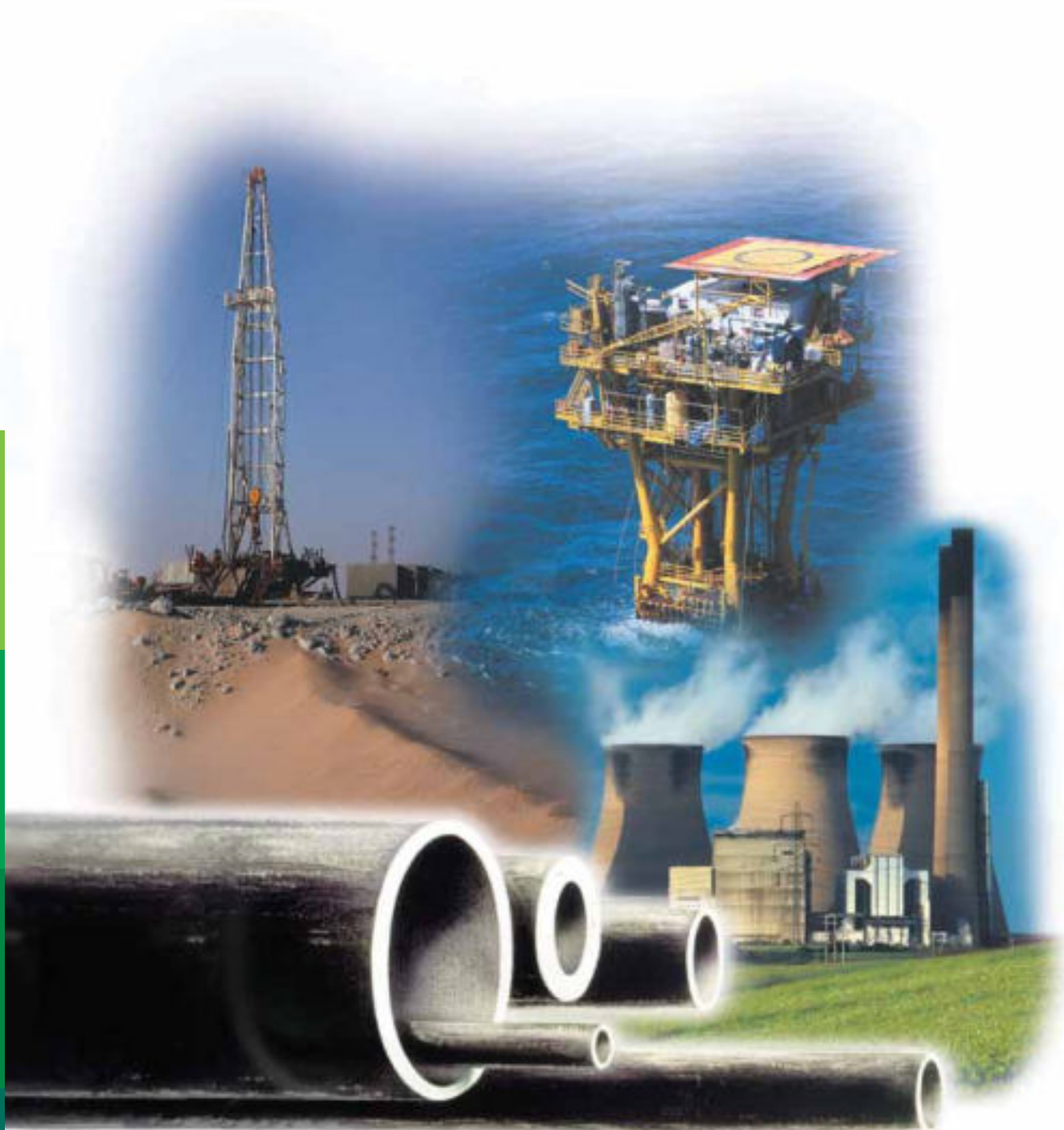


**MAGNETIC FLUX LEAKAGE
TESTING WITH
ROTOMAT + TRANSOMAT**



FLUX LEAKAGE METHOD APPLICATION AND BASIC MODE OF OPERATION

Process reliability and quality control in production of oil field and boiler tubes

Dry – fast – online

The User Standards of the API (American Petroleum Institute) recommend magnetic flux leakage testing expressly for tubes in the range of small to medium wall thicknesses. Online flux leakage testing is used for ensuring process reliability when manufacturing boiler tubes.

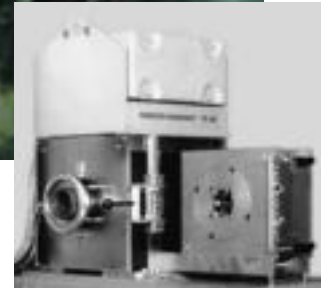
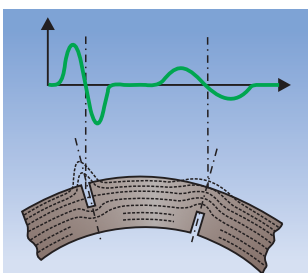
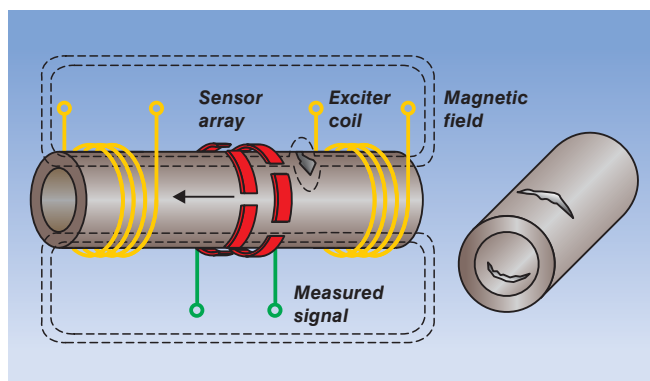
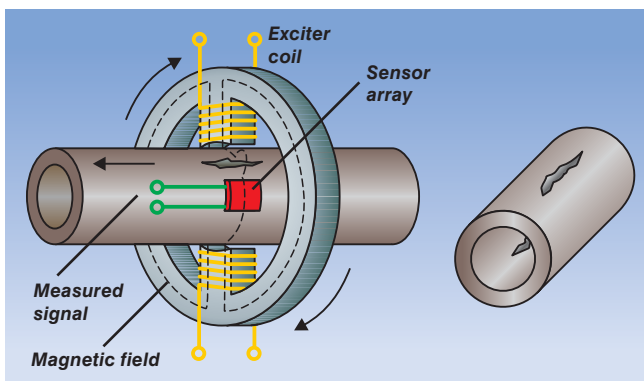


Fig. left: Longitudinal flaw testing with ROTOMAT® and Fig. right: Transverse flaw testing with TRANSOMAT® integrated in multi-test block – in this case at Vallourec Mannesmann in Belo Horizonte, Brazil, for seamless tubes up to 168.3 mm diameter and 12.7 mm wall thickness.



DC field magnetisation over the entire cross-section, transversely on the ROTOMAT and longitudinally on the TRANSOMAT, allows simultaneous testing for external and internal flaws and, thanks to state-of-the-art filter technology and signal gating, permits separate detection of internal and external flaws.

Internationally standardized test methods

The EN Standards 10 246-4 and -5 and ISO 9402 and 9598 describe the process of magnetic flux leakage testing. It is the most efficient method for integra-

tion of an automated, non-destructive test in the production process for seamless, hot-rolled tubes. The primary aim is to detect rolling flaws.

EFFICIENT SOLUTIONS FOR YOUR PRODUCTION



Production



Shipment



Statistics



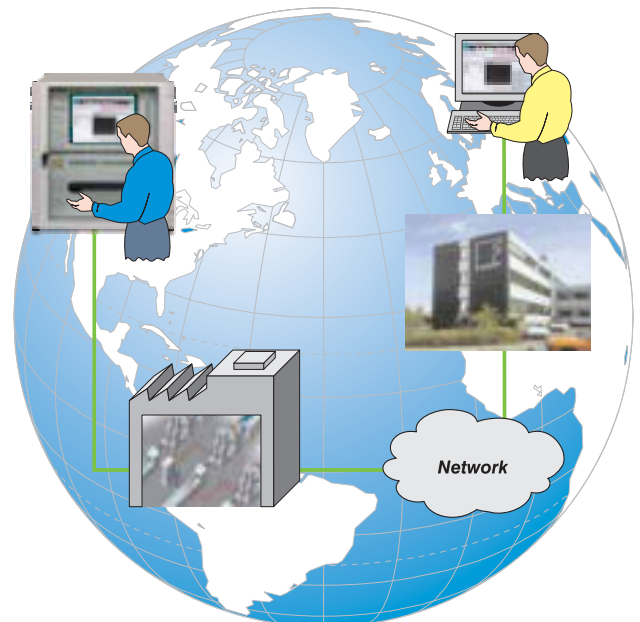
Remote Service

FOERSTERnet

ROTOMAT®/TRANSOMAT® in-process flux leakage method



Any number of computers can access the testers via the FOERSTERnet®. This is made possible by implementation on the Windows® platform and Active X interfaces to other Windows® programs. Automatic adjustment operations guarantee reproducible testing. Integrated diagnostic functions make the automatic test result reliable. Archiving of all test results allows individual result summaries for short-term and long-term documentation and for result investigation.



Network integration

Even existing production and quality assurance systems can be expanded conveniently with the ROTOMAT/TRANSOMAT testers. The platform for this integration is formed by the DEFECTOTEST® DS 2000, the new instrument concept for electromagnetic testing using digital systems engineering. It allows multi-channel applications and adaptations to individual requirements.

Production

Intended for use in the production environment, the monitor is designed as a touch screen in line with industrial requirements. Operation is facilitated by logical menu prompting. The test sequence is performed in real time with visualisation of the original signal and provides a full overview at all times.

Shipment

Documented quality to ISO 9000 thanks to user-specific, automatic logging.

Statistics

Extensive documentation for each test piece and each flaw allow subsequent research and form the basis for product liability

Remote service

Direct communication with the test instrument through connecting to other networks (LAN and WAN) allows remote servicing by qualified FOERSTER Support Center staff.

INSTRUMENT STRUCTURE

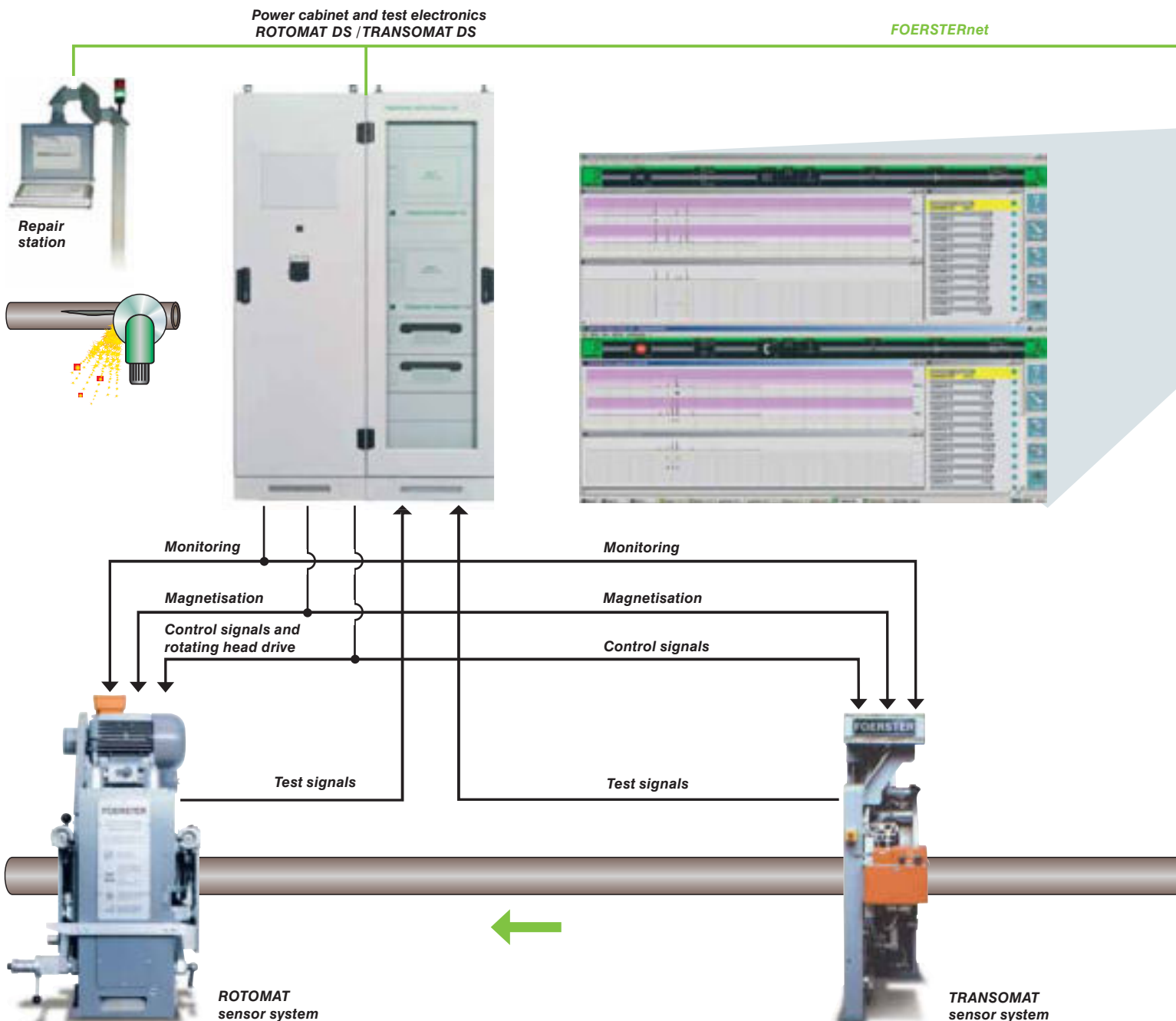
Layout

The instrument concept provides one common cabinet for the test elec-

tronics of **ROTOMAT DS** and **TRANSOMAT DS**. Functions serving the pur-

pose of control and monitoring of the sensor systems resp. relating to the testing section are accommodated in a separate power cabinet which con-

currently operates as the interface to the testing section PLC.



The central PC acts as the operator interface with touch screen, mouse and keyboard. This is where the instrument specific functions are combined for

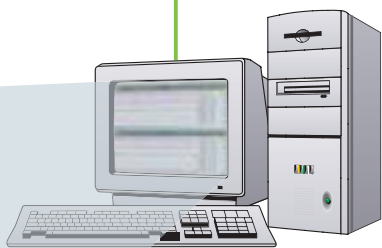
- setting
- signal display
- evaluation
- result presentation
- result storage

The **Instrumentation Software** – a Data Management Tool from **FOERSTER** – can be installed as well in this central PC as an option. This special software tool combines the various testing systems of a multi test block by a standardized network. This enables a

central setting procedure of all testers, a central start of test requests, a summarized display of test results, and as well a combined test protocol for each tested tube and for each test request. The Instrumentation Software is able to operate up to eight testers.

At the same time the central PC operates as the interface to higher-level quality monitoring and production control computer systems.

FOERSTERNET



Central PC

Adding other FOERSTER testers

Grade verification with **MAGNATEST® DH** based on simultaneous multi-frequency technique and special-purpose HZP evaluation software eliminates the possibility of material mix.



MAGNATEST DH

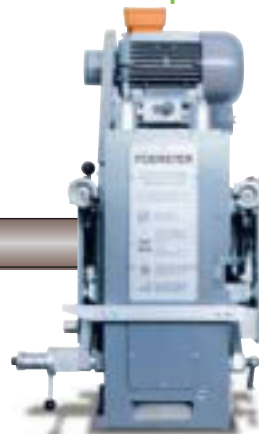


MAGNATEST coil

Adding other testers

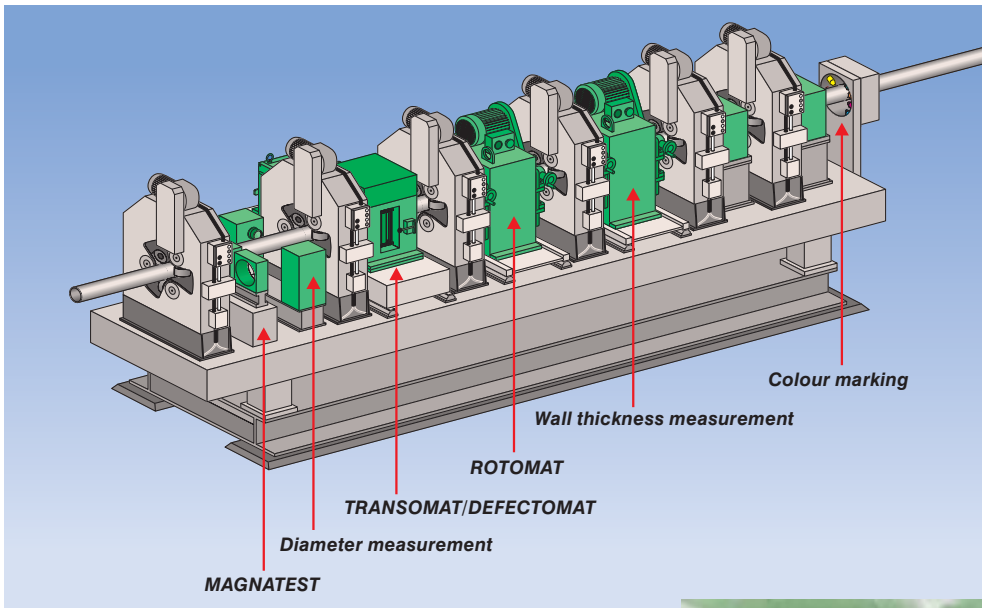
Wall thickness measurement in particular represents a practical complement for assessing process reliability. Ultrasonic testers are used for such applications. The answer of **FOERSTER** is **CIRCOSON® WT** based on EMAT technology.

Integration of laser measuring instruments for determining the tube diameter or integration of length measuring systems are also possible.



CIRCOSON WT sensor system

ALL-IN SOLUTIONS FROM ONE SINGLE SOURCE



Guide elements

For the use of centric arrays, it is advisable to set the arrays up on a joint lifting table, which minimises the conversion times. The sensor systems are located on individual shifting tables, so that they can be withdrawn individually from the line. When using V-roller arrays, the sensor systems are positioned on the lifting/shifting tables.

Mechanical construction of the testing section, integration of other testers

FOERSTER supplies not only the tester, consisting of electronics and sensor systems, but also the required testing mechanism. Only the interaction of all units complies with the stringent requirements applicable to a test system for reliable quality assurance. Driver and guide elements in a centric or V-roller array provide the required precision when transporting the tubes through the sensor

system. The test system can be extended with other testers, e.g. for grade verification with MAGNATEST, for diameter measurement and for wall thickness measurement with laser or ultrasonic systems made by other manufacturers as a complement to the ROTOMAT DS and TRANSOMAT DS flaw testing system. A corresponding multi-channel colour



marking system is self-evident. The results of all testers are merged and documented on a com-

mon computer with software which is generally customer-specific.

Control room providing a direct view of the multi-test block



SENSOR SYSTEMS

Interchangeable inserts and various sensors allow flexible testing, matched to throughput and material

The Ro 180 and TR 180 sensor systems feature an extremely narrow design and are provided with interchangeable test inserts in order to minimise conversion times which play an important role in the small

tube diameter range since the sensor systems are pre-assembled. This smaller design also achieves the maximum throughput speeds of 2.6 m/s. The larger sensor systems are designed longer and allow max. test speeds of 2 m/s, depending on tube diameter.

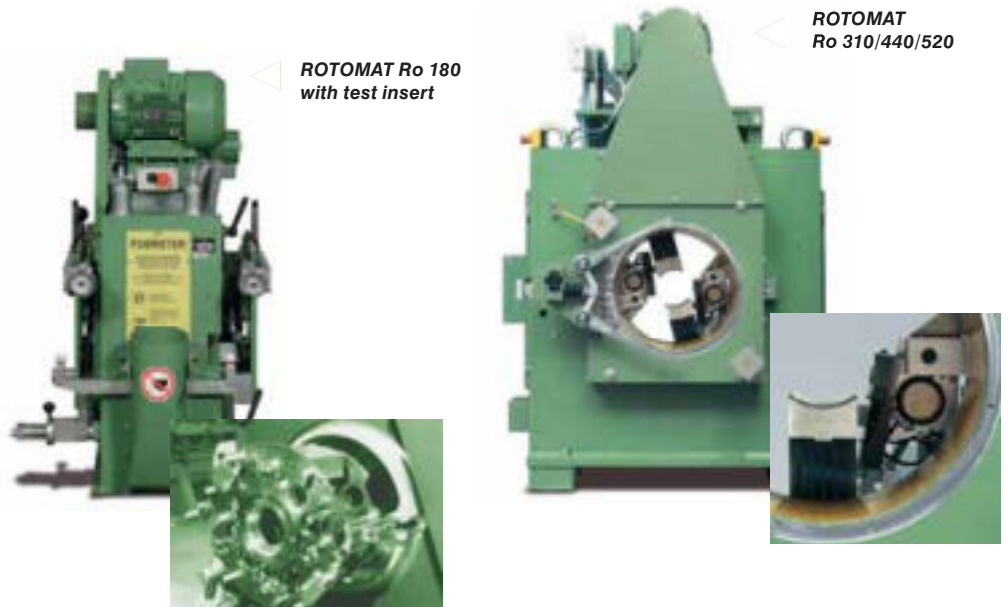
The test heads are guided on the material and are protected reliably against

wear. Slide-on mode or touch-down mode can be selected for operation depending on the nature of the tube ends. Tubes with flared ends can be tested with sensor systems featuring lift-off control. The type, length and number of sensors in the magnetic field are selected depending on the testing task and will also depend on the throughput. The Ro 180 basically has one

integrated roller guide upstream and downstream of the sensor system. The Ro 310 optionally features an inner roller guide and an exit roller guide for small tube diameters which can be controlled in the case of tubes with upset ends.

ROTOMAT sensor systems

Four rotating heads cover the diameter range of the tubes up to max. 520 mm.
Ro 180 from 20 to 180 mm
Ro 310 from 40 to 310 mm
Ro 440 from 50 to 440 mm
Ro 520 from 60 to 520 mm



TRANSOMAT sensor systems

Three sensors systems cover the diameter range of the tubes up to max. 440 mm.
TR 180 from 26 to 180 mm
TR 310 from 40 to 310 mm
TR 440 from 50 to 440 mm





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