. The sound fields produce overlap in the circumferential and axial direction.

The ultrasonic probe configuration is dependent on the testing task and the respective specification:

- Longitudinal flaw detection with 16 probes transmitting ultrasound in the clockwise direction. Another 16 probes are designated for the anti-clockwise direction. Ultrasound penetrates into the tube un-

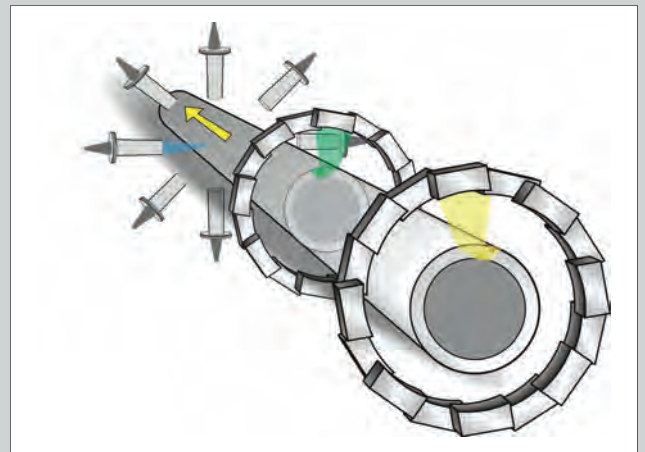
der a refraction angle between 30° and 70° (adjustable dependent on the ratio of wall thickness and diameter). One probe cassette carries 16 probes. Therefore, one set of two cassettes is required during the inspection. One cassette size can be used for a diameter range of approximately 20 mm. More than one set is used to cover a larger diameter range.

- Transverse flaw inspection with 8 probes orientated in feeding direction, and 8 probes orientated against the feeding direction, penetrating with 45° angle of refraction (option).
- Combined wall thickness measurement and lamination inspection with 8 probes with normal sound incidence (option).

The closing mechanisms of the testing chambers are designed for tube inspection without plugged ends. Even shorter untested tube ends can be achieved by plugging the tubes or by testing the tubes end by end.



Fast system calibration using the automated sensitivity adjustment, i.e. each probe is adjusted to the same sensitivity.



Two probe rings to detect longitudinal defects (yellow: clockwise incidence, green: counter-clockwise) and one ring to measure the wall thickness (blue).



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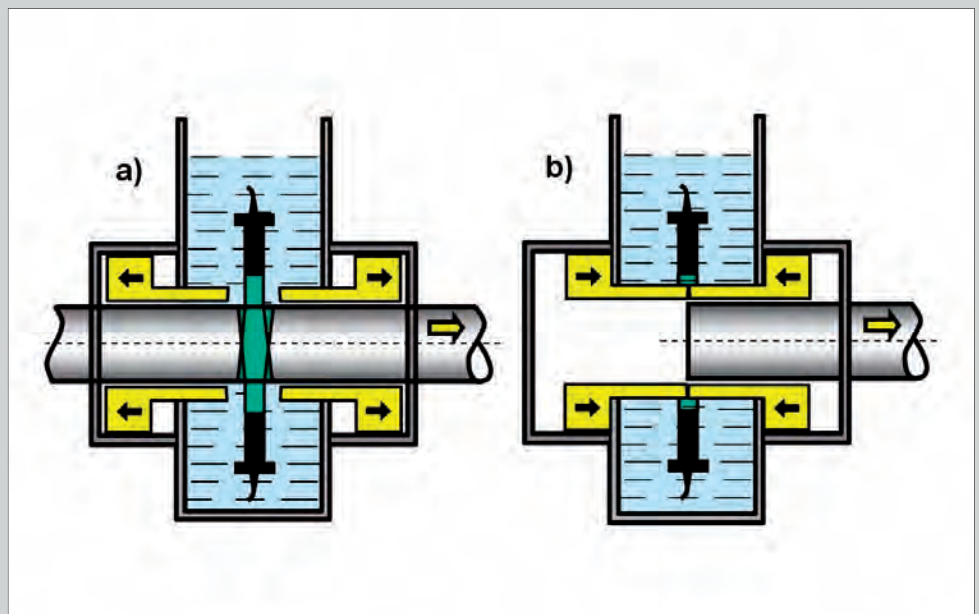
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Tube testing system and operator panel to adjust the ultrasonic test parameters and the PLC parameters (Siemens).



Immersion test chamber for high-speed tube testing



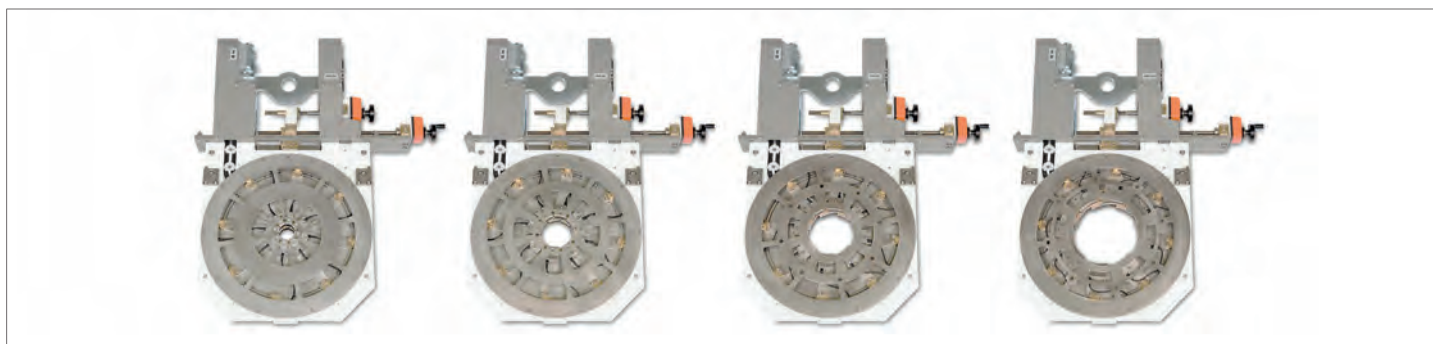
Fast mechanics open and close the immersion test chamber during the inspection and provide short untested tube ends: a) open test chamber during test, b) closed test chamber after tube testing.

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Special line-focussed probes for angular incidence in different sizes to test the respective tube diameters. Each probe covers 30 degrees of the tube circumference. In dependence to the tube diameter 16 to 20 probes are provided for full ultrasonic coverage.



Probe cassettes in five sizes (four sizes are shown) are required for the inspection tube diameters between 10 mm and 180 mm. The diameter ranges of the cassettes overlap. The orange dials centrally adjust the testing angle of the angle beam probes. Typically, a testing angle between 40° and 50° is chosen.

### Specimens

#### Seamless or Welded Tubes

Diameter range (D)	10 mm - 180 mm
Specimen ends	machined, no burr
Straightness deviation	max. 1 mm/m
Surface condition	as rolled, without loose scale or better
Processing stage	rolled, drawn, stretch-reduced, welded, extruded, turned, grinded
Testing tasks	longitudinal defect detection, options: wall thickness measurement and transverse defect detection
Wall thickness (s)	> 0.3 mm
s/D-Ratio	< 0.2

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