

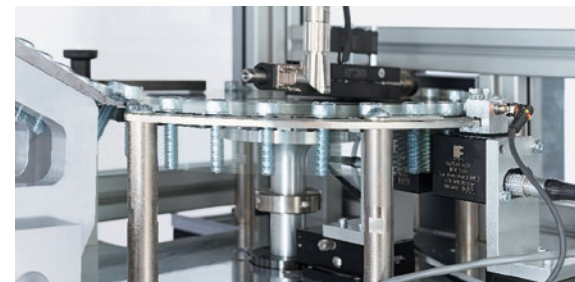
# FASTENERS & CONNECTORS

Reliable quality control for complex parts.



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**When the smallest components must meet the highest requirements**

For over 70 years, FOERSTER has been dedicated to the development and manufacturing of non-destructive testing methods. A wide variety of methods such as eddy current or magneto-inductive testing reveal the quality of metal components and semi-finished products. Our instruments are used worldwide and in a variety of industries – wherever high material quality is absolutely crucial.

For end-to-end quality control in your production processes, we inspect your fasteners quickly, reliably and reproducibly for cracks in the material surface, temper, and the quality of hardening.

Since automation plays a major role in the manufacturing of fasteners and connectors, we also offer automated test solutions individually tailored to your processes in addition to standalone devices.

And we stand by you the whole way: from your first contact with us to the development of customer-specific solutions, through to commissioning and service. Throughout the entire journey, you always have a single point of contact: FOERSTER.

Making quality visible.





FASTENERS & CONNECTORS

# Fasteners & Connectors





**Reliable quality control for fasteners and connectors**

Whether fasteners are simple or complex, the material requirements placed on them are constantly growing, and the production process must keep up with those increasing demands. Not least because these parts are exposed to – and must withstand – constantly high loads, failure can result in exorbitant costs or, even worse, danger to human life. To ensure that these tiny elements cause no great harm, potential material defects like surface cracks must be detected in time. Only then can countermeasures in the production process be undertaken and defective parts promptly rejected.

This is why our instruments, in combination with various sensors, are designed to automatically and non-destructively check your fasteners for cracks, temper and material composition – directly in the production line. The components are inspected at high speed and sorted immediately thereafter. That means you can quickly and reliably assess and document the quality of the components, making adjustments as necessary to the production process.

The following pages will help you discover the variety of testing solutions we offer for your applications.



### Pegs and cotter pins

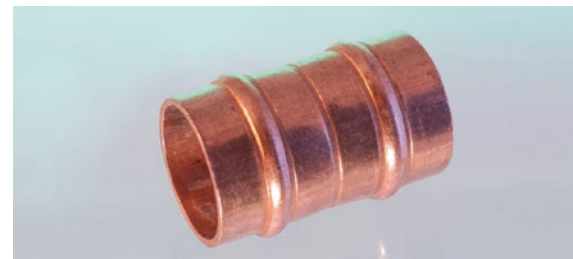
Securing elements such as pegs and cotter pins are often exposed to extreme loads. To make it possible to monitor material properties such as hardening depth and microstructure during the manufacturing process, FOERSTER has developed an automated and non-destructive test solution with high throughput speed.

The MAGNATEST D achieves reliable and reproducible results through automatic test triggering and harmonic evaluation. To ease integration into existing manufacturing processes, we provide a wide selection of encircling coils for different component geometries.



### Nuts and bolts

It's impossible to imagine life without nuts and bolts – they're everywhere! And each one must perform its own important task. Thus, the raw materials must be in perfect condition. FOERSTER has developed special, geometry-adapted probes and encircling coils for in-line inspection of temper and microstructure. For additional surface testing, the STATOGRAPH module is used along with specially created rotating probes to check for surface cracks and to guarantee a high-resolution inspection of the material surface.



### Fittings

A wide variety of fittings are needed to seamlessly connect tubing sections in piping systems. During forming, production-related natural defects can occur – which may later cause component failure. In order to find these cracks early on, FOERSTER offers a testing solution using the STATOGRAPH CM+ along with its FLEXPROBES. These flexible sensors can be optimally adapted to the component geometry of the fittings, and large track widths enable fast and reliable inspection of the entire surface.

- (1) STATOGRAPH® CM+
- (2) FLEXPROBES
- (3) Rotating head R2
- (4) Probes





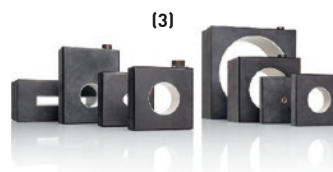
### Clamping rings and springs

Springs and clamping rings are typically under constantly high tension. But they won't withstand this pressure for long unless the components used have been correctly heat-treated. To ensure this, 100% inspections are carried out during production. With its specially adapted coils and probes, the FOERSTER MAGNATEST D enables stable, fully automated testing of the temper and prevents material mix-ups. By using high-performance harmonic evaluation, the MAGNATEST D can reduce interference factors during testing such as geometric part tolerances or temperature influences, thus achieving stable results over the long term.



### Hollow bolts

Although hollow bolts have relatively thin walls, they still need to be very strong. This presents manufacturers with enormous challenges during production. To make sure that only perfect components are supplied, 100% quality inspection for cracks and microstructure are required. This is where our MAGNATEST and STATOGRAPH test systems come into play, in combination with encircling coils and probes. The critical points of the bolts are examined for surface defects and the hardness of the entire component is measured.

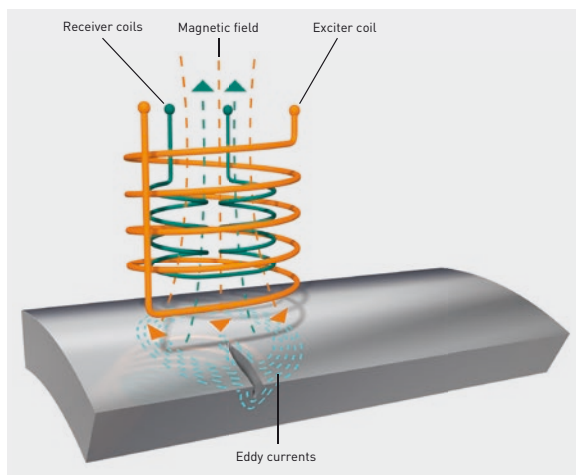


- (1) MAGNATEST® D
- (2) Probes
- (3) Encircling coils

## Crack testing

### Non-destructive testing with the eddy current method

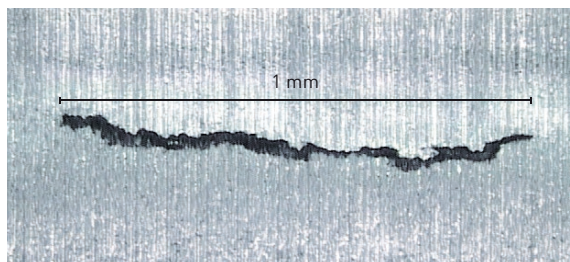
The keen attention paid to quality these days – not to mention the risks associated with product liability – increasingly necessitates 100% inspections of fasteners. The eddy current method according to DIN EN ISO 15549 is an effective non-destructive, non-contact method for material testing. It detects surface defects such as cracks, overrolling, pores and cavities. And it works quickly, reliably and economically: a magnetic field is generated with the aid of differential measuring coils, which in turn induces high-frequency eddy currents in the material. The receiver signal is evaluated against the amplitude and phase shift relative to the exciter signal, exposing even the smallest defects in the material.



The principle of the eddy current method

### Testing for cracks in the material

For crack testing, the test specimen is mechanically rotated and scanned with a fixed probe; alternatively, a rotating probe scans a stationary test specimen. As long as there is no damage, the eddy currents flow evenly through the material, because the electrical resistance is homogeneous. But if there is a crack in the material, the eddy current density shows up as different from that of an undamaged part. This change is recorded and displayed as an error signal.



Natural cracks in turned surfaces

### Testing with STATOGRAPH®

When using eddy current to test for material cracks, appropriate evaluation electronics and probes adapted to the testing task are required. Depending on the test scenario and test object, the STATOGRAPH family of test instruments offers the right system for the purpose.

A variety of standard and shape-matched probes for special applications are available. The choice of probe depends on the component geometry, the cycle time and the defect specification.



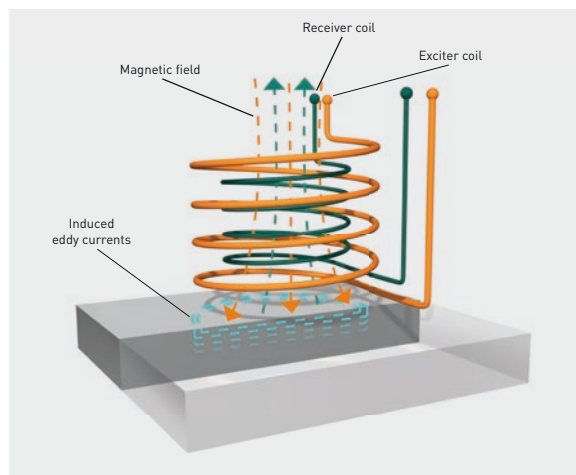
- (1) STATOGRAPH® CM
- (2) STATOGRAPH® CM+
- (3) Probes
- (4) FLEXPROBES



## Checking material makeup and microstructure

### Magneto-inductive testing

The magneto-inductive method also works with eddy current, because its large frequency range allows utilization for different testing purposes. While the high-frequency test reveals material cracks, the low-frequency magneto-inductive test enables greater penetration depths and thus provides information about the temper of the test specimen. Material or microstructure tests can be employed to prevent material mix-ups, for example, or to determine the quality of the hardening. Typical sorting criteria are alloy content, surface hardness, hardness depth, strength and microstructure.



The principle of magneto-inductive testing

### Testing for material properties

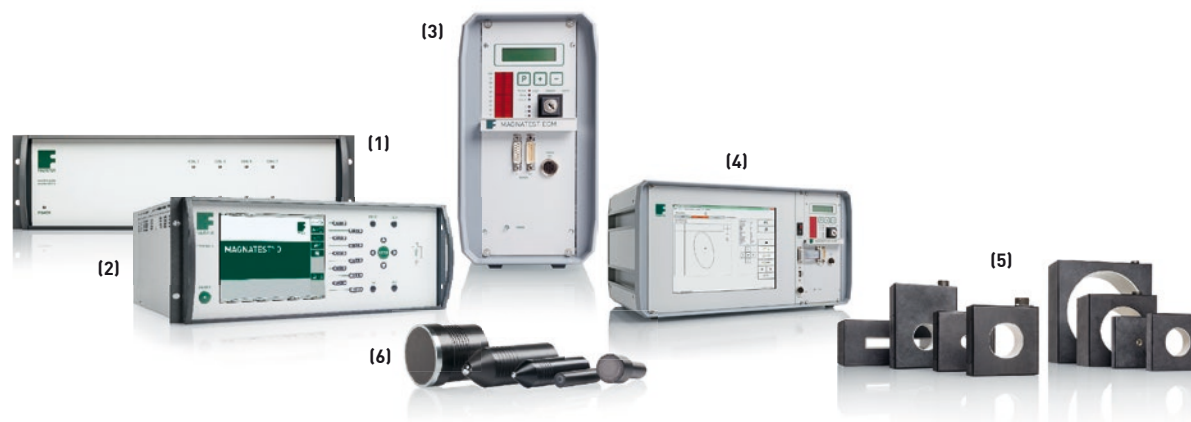
To test for material properties, the specimens usually pass through an encircling coil. Low-frequency eddy currents are induced into the material. The test voltage recorded by the sensor is a result of the magnetic and electrical properties of the part being tested, where the voltage value is graphically displayed as the measuring point. The different hardnesses, alloy constituents or microstructure conditions change the receiver currents and thus allow conclusions to be drawn about the material properties of the test piece.

Statistical evaluation of several measured values during calibration automatically creates a sorting limit. In a subsequent series test, all other measuring points are compared with the specified tolerance limits. The workpieces are then sorted according to their respective test results.

### The MAGNATEST® product family

Depending on the area of application and type of test specimen, the MAGNATEST instrument family offers the right system for magneto-inductive material and microstructure testing on metal parts. A variety of coils and probes round off the extensive product portfolio.

- (1) MULTIPLEXER MAGNATEST® D
- (2) MAGNATEST® D
- (3) MAGNATEST® ECM
- (4) MAGNATEST® ECM CE
- (5) Encircling Coils
- (6) Probes



SYSTEM PROVIDERS

Your system providers  
for completely automated  
testing systems

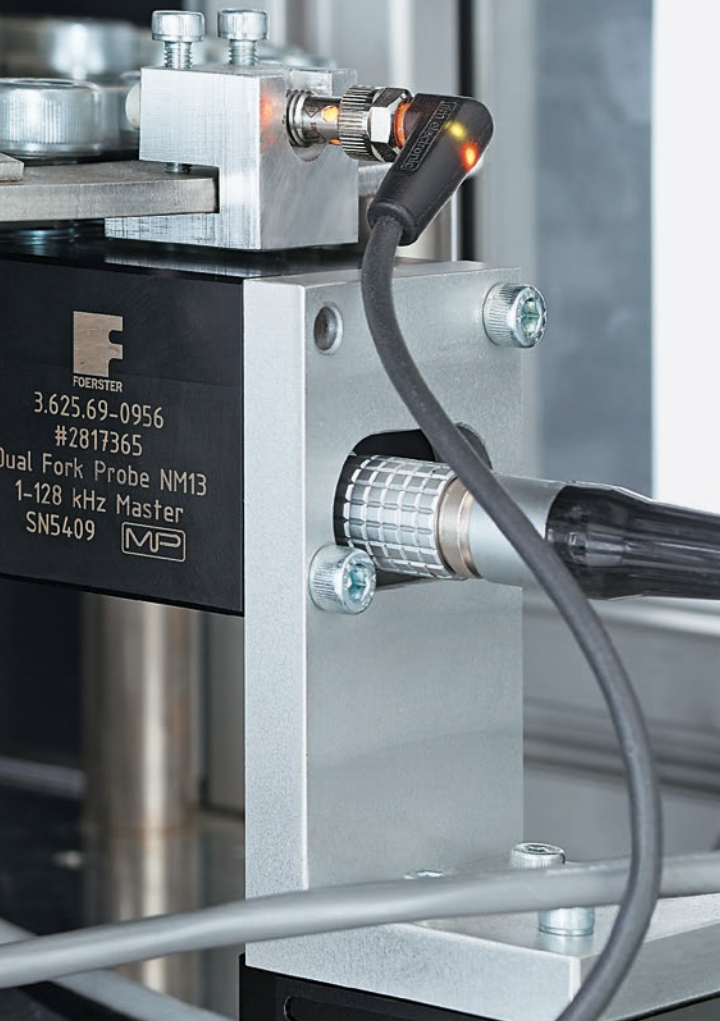




### Automation solutions from FOERSTER

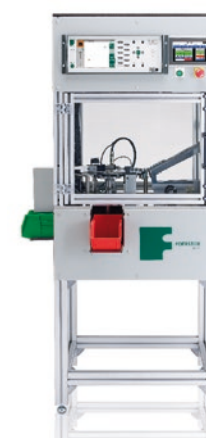
Fasteners and connectors are typically produced in high-speed manufacturing processes. We've taken steps to ensure that you can carry out comprehensive quality assessments without disrupting your production processes. For this reason, we offer not only individual testing instruments but also fully automated testing solutions, including all the mechanics needed for your production line. These are developed and manufactured in close cooperation with you, the customer – always keeping your applications and requirements in focus.

After your consultation with our product and sales specialists, we draw up a concept tailored to your needs. In the subsequent manufacturing process, we work with professional machinery manufacturers, in order to create the best possible product-specific solution for you. We also collaborate with mechanical suppliers suggested by our customers – suppliers who know the characteristics of the components and already have experience in execution. After assembling the line, we further support you with commissioning of the test system, and our service team is available to answer any questions you may have afterwards. In addition, we offer individual product and service training so you can make the best possible use of your testing equipment – starting on day one.



*The "Merkur" production-line test cell at the HDS-Group GmbH for geometry and microstructure testing of headless connection elements such as pins and sleeves. With an integrated MAGNATEST D from FOERSTER*

© Image courtesy of HDS-Group GmbH, Remscheid, Germany



*FOERSTER Fastener Tester for automated structure testing of a wide variety of fasteners such as screws, bolts or pins*





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