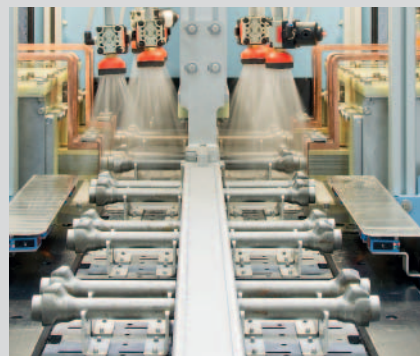


Definitely Tested!



DEUTROFLUX / DEUTROMAT
Magnetic Particle Testing Systems

KARL DEUTSCH

KARL DEUTSCH Pruef- und Messgeraetebau, Wuppertal Company Portrait

The company KARL DEUTSCH was founded by Ing. Karl Deutsch in 1949. Since the early 1950's, instruments, magnetic inks and testing systems for magnetic particle testing have been developed and produced. Three application laboratories support our customers in case of difficult test tasks. Mechanical and electrical construction, as well as PLC-programming are carried out in-house. This provides one-stop solutions and allows fast reactions to customer-specific requirements. A modular mechanical design is the base of our modern testing systems. Normally, multiple AC circuits are provided and water-based FLUXA concentrates (magnetic inks) are used for crack detection.

The product range of KARL DEUTSCH also includes mobile solutions for magnetic particle testing such as DEUTROPULS yokes and power packs. Portable ECHOGRAPH ultrasonic flaw detectors and stationary ultrasonic testing systems are used for the detection of internal defects. In addition, test gauges for the measurement of coating thickness, wall thickness, magnetic field and crack depth have been a part of our product range for many decades.



Works 1 (erected in 1967, extended in 1972) is the head office where the administration, application labs and electronics R&D are located. Portable test instruments, sensors and crack detection liquids are produced here.

Already in 1993 our quality management system was certified by TÜV Nord in accordance with DIN EN ISO 9001. Regular audits have been successfully conducted since.



In 1978, Works 2 was erected for the enlarged production of testing systems. It was extended in the years 2004, 2006 and 2013. The hall built in 2013 houses a laboratory for ultrasonic testing systems. In 2008, a 108 years old segment of Wuppertal's famous suspension railway was purchased and is now on display as an industrial monument.



The staff of KARL DEUTSCH in front of a large testing system. Overall, an assembly area of 1800 m² and two overhead cranes are available in the testing systems workshop.



Modern machinery is used for the in-house production of mechanical parts. The picture shows a CNC-machine which is able to import CAD-data for fast processing and production.



The electrical and mechanical assembly in Works 2 is carried out by qualified and motivated employees.

DEUTROFLUX EW HW and UWE Test Benches

Testing Systems with Two Contacts

Most application problems in magnetic particle testing can be solved by testing systems with two contacts (yoke magnetization principle). Often the parts to be tested are manually placed into the respective supports of the testing system. Afterwards, it pneumatically clamps the test piece. The next step comprises magnetization and spraying with magnetic ink. This usually takes about 4 seconds. Water-based concentrates are commonly used and sprayed by nozzles onto the workpieces.

Usually a multi-directional magnetization is employed. A longitudinal current is fed through the test piece and hereby a circular magnetic field is generated (direct current flow). This circular field enables the detection of longitudinal cracks. Additional coils are mounted to the workpiece supports of the testing system. Therefore, at the same time, a longitudinal magnetic field is produced which allows the detection of transverse cracks

(field flow). Usually both magnetic fields are phase-shifted alternating fields (also called swinging fields) which oscillate with the mains frequency (50 or 60 Hz, respectively). The resulting rotating magnetic field facilitates the detection of defects of all orientations.

For the next step of the test cycle, spraying with magnetic ink is stopped and the magnetic field is kept constant for another 1-2 seconds: the so-called post-magnetization. During this time, the magnetic particles (iron or iron-oxide powder) in the ink form the crack indications. Most inks use fluorescent particles and therefore the crack indications are evaluated under UV-light.

The demagnetization can be carried out directly within the testing system by reducing the field strengths to zero following a linearly decreasing slope. Alternatively, a separate coil outside the testing system can be used.

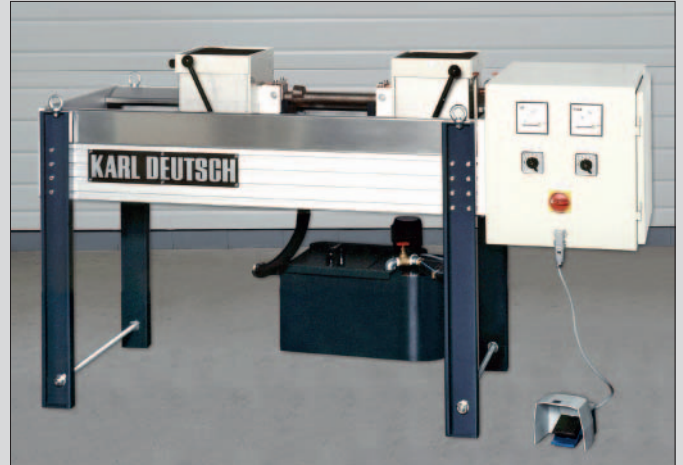


DEUTROFLUX UWE: Universal test bench with two contacts and multi-directional magnetization. Both fields can be adjusted independently. The test bench is available in three sizes. The maximum length of the test piece is then 350 mm, 600 mm or 900 mm, respectively. A release handle for the adjustment of the clamping length is mounted outside the spraying area. Therefore, a smooth-running adjustment is ensured. The picture shows a pneumatic spraying unit which automatically moves backwards after the designated spraying time.

DEUTROFLUX EW HW and UWE Test Benches Testing Systems with Two Contacts



The HW testing system provides a circular magnetization produced by a direct current flow for the detection of longitudinal cracks (e.g. for wire testing). The system contains a fixture for two mobile UV-LED lamps which can be easily removed for flexible evaluation of all test piece surfaces.



The EW testing system offers multi-directional magnetization (2 separate field circuits) and is available in two lengths (300 mm and 600 mm).

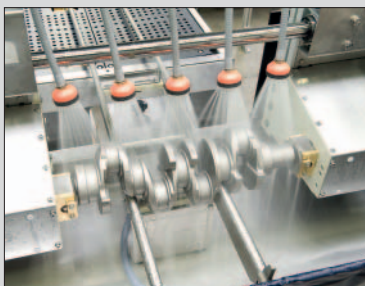


The UWE 350 testing system provides clamping lengths of up to 350 mm. This example shows a mobile test bench with a motorized adjustment of the clamping length, MEMORY PLC software, heavy duty rollers and a folding roof – perfect for service inspection companies.



This example shows a special version of a UWE bench with a test mechanic of low height for convenient loading. It is therefore well suited for production lines with a high level of automation. The adjustment of the clamping length can be motorized and automated.

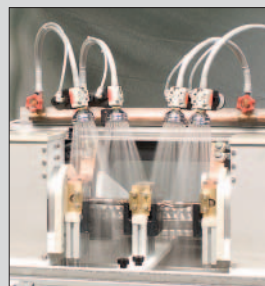
Options:



Automated unloading with pneumatic workpiece ejector



Drawer for test ink container



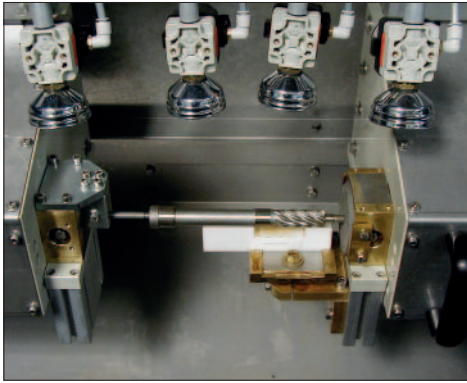
Testing of two small parts per cycle with middle contact



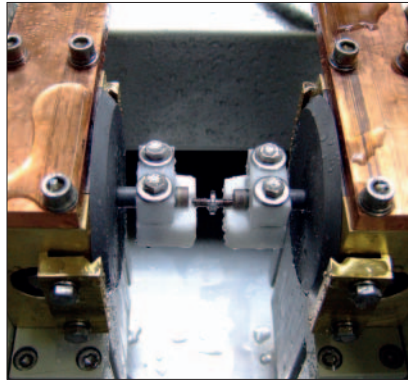
Field clamping switch (AC/DC for aerospace parts)

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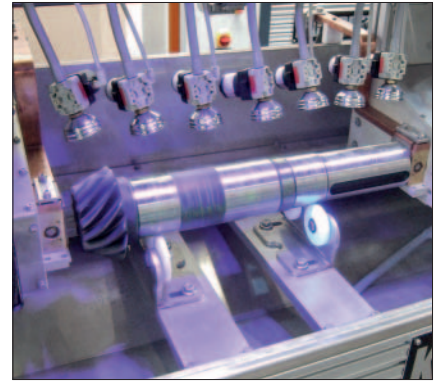
Workpiece Holders for Test Benches with Two Contacts



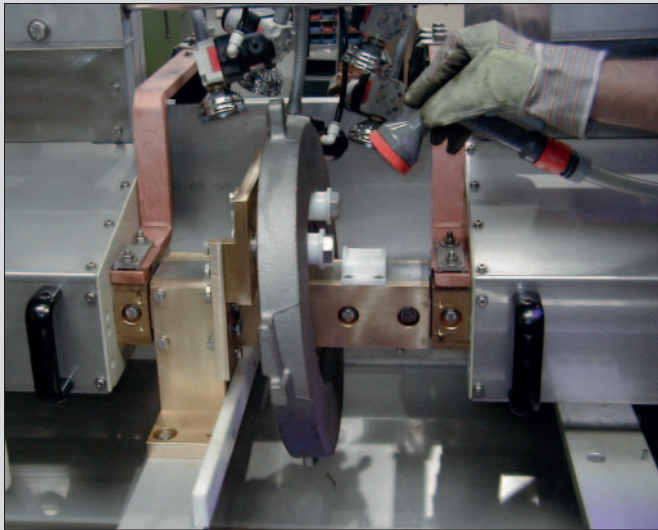
Workpiece holder and special contact for spindle



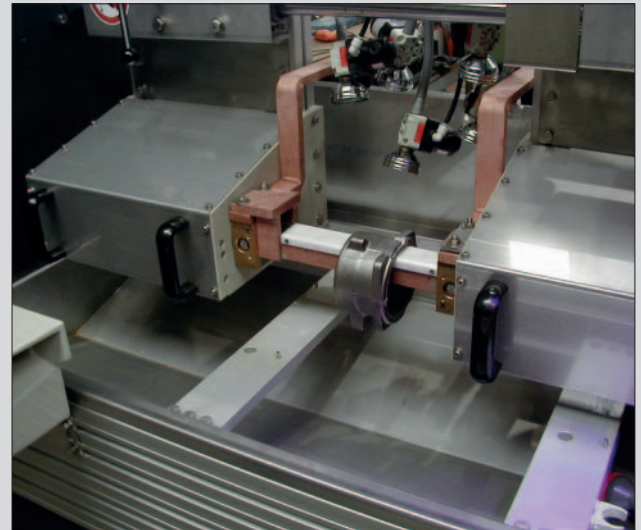
Workpiece holder and special contact for testing of small parts



Roller support for shaft testing. In this case the shaft is turned manually.



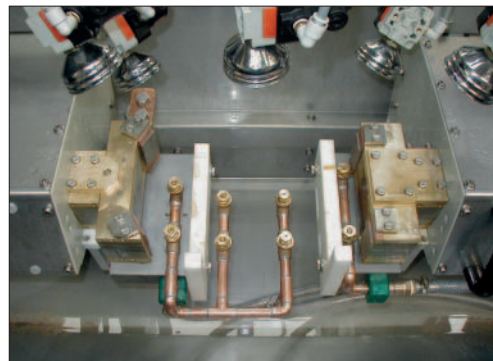
Testing of hollow parts with a magnetization bar and a plastic roller support for manual rotation of the test pieces during evaluation.



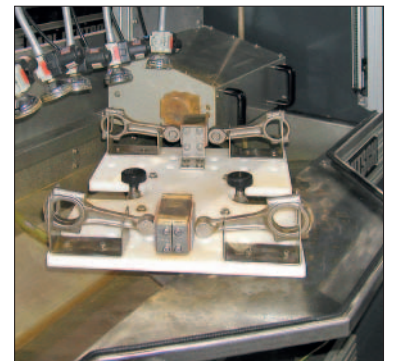
Hollow part testing with side-mounted magnetization bar. The surface of the bar is covered with plastic to protect sensitive test parts.



Workpiece holder for complex-shaped casting



The same workpiece holder, now empty. Nozzles for spraying the bottom surface are visible.



Rotary workpiece holder with middle contact for piston rod testing

DEUTROFLUX UWS Series

Testing Systems with Moving Coil for Long Workpieces

Workpieces with a length above 900 mm can not be satisfactorily tested with testing systems where the longitudinal fields are produced by side-mounted coils (principle of yoke magnetization). While the current magnetization and the respective circular magnetic field for longitudinal defect detection is constant for the entire workpiece length (for constant diameter), the longitudinal field for transverse defect detection is too weak in the center region of the workpiece. Therefore, a moving coil is employed, which fully surrounds the workpiece. The magnetic ink is sprayed onto the workpiece with a ring of nozzles, which is mounted to the moving coil. The speed of the moving coil is adjusted so as to perfectly wet the entire workpiece surface and to ensure sufficient magnet-

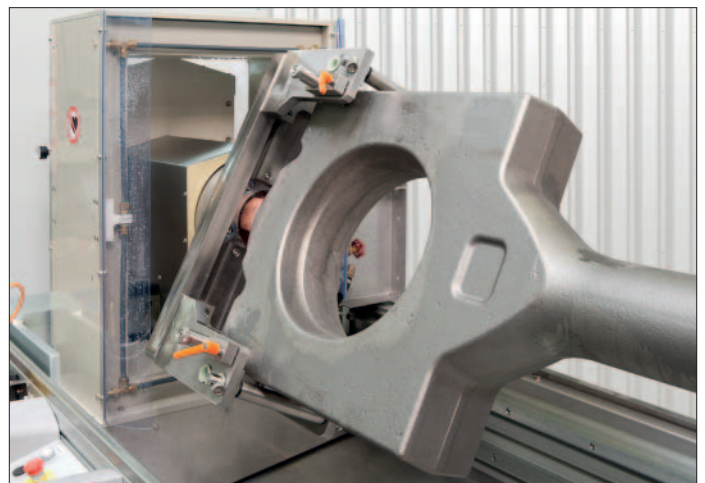
izing time to form the crack indications. The moving coil of the DEUTROFLUX UWS system contains two nozzle rings for spraying. Therefore, the moving coil can operate in both travelling directions. The clamping length is manually adjusted and the respective movable contact is mechanically clamped. Optionally, the clamping length adjustment can be fully automated. In that case, the movable contact is motorized and the contact position for each respective workpiece is stored in the MEMORY PLC software. After arrival at the designated position, the contact is pneumatically clamped. Normally, the rather heavy workpieces are loaded by cranes, robots or lifting devices. The roof of the darkroom cabin must be prepared accordingly with an opening.



DEUTROFLUX UWS testing system for the inspection of railway axles. This testing system is equipped with three UV lamps which are mounted to a common support. The support is pneumatically moved between safety position during loading and test position. The axles are approximately 2.5 m in length. A motorized roller support provides a workpiece rotation in both circumferential directions for convenient visual inspection.



Moving coil with ring of nozzles for crankshaft testing



Specially designed current contact for ship piston rod

DEUTROFLUX UWS Series Testing Systems with Moving Coil for Long Workpieces



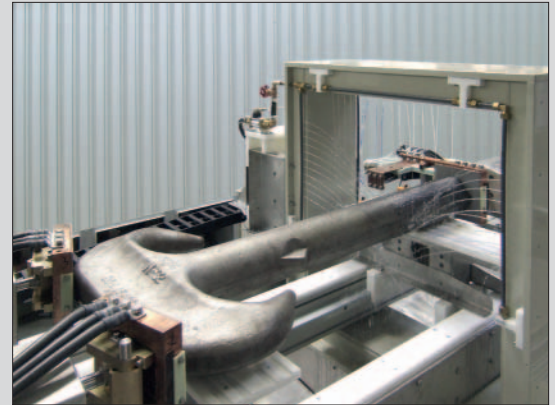
Inspection of a large shaft for power generation. This UWS testing system is equipped with a heavy duty traverse in order to handle large workpiece weights. The traverse and the workpiece are both surrounded by the moving coil.



Additional side-mounted coils (UWE magnetization principle) are added to this UWS testing system. Therefore, this machine can be used for short or long workpieces, respectively. The picture shows a pinion shaft and a gear wheel for power generation.



The inspection of ship piston rods requires workpiece-specific supports. The supports must allow for a secure motorized rotation for convenient inspection of all surfaces.



The inspection of these large hooks is carried out with a moving coil and three current contacts.



Many workshops of DEUTSCHE BAHN AG (German Railways) use KARL DEUTSCH systems for axle testing.



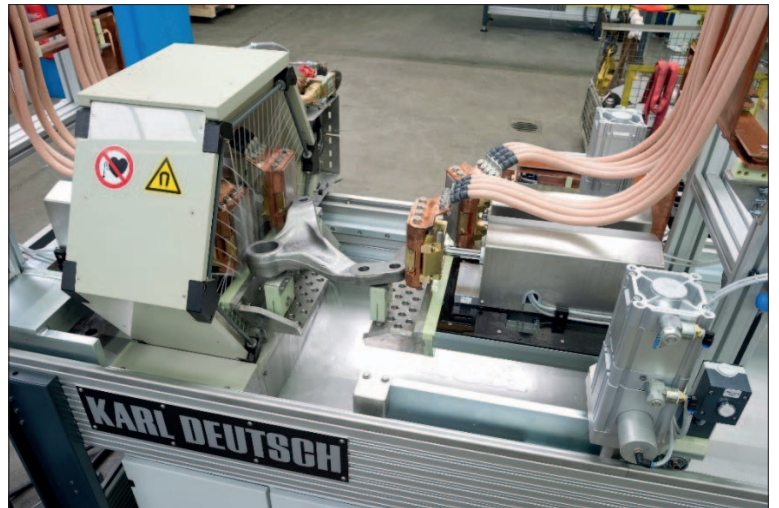
The inspection of railway axles with mounted wheels requires a coil of extended diameter.

DEUTROMAT – Customer-specific Testing Systems

Multi-Contact Testing Systems, Systems with Chain Conveyor



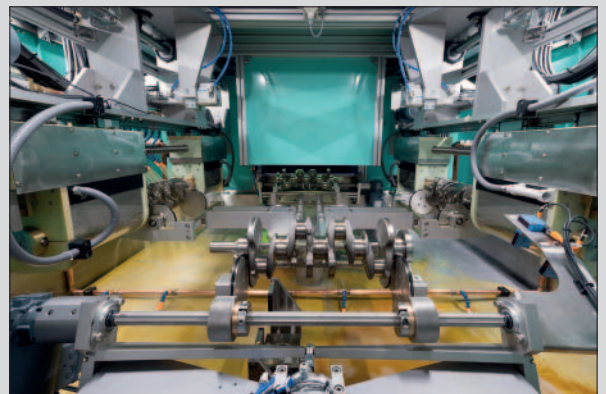
This truck steering knuckle is tested with four contacts. The workpiece loading is carried out with a robot. The steering knuckles are discharged towards the rear of the testing system by means of two height adjustable heavy duty chain belts.



Forgings of complex shape can be magnetized in this testing system with up to four current contacts and a moving coil. The shown transverse link requires a coil and three current contacts.



Testing systems in turn table design allow efficient loading and discharging, e.g. by means of a robot.



This turn table for crankshafts provides four stations: Loading/discharging, magnetization, evaluation and demagnetization.



This picture shows a system for wheel hub testing with a chain conveyor for workpiece transport. Similar testing systems for up to eight test pieces per test cycle were implemented already and provide a very high throughput.



This testing system with a middle contact is used for the inspection of two wheel hubs per cycle. Discharging of the test pieces is carried out via a chute.

DEUTROFLUX MEMORY – PLC with Parameter Storage for Magnetic Particle Testing FLUXA-Control – Automated Supervision of the Magnetic Ink

The requirements concerning documentation and level of automation are constantly increasing. The DEUTROFLUX MEMORY PLC software is therefore an important tool. Relevant test parameters, test time, test result and – where necessary – name of operator etc. can be managed and documented by

the Siemens PLC software. Password protection for some parameters can prevent operating errors. Regular service intervals or the supervision of magnetic ink or UV lamps can be monitored by the PLC software.



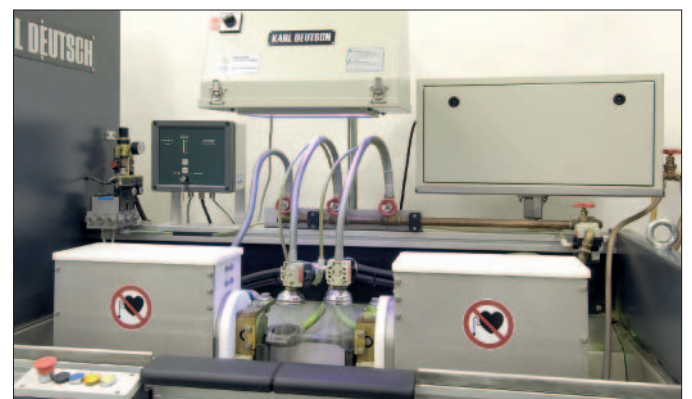
In-house PLC programming provides flexible implementation of customer-specific requirements.



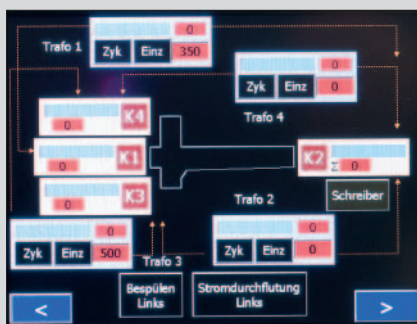
As needed, mobile touch panels are provided.



With a Siemens touch panel, clear text menus are provided.



With FLUXA-Control, a fully automated supervision of the magnetic ink is implemented. Every two minutes, the quality of the ink is measured and controlled.



Complex tasks such as multi-contact testing can be managed and documented in a convenient way.



FLUXA magnetic inks are available in many different recipes. Grain size, corrosion inhibition, carrier fluid and other parameters are carefully adapted for the respective test task.

DEUTROFLUX / DEUTROMAT

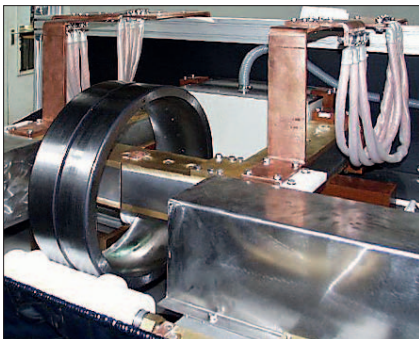
Applications from Many Fields of Industry

Magnetic particle testing is a common method in various fields of industry. Many customers are from the automotive industry, where forgings are tested for surface cracks directly after their production. Railway and aerospace components

are often tested in new condition, but also in the maintenance workshops at regular checking intervals. Also the power generation industry requires a wide range of tests on shafts, bearings and gears.



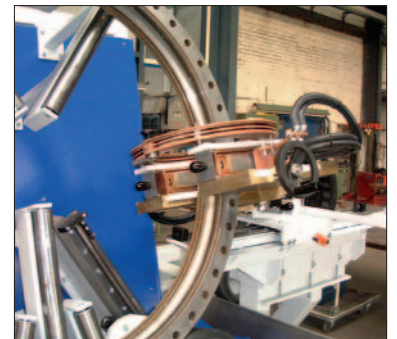
This picture shows a testing system for new railway wheels. The system is part of a fully automated production and inspection line. A workpiece carriage (left in picture) is used for efficient loading and discharging to achieve the highest possible throughput. The carriage is fitted with adjustable motorized rollers which can handle and rotate all specified wheel geometries. After the wheels have arrived at the test position, a trapezoidal coil is lowered and surrounds the top portion of the wheel. The inspection takes place during wheel rotation and spraying with magnetic ink.



The inspection of large bearing rings by means of a magnetization bar and a closed yoke for highest possible magnetic fields.



Large rings for wind turbines are often tested in vertical position. The inspection requires one full rotation.



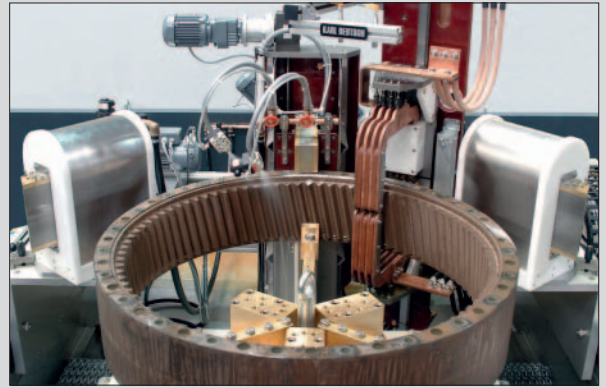
The magnetization unit for large rings consists of a pair of yokes and a flap coil.

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Applications from Many Fields of Industry



The inspection of a large pinion shaft with a weight of 4 tons is carried out by means of a specially designed moving coil.



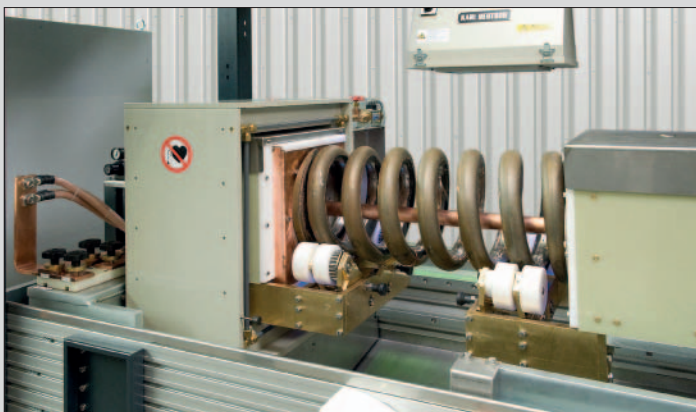
Large gear wheels for wind turbines can be inspected with a cross-yoke arrangement or with a yoke pair and coil.



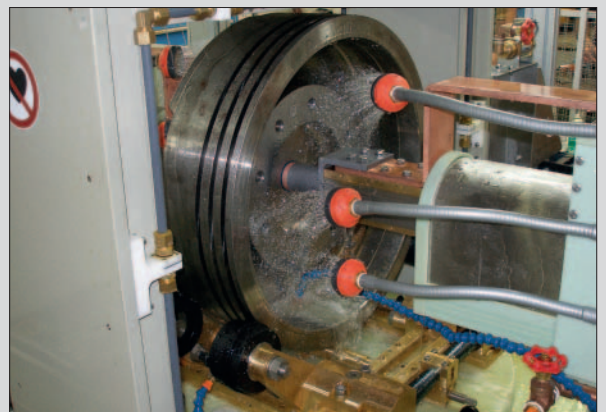
This HW testing system with direct current magnetization for steel bar testing allows rotation and visual evaluation directly in the system.



Seamless tubes can be linearly fed through a combination of magnetizing yoke pair and coil.



The inspection of railway springs uses a combination of direct current magnetization and magnetization bar.



This picture shows the inspection of a large piston for ship's engines with a UWS system.

DEUTROFLUX

Know How on Magnetic Particle Testing – Made in Wuppertal, Germany



Extensive literature on nondestructive testing (NDT) from Prof. Volker Deutsch and his co-authors is available.



KARL DEUTSCH operates an NDT school which is authorized by the German NDT Society (DGZfP). UT, MT and PT courses in accordance with ISO 9712 are offered in German language. Our modern lecture room and our Level 3 personnel ensure a perfect environment. The dates can be found on our website.



Three application laboratories in both workshops are available for customer-specific trials. The available equipment also includes fully operational MT and PT systems. Test method and magnetic ink can be optimized for the samples handed in by our customers.



Our in-house production of MT and PT test agents is subject to strict standards. Internal batch testing and external sample certificates are described in the data sheets.

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