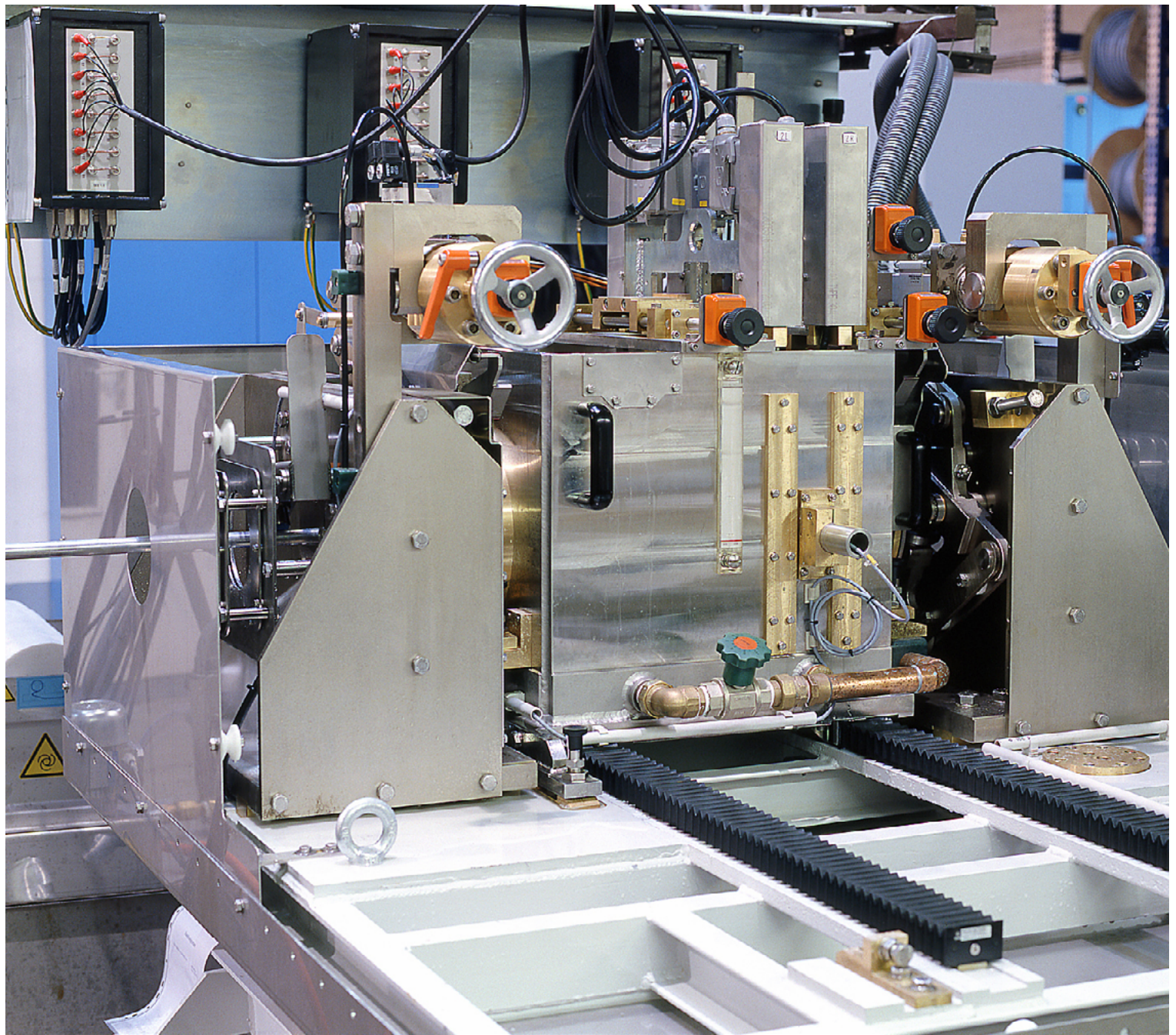




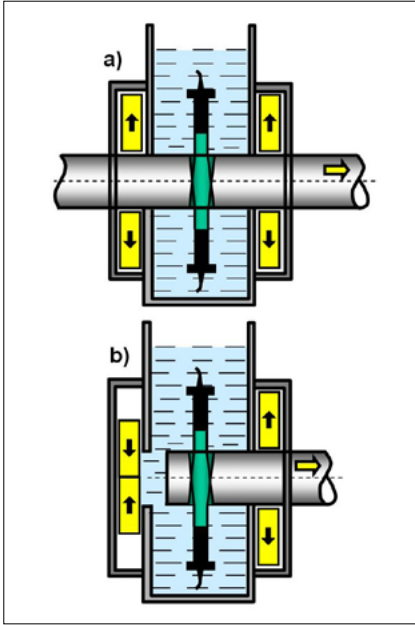
ECHOGRAPH HRPS

High-Speed Ultrasonic Inspection of Bars

KARL DEUTSCH

ECHOGRAPH HRPS

High-Speed Ultrasonic Inspection of Bars



Principle of closing mechanics of test chamber: a) Opened test chamber while bar is tested, b) Bar is leaving the test chamber and one side of the chamber is already closed. The ultrasonic probes are active as long as the bar is within the ultrasonic beams. The electronic test enable signals (to activate the probes) are programmable to achieve the shortest possible untested ends.

High-Speed Ultrasonic Inspection of Bars

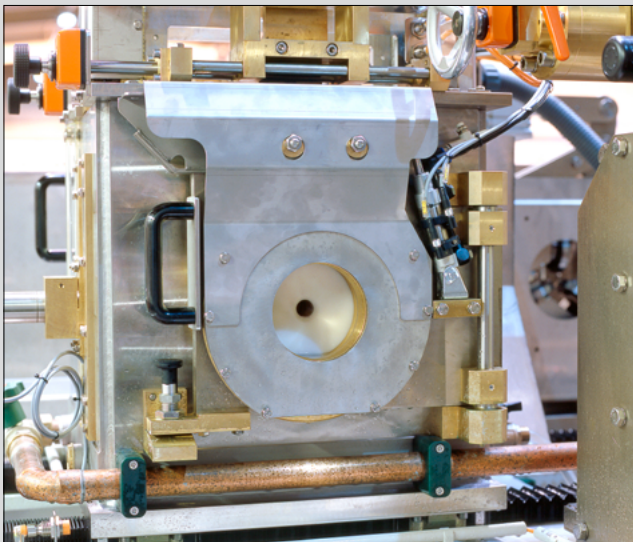
KARL DEUTSCH has developed ultrasonic testing equipment since 1951 and has shipped the first inspection system for billet inspection in 1965. Many improvements for the ECHOGRAPH electronics, the robust testing mechanics and the ultrasonic probes have led to our current state-of-the-art. KARL DEUTSCH maintains a strict quality management system according to DIN EN ISO 9001.

At the moment, a bar diameter range from 7 to 100 mm can be tested with the ECHOGRAPH HRPS system. The testing system works with the immersion technique, meaning that the part of the bar to be inspected is fully immersed in water. The system uses a water chamber and several probe cassettes on which the ultrasonic probes are mounted around the circumference of the bar. No mechanical rotation is employed in this concept, therefore avoiding mechanical wear of the testing mechanics and the untested zones which might occur with helical test traces and high testing speeds.

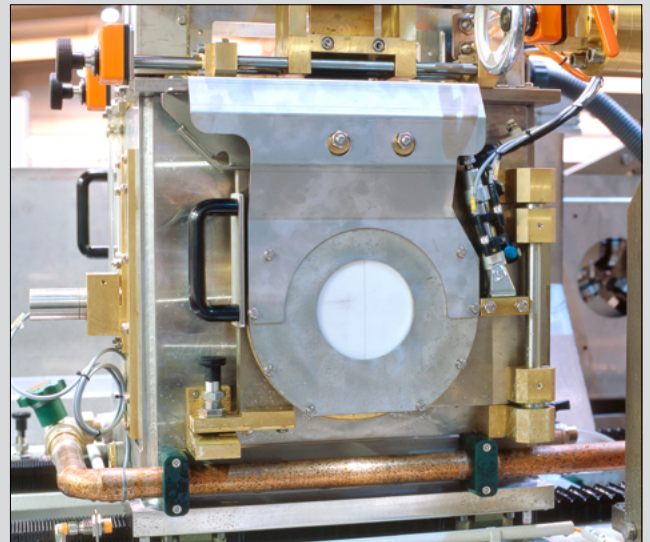
A key feature of the testing concept with stationary probes is the high inspection

speed of up to 2 m/sec and the robust mechanics which shows very little wear since no rotational components are used. The ultrasonic pulse density in the transportation direction is high enough so that overlap occurs there. Thus, another important feature of the system is the detection of short defects.

Most defects show a longitudinal geometry due to the rolling process. The determination of the length for longitudinal defects is an easy task with stationary probes. The defect is always found by the same probe. Counting the pulses above the calibrated amplitude threshold and knowing the pulse density quickly produces the defect length. To avoid pseudo indications, e.g. from surface scratches, a pulse counter can be set to a value which is suitable for the bar quality. A minimum number of ultrasonic pulses over the preset threshold is required before the system alarm becomes active. Again this feature can be used to adjust the minimum flaw length which should be detected with the system.

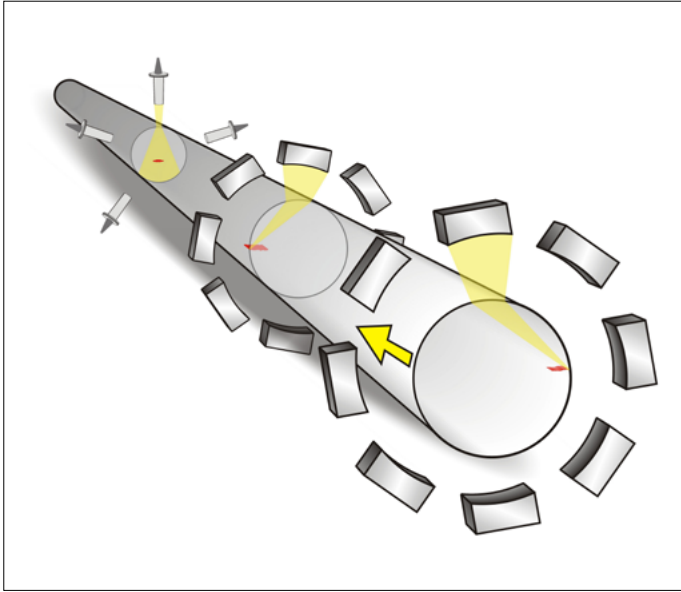


Test chamber in opened and closed condition

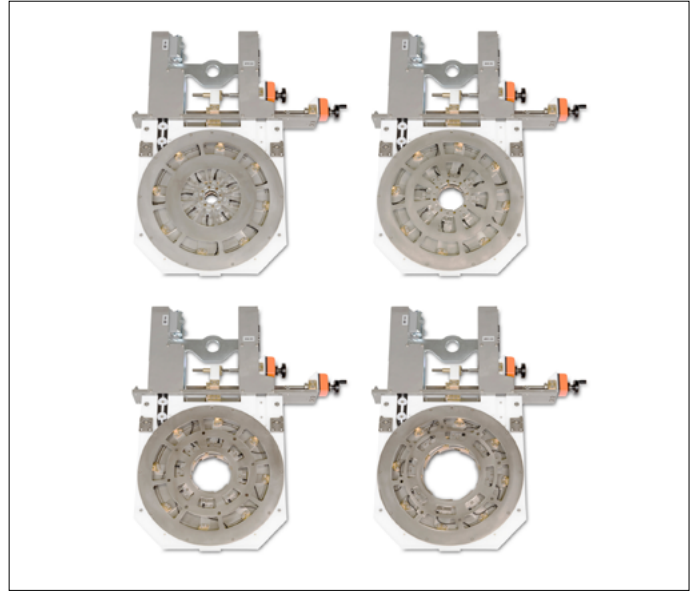


ECHOGRAPH HRPS

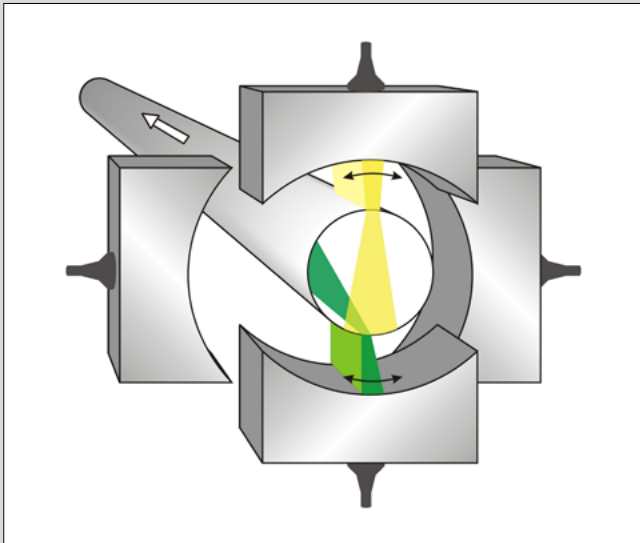
High-Speed Ultrasonic Inspection of Bars



Since the invention of the HRPS-setup, many probe configurations have been implemented. For bar testing, a setup with 16 angle beam probes and 5 straight-beam probes has been proven to be a reliable setup for 100 % cross sectional coverage of the bars. The more probes are used, the higher is the probability of detection (POD) also of oblique and crack-type defects.



Test cassette with ring of ultrasonic probes. Angle beam probes are used to detect surface defects while straight-beam probes are used to detect core defects. The testing angle of all angle-beam probes is centrally adjusted by the spindle and the orange dial.



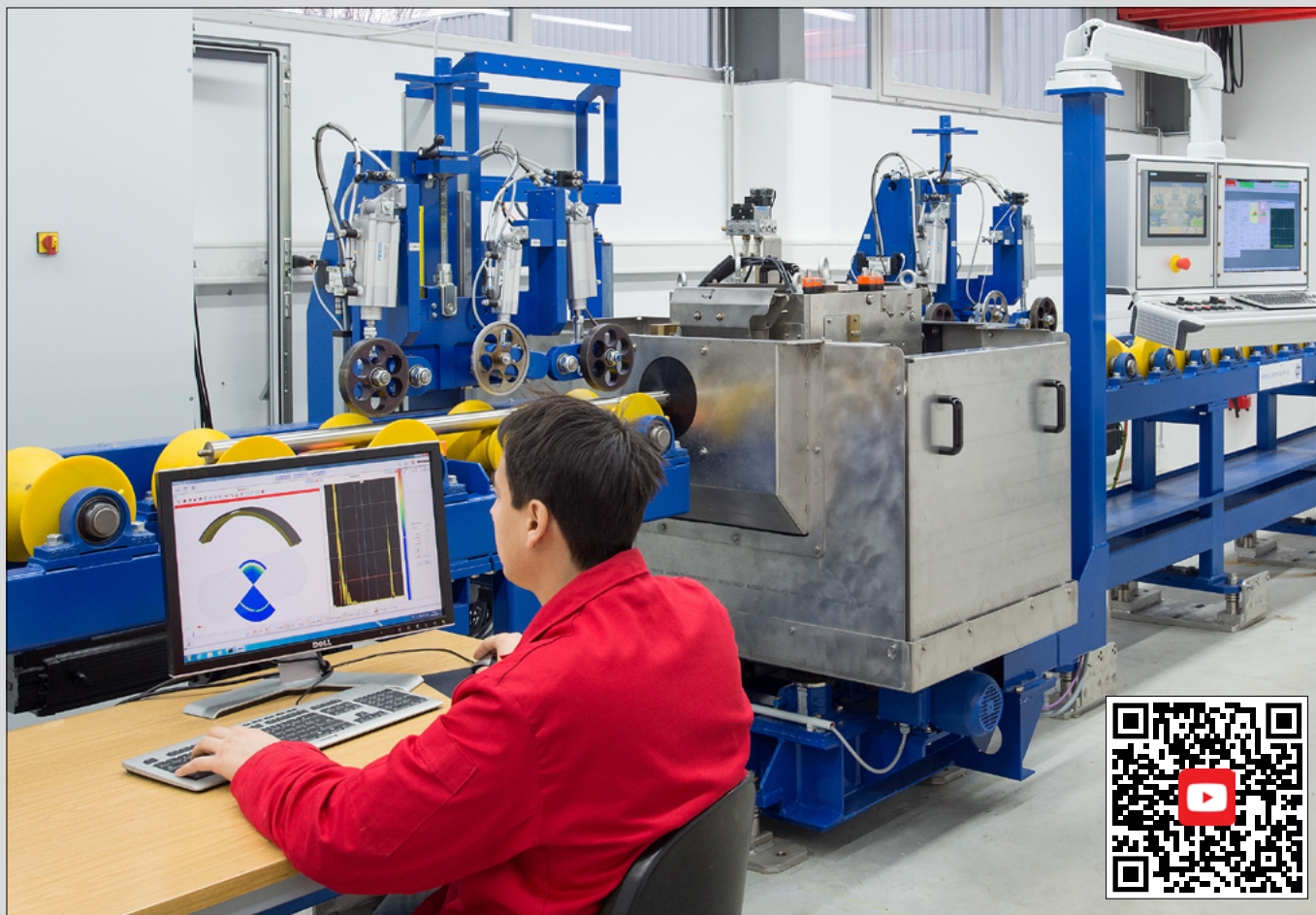
Similar test results can be obtained by using ultrasonic phased arrays. The bar is entirely enclosed by an annular ring array as shown in the top image, where the probes are arranged in array cassettes mounted in an immersion tank. The phased array technique can then be used for straight-beam testing (yellow beam) or angle beam testing (green beam).



Examples of phased array probes for bar testing, manufactured with up to 128 elements in various radii of curvature and test frequencies. These probes are manufactured entirely in Wuppertal and are type-compatible to systems from other manufacturers.

ECHOGRAPH HRPS

High-Speed Ultrasonic Inspection of Bars



ECHOGRAPH HRPS PAUT bar testing system in the KARL DEUTSCH test laboratory – ready for use at any time for customer-specific trials!

ECHOGRAPH HRPS

Applications	bars
Diameter range (D)	10 – 100 mm
Specimen ends	machined, no burr
Straightness deviation	max. 1 mm/m
Surface condition	machined (desirable)
Ovality	max. 1% of diameter

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