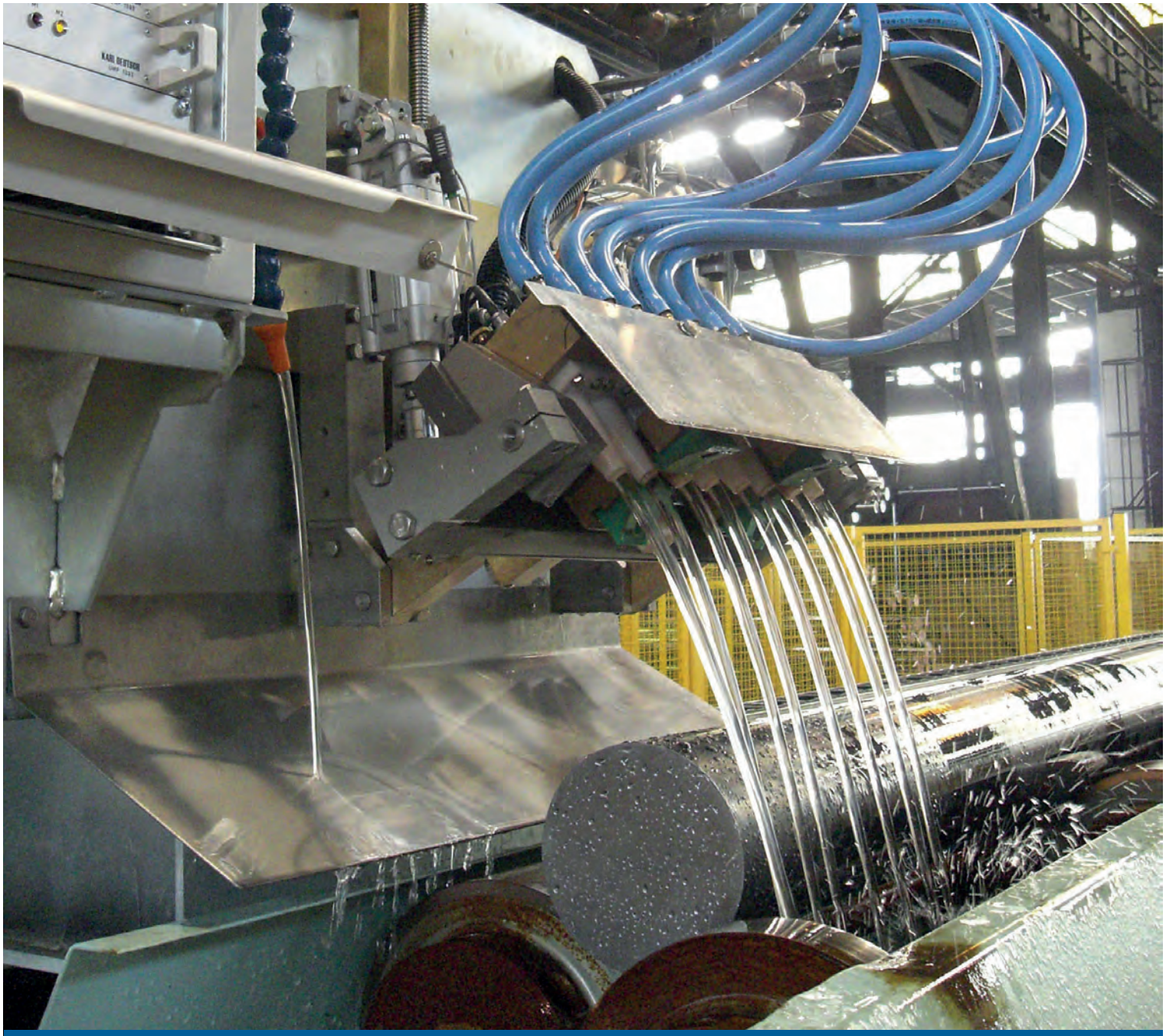


ECHOGRAPH-ALPT/RPTS

Ultrasonic Inspection of Round Billets

KARL DEUTSCH

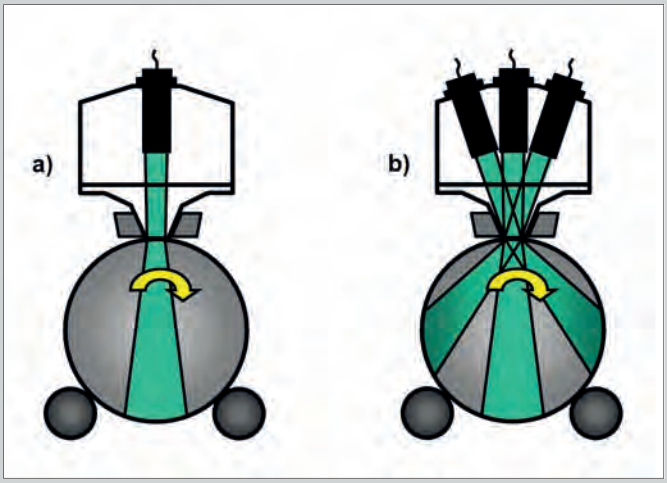
ECHOGRAPH-ALPT/RPTS
Ultrasonic Inspection of Round Billets

ECHOGRAPH ultrasonic test systems are designed for rough industrial environment and high throughput. During the inspection, the billet is scanned with helical testing tracks. While the billet is rotating, the probes are linearly guided along the billet axis.

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.

Test portal for round cast aluminium billets with ten straight beam probes for core-defect detection in accordance with ASTM B 594-90. In addition, six angle beam probes inspect the billets for surface defects in critical areas of the billet.

Key point of the billet inspection system is the coupling technique. Ultrasonic coupling with guided water jets allows almost wear-free probe holders and short change-over times for different billet diameters. This technique is also called squirter technique and describes a water column between probe and billet. The distance between probe and billet surface is in the order of several centimetres which leads to long-lasting probes. Instead of dual-element probes (formerly used for gap coupling in older testing systems), immersion type probes with large bandwidth are used. Since the wear shoes do not have to be changed for varying billet diameter, short change-over times can be ensured. In combination with the electronic distance amplitude correction (DAC) a constant testing sensitivity is achieved for all flaw depths.



The distance between ultrasonic probe and billet is kept constant by guiding the probe holders along the billet surface by means of skids and/or rollers. The straightness deviations require a gimble joint for the probe holders to perfectly follow the billet surface.

a) Often only straight beam probes are used. Due to the rotation of the billet, good ultrasonic coverage is achieved.

b) Near-surface defects in round billets are better detected with angled beams. This is achieved by tilting a straight beam probe with respect to the billet surface. Taking the law of refraction at the billet surface into account, beam angles of around 45° are typically used inside the billet. Both circumferential directions are provided (clockwise and counter-clockwise sound transmission) to detect near-surface defects of different orientations.

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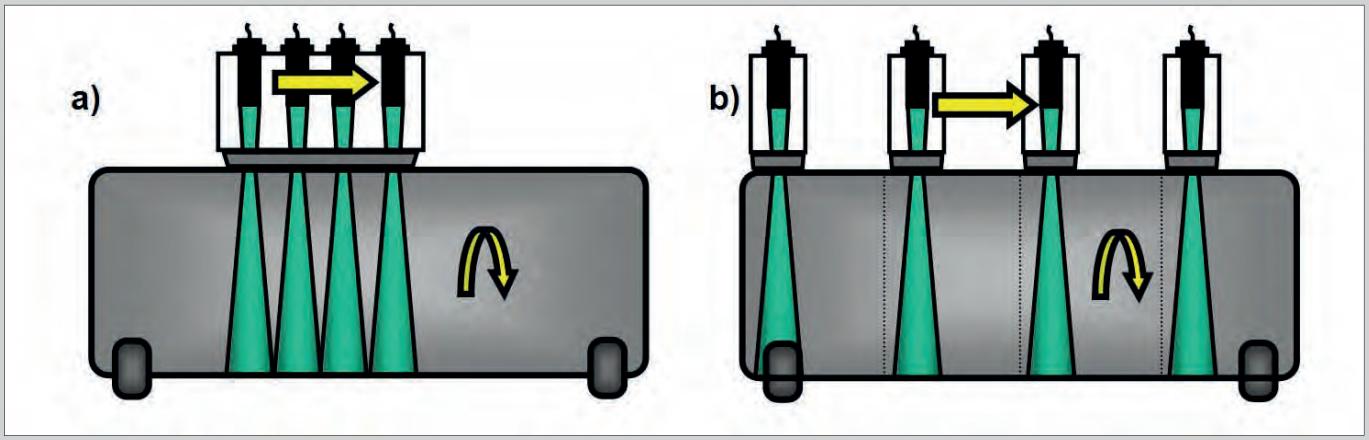
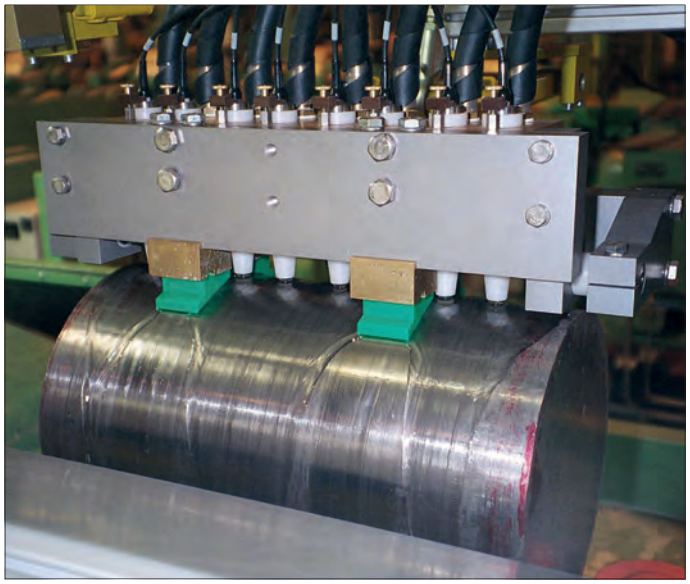
All probes are either mounted into the same probe holder (system type ECHOGRAPH-RPTS), or the probes are evenly distributed over the billet length (system type ECHOGRAPH-ALPT). This depends on the billet diameter, the billet end condition and the billet straightness. Clean cut ends, rather small diameters and good straightness conditions allow the solution of one common probe holder. Cast aluminium slabs with rough ends require the probes being mounted into separate probe holders. In that case, each probe covers a specific section of the billet.

In all cases, overlapping test tracks must be provided for full ultrasonic coverage. The required throughput determines the number of probes. Of course, the probes are a key issue for such a testing machine. Special probes are often line-focussed which enables a high testing sensitivity and a large test track per revolution.



Different probe holder designs for round billet testing: a) all probes are mounted into the same probe holder with a common skid, b) the probes and probe holders are evenly distributed over the billet length. In this simple example, each probe covers 25% of the billet length.

Here, each probe holder contains one straight beam probe. A large metal skid protects the probe and the water nozzle from damage. The cast surface of this aluminium billet is quite rough.



Closer view of a common probe holder with eight straight beam probes. A (white) water nozzle guides the ultrasound for each probe. In this case, (green) plastic skids are used to protect the machined billet surface.

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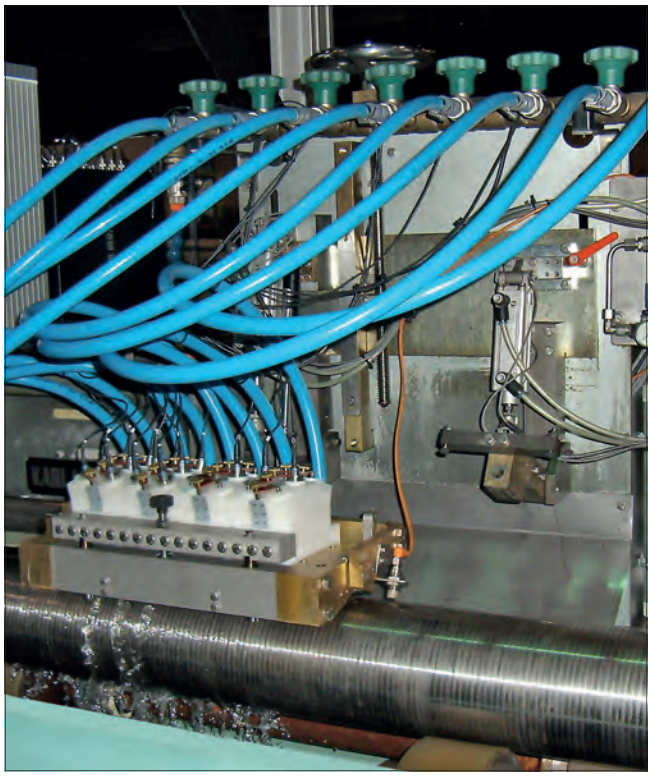
Ultrasonic Inspection of Round Billets

Test portal for steel bars with one common probe holder. The billets are loaded by a transverse conveyor (walking beam) into the test system. After inspection, a linear conveyor discharges the billet.



Testing portal for steel bars with one common probe holder. In this case 8 straight beam probes and 16 angle beam probes (8 clockwise, 8 counter-clockwise) are used. This results in a test track of 80 mm per revolution.

Specimens and Typical Project Data	
Round billets	
Diameter range (D)	typically 100 – 600 mm
Length	typically 3 – 8 m
Weight	typically 100 – 2500 kg
Ovality	up to 1 % of diameter
Straightness deviation	up to 1 mm per metre
Billet end condition	as cast (solution with separate probe holders), clean-cut (allows one common holder)
Test sensitivity	0.8 - 2 mm FBH, depends on material (aluminium or steel), material structure, surface condition

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