

Dynamic and Fatigue Testing Systems



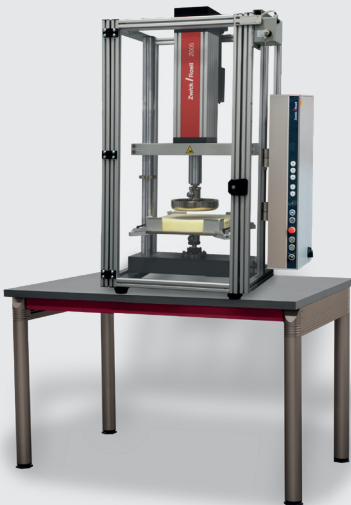
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1 ZwickRoell – Passion and expertise

For over 160 years, ZwickRoell, a family-owned company has stood for extraordinary technical performance, innovation, quality, and reliability in materials and components testing. ZwickRoell is a world leader in static materials testing. Our testing machines are used in R&D and quality assurance in more than 20 different industries.

ZwickRoell also has a long-standing tradition in the field of dynamic testing technology. It is hard to imagine a laboratory engaged in high cycle fatigue testing of metallic specimens and components without resonance testing machines. To this end, our strategy includes gradually expanding our servohydraulic product portfolio, which we most recently enhanced with our newly developed LTM testing machines with patented linear drive.

Dynamic testing machines from ZwickRoell



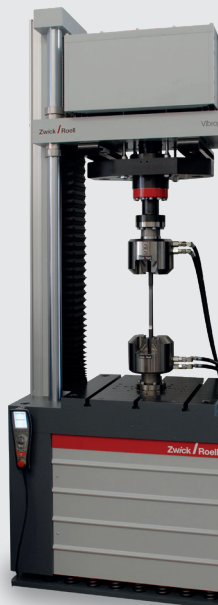
Electromechanical servo testing actuator



LTM electrodynamic testing machine



HA servohydraulic testing machine



Vibrophore

At ZwickRoell, we use various physical drive principles for our dynamic testing machines. Each has its own specific advantages and areas of application, allowing us to find the optimal solution for your test task in line with your requirements.

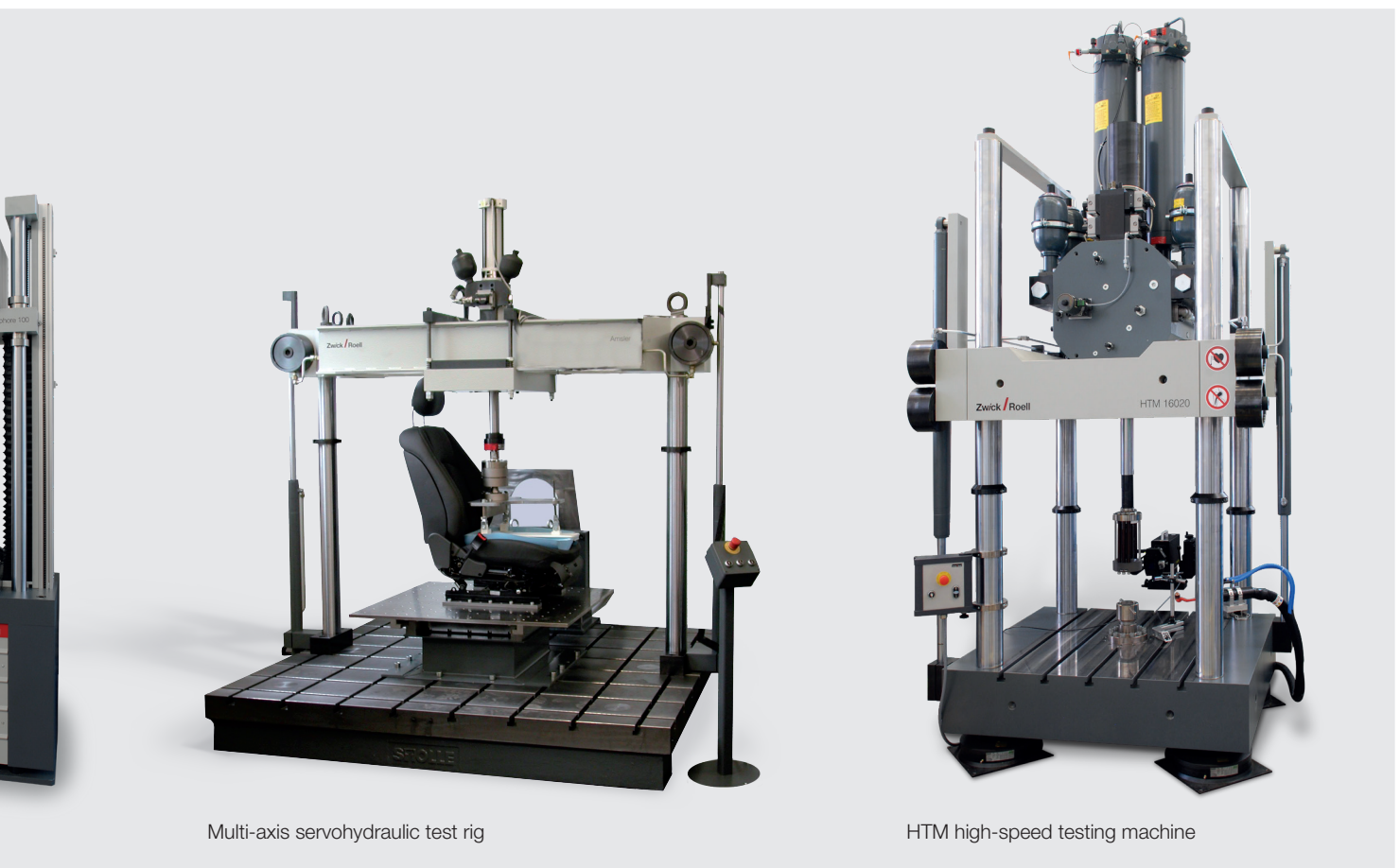
The strengths of servohydraulic testing machines lie in the wide range of applications for which they are suitable. In terms of force, amplitude and frequency, they can be used universally. This also allows servohydraulic testing machines to be used for multi-axis fatigue tests or to perform crash tests at speeds of up to 20 m/s. Their modular design includes testing systems up to 2500 kN, and even higher with customized versions.

Vibrophores use an electromagnetic resonance drive to generate dynamic loads, which enables very high testing frequencies and results in short testing times with minimal energy use. The additional screw drive enables the Vibrophore to also be used as true static testing machines. Vibrophore resonance testing machines

are available for test loads up to 1,000 kN and are the preferred choice for tests on metallic specimens and components.

The LTM is an electrodynamic testing machine with a drive based on linear motor technology. ZwickRoell's patented oil-free drive makes these machines suitable for a wide range of static and dynamic tests up to 10 kN. Quasi-static tests at only 0.016 mm/s can also be performed just as easily as dynamic tests at a frequency of up to 100 Hz.

Our versatile, universally applicable electromechanical servo testing actuators can also be used to perform high cycle fatigue tests under certain conditions, for example for testing flexible foams as used in car seats.



Multi-axis servohydraulic test rig

HTM high-speed testing machine

2.1 Servohydraulic testing machines up to 2,500 kN

With characteristics such as high stiffness, ZwickRoell servohydraulic testing machine load frames have been specially designed to sustain the tough demands of fatigue tests. Depending on testing requirements and the need for ergonomic working conditions in everyday testing, the testing actuator is mounted either above or below the test area.

HA series up to 500 kN

With the testing actuator mounted in the lower cross-head, the HA series represents the typical servohydraulic testing machine as used for determining material properties under cyclic loading. It is particularly suitable for tests requiring the use of high-temperature furnaces.

HB series up to 2,500 kN

The HB range has the actuator located above the test area. These machines are particularly versatile. In the version with an integrated T-slot platform, flexure tests and components testing can be performed in addition to standard high cycle fatigue tests.

Features

- Convenient working height
- Hydrostatic-bearing sealless axial actuator - no sliding friction and therefore no wear or stick-slip effects
- Only hydrostatic-bearing actuators can absorb considerable transverse forces; this is of particular importance in compression and flexure tests and in component testing
- Hydraulic clamping and adjustment for easy positioning of upper crosshead
- Hard-chromed columns for precise guidance of upper crosshead for tests in corrosive media
- Wide range of dynamic load forms, including sinusoidal, rectangular, triangular and trapezoidal
- Also suitable for quasi-static tests due to ZwickRoell's "two-in-one" function



Fig. 1: HA 100 for low cycle fatigue (LCF) tests at high-temperature (up to 1,200 °C)



Fig. 2: High cycle fatigue tests on wire strands to ISO 15630-3

Low cycle fatigue (LCF) tests

Typical applications for servohydraulic testing machines include low cycle fatigue tests. During a low cycle fatigue test, the material is cyclically loaded at a specific (usually elevated) temperature until it undergoes a slight plastic deformation. The specimen (material) withstands only a few thousand load changes under this type of loading. During this process, the demands placed on the testing machine and the machine controller are particularly high. In the transition from elastic to plastic deformation, the stiffness of the specimen changes dramatically and the controller must react very quickly to, for example guarantee a constant strain increase rate. Here, very high stiffness of the testing machine plays an imperative role.

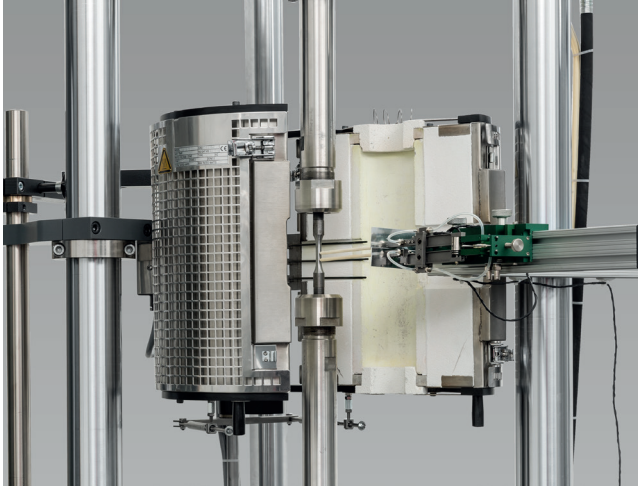
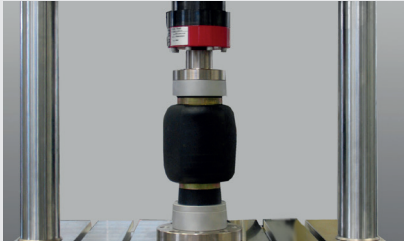
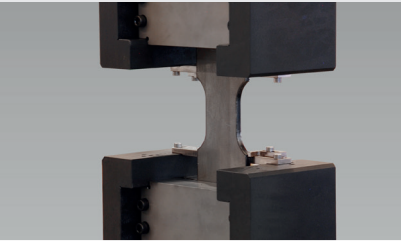


Fig. 1: Low cycle fatigue (LCF) tests at high temperatures

Further typical applications for servohydraulic testing machines



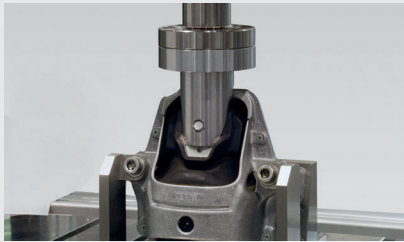
Air springs



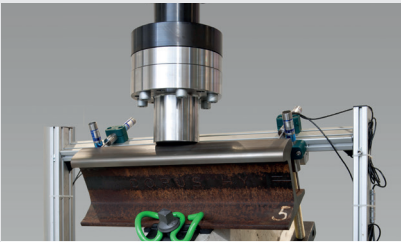
Flat specimens



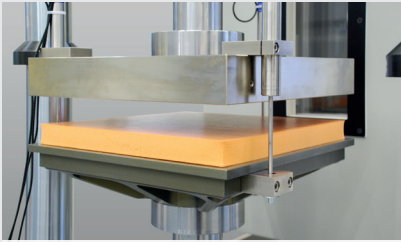
CT specimens



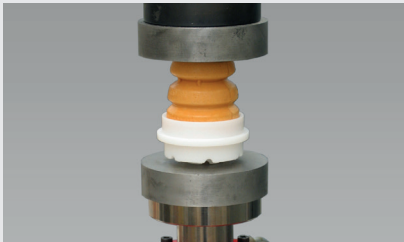
Engine mounts



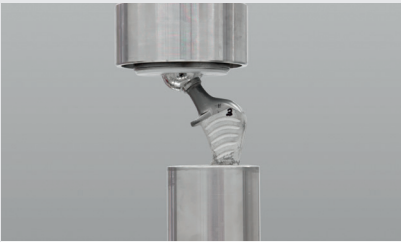
Railroad ties



Damping mats



Rubber-metal dampers



Implants



Wire strand testing

HC series and HC Compact: up to 25 kN

The HC 10 kN and 25 kN versions are table-top models, which can be placed on the supplied concrete base for instance. With these models, the actuator is positioned above the test area, which is equipped with a T-slot platform. The HC Compact with 10 and 25 kN versions is distinctive in that the hydraulic power pack serves as the machine table. With a flow rate of nearly 11 l/min, special sound insulation for the hydraulic power pack and a minimal footprint, the HC Compact is ideal for laboratory operation.

Features

- Testing actuator located in upper crosshead
- Suitable for axial actuator (10 kN and 25 kN)
- Suitable for combined tensile and compression-torsion actuator with maximum torque of 250 Nm
- Hard-chromed T-slot platform and columns for tests in corrosive media
- Wide accessory range: Temperature chambers, test fixtures, specimen grips, alignment fixtures, etc.
- Optional hydraulic adjustment for easy positioning of upper crosshead



Fig. 1: HC 25 servohydraulic testing machine with concrete base

HC Compact 50 and 100 kN

We are expanding the HC Compact series to include 50 kN and 100 kN force levels, which are specially designed for composites testing. As with the smaller force levels, the hydraulic power pack serves as the machine table. This power pack also features special sound insulation at a flow rate of nearly 30 l/min. With the 50 and 100 kN HC Compact models, the actuators are located below the test area.

Features

- Testing actuator installed below the test area
- Suitable for axial actuator (50 kN and 100 kN)
- Wide accessory range: Temperature chambers, test fixtures, specimen grips, alignment fixtures, etc.
- Hydraulic adjustment for easy positioning of upper crosshead
- Internal cooling circuit reduces the emission of heated air into the environment via the hydraulic power pack



Fig. 2: HC Compact servohydraulic testing machine 100 kN with integrated hydraulic power pack and temperature chamber

HCT and HBT series for combined tensile, compression and torsion loading

HCT/HBT are variations of the proven HC/HB series, equipped with a combined servohydraulic linear drive for superimposed tensile-compression-torsion loading on standardized specimens or components. In addition to axial stiffness, the frames feature high torsional stiffness. The set values for the linear and rotary drives can be configured independently of each other with freely adjustable phasing. The drive unit is mounted on the upper crosshead and the frame is equipped with an integrated T-slot platform, enabling tests on components as well.

HCT series up to 25 kN

The HCT series is designed as a compact, space-saving, table-top model and is available in the following combinations: 10 kN/100 Nm or 25 kN/250 Nm. The actuator stroke is 100 mm in each case and the angle of rotation is 100°. The HCT series table-top model covers test loads up to 10 kN or 25 kN and 250 Nm for servohydraulic oscillating torsion.



Fig. 1: HCT 25 servohydraulic testing machine with integrated torsion drive

HBT series up to 500 kN

As a floor-standing model, the HBT series covers a load range up to 500 kN and 5000 Nm for test tasks with superimposed tensile-compression-torsion loads. For special applications and high torques, 4-column frames are also used. The HBT 100/1000 with 100 kN and 1000 Nm is an example of a standard size which is suitable for several test tasks.

- Testing actuator stroke 100 mm
- Loads up to 500 kN
- Torque 5,000 Nm
- Angle 100°

Advantages and features

- Hydrostatic-bearing, sealless linear and rotary actuators
- Torsionally stiff, backlash-free length-compensating coupling
- Hydraulic adjustment of upper crosshead
- Hard-chromed T-slot platform and columns for tests in corrosive media



Fig. 2: HBT 100 servohydraulic testing machine with integrated torsion drive

Special solutions

In addition to standardized systems, ZwickRoell also designs and produces special dynamic testing systems. Thus, multi-axis systems, combined tension-torsion systems, testing systems with various media environments and large-scale testing systems all form part of the ZwickRoell product portfolio.

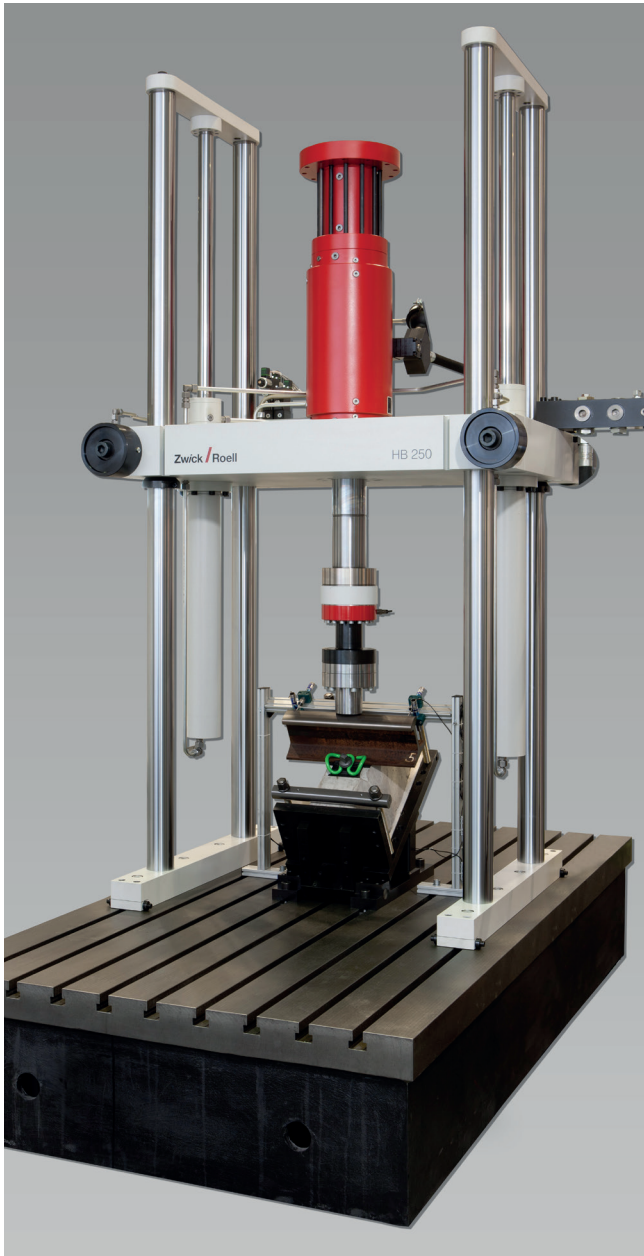


Fig. 1: Servohydraulic test portal with adjustable crosshead for components testing



Fig. 2: Four-column HB250 for materials and components testing



Fig. 3: Servohydraulic test portal for testing aircraft components

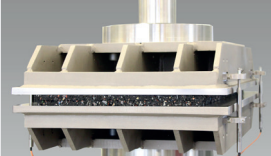
Components for servohydraulic testing machines

The final element in our dynamic testing product portfolio is the manufacture of all the necessary accessories. Our portfolio is constantly being expanded through a program of continuous development and inclusion of new products, allowing us to satisfy our customer's most demanding quality requirements while continually improving the quality of our products.

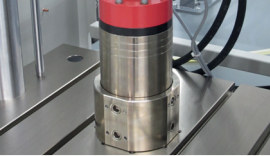
Servohydraulic testing actuator



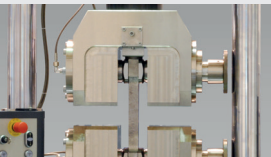
Specimen grips, test tools, and accessories



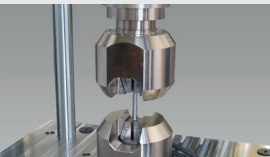
Compression platens



Alignment fixture 25 kN



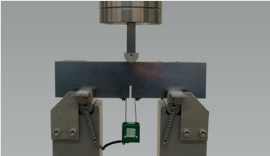
Hydraulic parallel grips



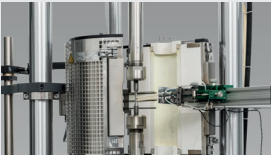
Hydraulic wedge grips



Media container



Flexure test kits



High-temperature furnaces



Temperature chambers

Servohydraulic infrastructure (distribution units, valves, hydraulic power packs)



2.2 Vibrophores

Modern laboratories and institutes, whether in research, training or industry, are increasingly confronted with frequently changing testing requirements. The latest generation of Vibrophores (high-frequency pulsators) from ZwickRoell can be used as both dynamic and static materials testing machines—a first for this type of machine—with test loads up to 1,000 kN. This makes them an attractive proposition for laboratories which mainly perform static tests, as well as for those which mainly carry out dynamic tests, with only the occasional static test.

The intelligent testControl II measurement and control electronics have a measurement and control frequency of 10 kHz, providing rapid response to events during tests as well as a high measured-value acquisition rate. When combined with the 24-bit resolution, this enables extremely precise measurements.

Another new feature is the remote control with display unit, which shows the measurement channels as well as the machine and test status. It simplifies the set-up procedure and enables accurate positioning of the oscillating crosshead without direct use of the PC. The result is enhanced operator convenience, particularly when for example, the machine is installed in an acoustic booth and the PC is external.

Dynamic tests with the ZwickRoell Vibrophore

The operating principle of the ZwickRoell Vibrophore is based on the concept of a mechanical resonator with electromagnetic drive. The mean force is applied by moving the upper crosshead with the lead screw drive. The dynamic load is generated by an oscillation system that works when the system operates at full resonance. In this way test frequencies of up to 285 Hz are possible, provided the specimens are sufficiently stiff. The dynamic and static drives are controlled separately, so that stress ratios (R-ratios) of any kind are possible. Tests can be force-, displacement- or strain-controlled.

Because testing occurs in the resonance range, the Vibrophore can detect developing and growing cracks in the specimen at an early stage through minimal changes in the test frequency. The signal form of the dynamic load applied always corresponds to a sine wave. The testXpert Research software provides intuitive test definition, performance and evaluation. Typical applications include fracture mechanics investigations on CT and SEB specimens, material fatigue tests and durability tests on standardized specimens and components (for example, piston rods, crankshafts, and screws), and production and quality control of components exposed to dynamic loads during their service life, such as concrete and reinforcing steel.

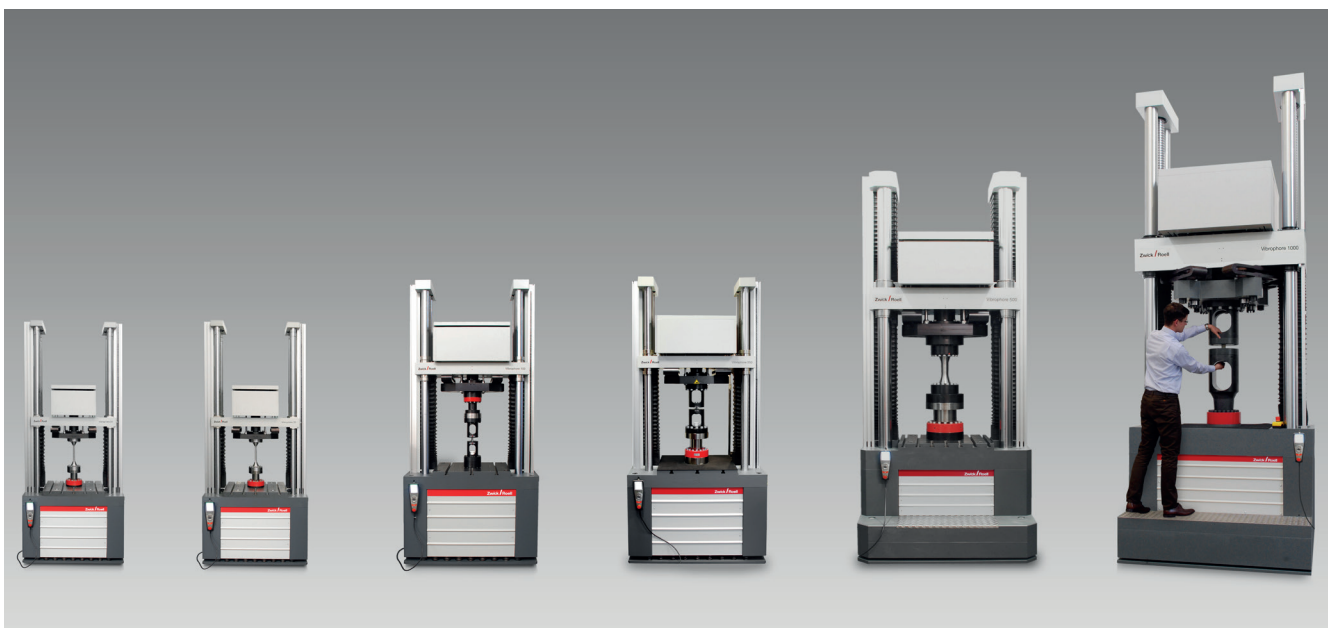


Fig. 1: Vibrophores from 25 to 1,000 kN

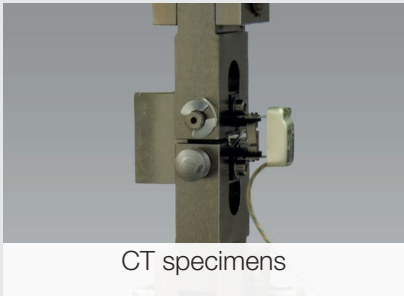


Fig. 1: Examples of typical Vibrophore applications

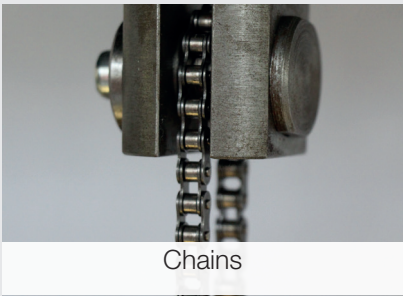


Fig. 2: Round specimens with quick-action clamping device

Typical Vibrophore applications



CT specimens



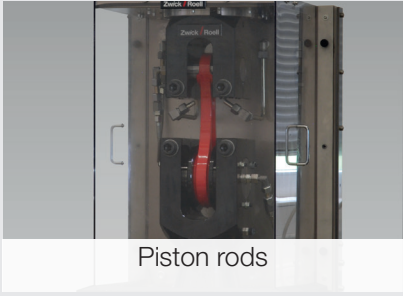
Chains



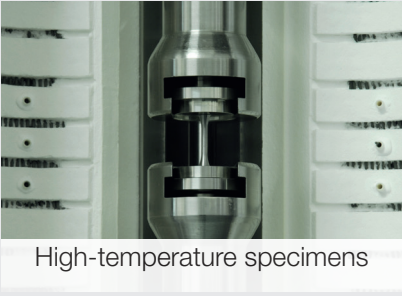
Gears



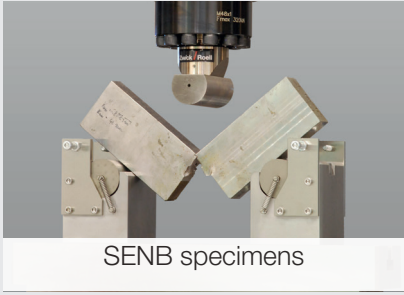
Concrete-reinforcing steel



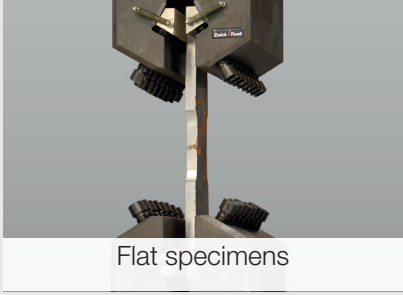
Piston rods



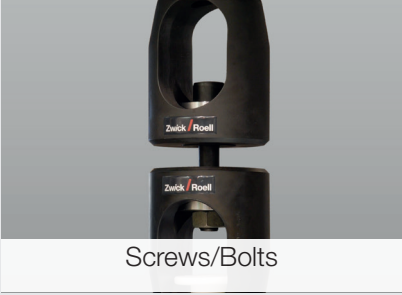
High-temperature specimens



SENB specimens



Flat specimens



Screws/Bolts

Static tests with the ZwickRoell Vibrophore

Mechanical clamping of the oscillating crosshead and the implementation of the testXpert III testing software transform the Vibrophore into a true static materials testing machine. Generous connecting surfaces and robust components ensure high machine stiffness. In combination with precision crosshead guidance, the Vibrophore minimizes unacceptable mechanical influences on the specimen.

By using suitable accessories, both static and dynamic tests can be performed under various environmental conditions (temperature, aggressive media). The Vibrophore can also be configured for torsion and flexure tests. The absence of a central lead screw enables test area variability to be maximized on the new Vibrophore, which makes it possible to test very short specimens as well as large components.



Fig. 1: Vibrophore 100 high-frequency pulsator with hydraulic wedge grips



Fig. 2: Integration of makroXtens extensometer (top) and Clip-on extensometer (bottom) for static tensile tests



Fig. 1: Vibrophore 25

Additional advantages and features

- Can be used as both static and dynamic materials testing machine
- High test-frequencies deliver short test times and high specimen throughput
- Resonance drive has very low energy consumption (approx. 2 % of that of servohydraulic testing machines)
- Stiff 4-column load frame, providing excellent guidance properties
- Clamping table at convenient working height with ample working area



Fig. 2: The Vibrophore can be used for dynamic (top) and static (bottom) tests

- Easy to install; no ancillary units or systems (e.g. hydraulics, coolant) required
- No additional structural vibration damping required
- Maintenance-free system due to the use of wear-free components
- Safe, reliable operating concept that is ideal for research and training
- Continuously controlled servo motor for fast, accurate mean force control
- High pulse width modulation resolution (120 MHz) for high control stability and low failure liability
- testXpert III and testXpert Research test programs matched exactly to the test tasks provide ease of operation
- Easy 8-step test frequency change by means of varying weights

2.3 LTM electrodynamic testing machine

The LTM linear motor testing system is based on a patented electrodynamic drive system from Zwick-Roell. Particular attention was paid to the positioning of the displacement measuring system—close to the specimen and in the center of the test axis. Due to the avoidance of tilting and bending moments, which lead to travel measurement errors, exceptional positioning and repetition accuracy can be achieved. The version with torsion drive allows an endless number of rotations and can be retrofitted to existing machines. The wide speed-range of the LTM allows it to be used both for dynamic fatigue tests and for quasi-static tests. An oil-free drive and closed cooling circuit make the LTM

an ideal solution for laboratory operation, as do its simple installation requirements— a connection to the power supply is all that is required. Due to the electrodynamic drive, LTMs are especially light on maintenance, keeping servicing costs low, while in day-to-day testing they impress with their flexibility and ease of operation.



Fig. 2: LTM 10 linear testing system with temperature chamber



Fig. 1: LTM 2 testing system as table-top model



Fig. 3: LTM 10 linear testing system with torsion drive

Our linear motor testing systems are available in force levels 1, 2, 3, 5 or 10 kN. We offer the torsion versions in 10 to 100 Nm. Versions up to 3 kN can be supplied as table-top models or optionally as floor-standing models with their own machine base. Typical applications are in the field of electronics, plastics, and biomechanics.

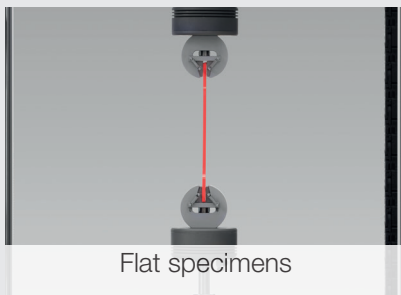
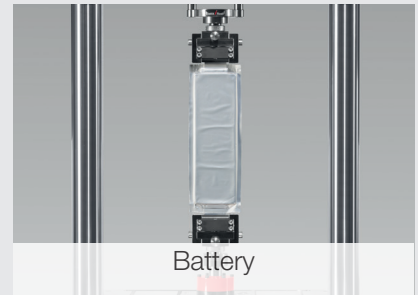
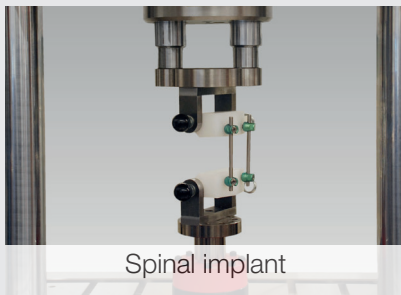
Features:

- Wide range of application for static and dynamic tests
- High dynamic performance of up to 100 or 120 Hz
- High transverse force stability thanks to patented motor design
- The torsion drive allows an endless number of rotations and can be retrofitted
- Improved performance due to mechanical decoupling of the torsion drive from the axial drive
- Long piston stroke of 60 mm enables wide variety of tests
- No additional pneumatic, coolant, oil etc. supply feeds required
- The drive technology of the LTM is nearly emission-free
- Motor-driven crosshead adjustment and electrically monitored crosshead clamping ensure safety and convenience with LED status display



Fig. 1: LTM 3 linear testing system with torsion drive

Typical LTM testing applications



2.4 High-speed testing machines

With a strain rate of up to $1,000 \text{ s}^{-1}$, the HTM range of high-speed testing machines are ideal for determining material behavior under crash loading. Their maximum piston speed of 20 m/s (72 km/h) is faster than the 64 km/h test speed used in the Euro NCAP frontal impact crash test. The strain rate can easily be varied by means of the piston speed, from quasi-static up to maximum speed. However, it can also be adjusted via the specimen length. The relationship as a function of specimen length l_0 and piston speed v is as follows: Rated at 25 kN and 12 m/s , the HTM 2512 is the smallest machine in the portfolio. The single testing actuator

$$\dot{\varepsilon} = \frac{\Delta\varepsilon}{\Delta t} = \frac{dl}{l_0} \times \frac{1}{\Delta t} = \frac{v}{l_0}$$

is installed below in the machine table. It is particularly suitable for testing plastics (polymers, polyurethane). In addition to high-speed tensile tests to ISO 18872, puncture tests to ISO 6603-2 are frequently performed using this machine.

The HTM 5020 is the most versatile machine in the series. Rated at 50 kN and with a maximum piston speed of 20 m/s , it can be used for testing both plastics and metallic specimens, e.g. sheet metal for automobile bodywork and fiber-reinforced composites. The actuator is mounted on the upper crosshead, enabling component testing in conjunction with the optional T-slot platform. The machine is also available in an 80 kN version designated HTM 8020.

The HTM 16020 is the largest machine in the portfolio with a static nominal force of 160 kN . The actuator is mounted on the upper crosshead of the 4-column frame. The base plate includes T-slots. The machine is designed for use in component testing. However, tensile tests on larger-dimensioned specimens or belts are also possible. The maximum tensile force at 20 m/s is 100 kN .



Fig. 1: HTM 5020 high-speed testing machine

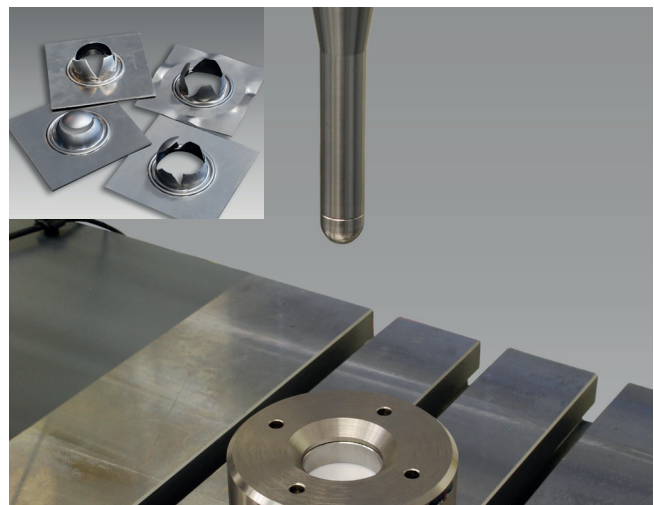


Fig. 2: Test fixture for puncture tests

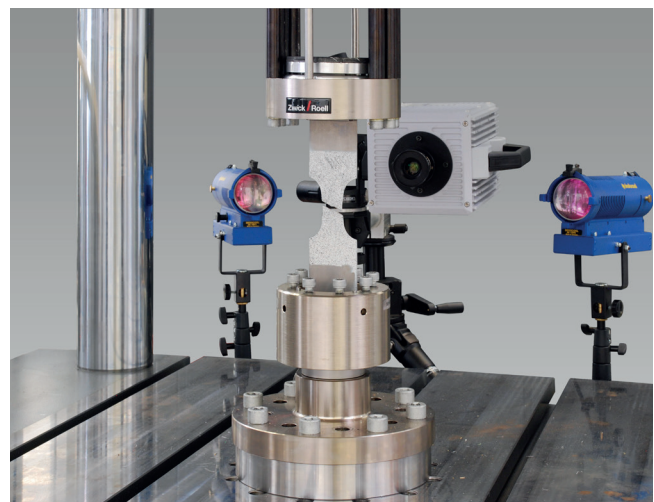


Fig. 2: High-speed tensile test with optical measurement system

2.5 Electromechanical servo testing actuator

Electromechanical servo testing actuators are universally applicable screw drive machines. They are suitable for tensile and compression tests and can be integrated into testing devices in various configurations.

Areas of use range from materials and components testing to testing finished end-products. They also enable testing of production steps (e.g. assembling/ joining, force-fitting and assembly) and are equally ideal for long-stroke cyclic tests, such as high cycle fatigue tests on flexible foams to ISO 3385. A typical test sequence is described below.

1. Indentation hardness and specimen thickness are first measured on an unloaded seat cushion.
2. In the second step the foam is loaded several tens of thousands of times. This loading can take place in a standard climate or under specified humidity and temperature conditions.
3. After continuous loading and waiting time expiration, the specimen thickness and compression stress value are measured again.
4. The results obtained are the hardness loss and thickness loss.



Fig. 1: Electromechanical servo testing actuator for fatigue tests on foam materials

The electromechanical servo testing actuator series is available from 1 to 100 kN and can be supplied with the new display-equipped remote control upon request.

Features

- Variable mounting via head or foot flange or via side trunnion
- testControl II measurement and control electronics in a separate housing and can be positioned as required
- Freedom in test sequence design via various programming interfaces
- Force or displacement control with smooth switching between operating modes
- Easy to install—no additional infrastructure required (e.g. hydraulic power pack, compressed air supply)
- Ideal for use in clean rooms
- Low maintenance costs and long service life

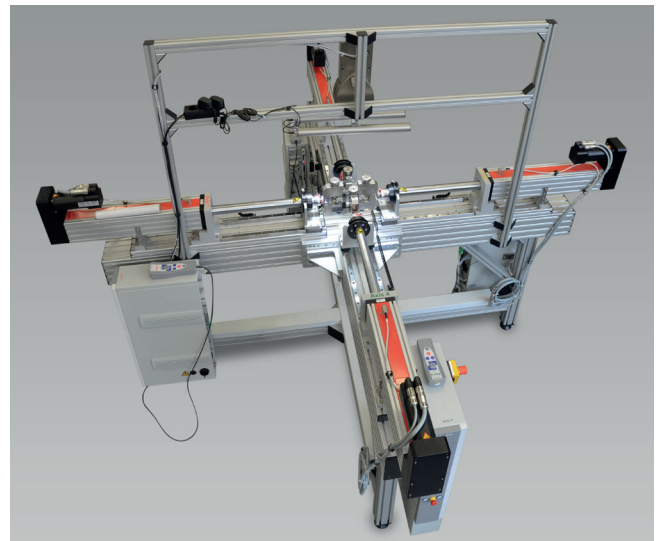


Fig. 2: Biaxial testing machine consisting of 4 servo testing actuators

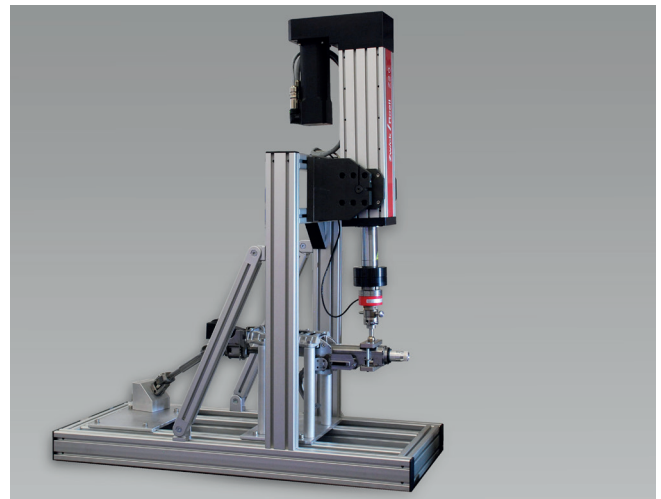


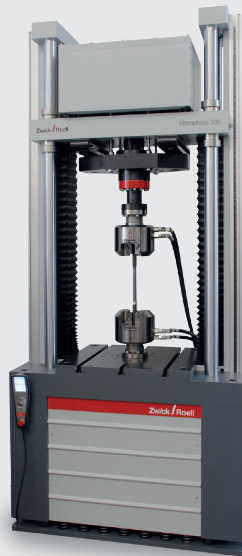
Fig. 3: Electromechanical servo testing actuator for fatigue tests on steering linkage

3.1 testControl II control electronics and testXpert testing software

LTM electrodynamic testing machine



Vibrophone

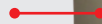


Servohydraulic testing machine



testControl II

ZwickRoell electronics platform



testXpert

ZwickRoell software platform

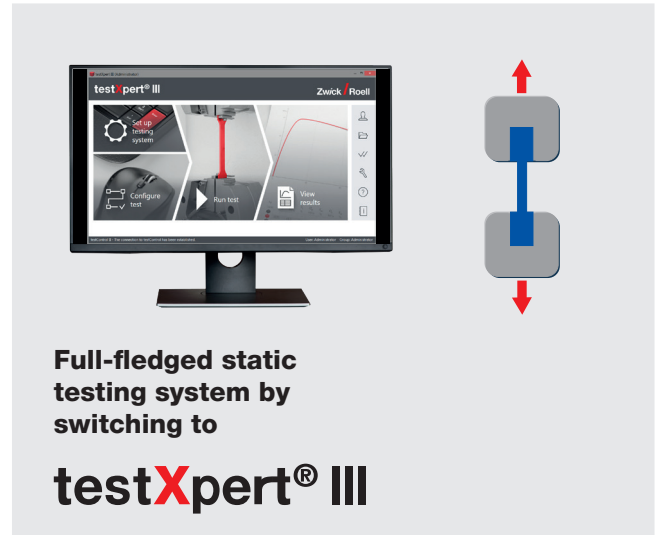


testXpert Research



- Intuitive and workflow oriented**
 The software uses an intuitive, ergonomic workflow to guide the user through every step of the test, from setup to export of the results.
- System configuration builder**
 System Configuration Builder allows you to preset and save all relevant testing system and safety settings in a freely definable system configuration. The saved system configuration checks the connected sensors.
- Intelligent wizard**
 The wizard shows the user which test parameters must still be configured and automatically checks all entries for plausibility.
- Traceable and tamper-proof test results**
 In testXpert R, the administrator defines what must be logged and for which activities and events the user must enter a reason.
- Secure data storage**
 All test and machine data are stored in testXpert Storage—a flexible, scalable, and future-proof database.

Switching to testXpert III



Full-fledged static testing system by switching to

testXpert® III

By switching from testXpert Research to testXpert III, fatigue testing machines can also be used as **full-fledged static testing systems**.

testControl II



One electronics system for all dynamic testing machines

- 24-bit** measurement signal resolution over the entire measurement range for **maximum data accuracy**
- Precision measurement and control** due to the data acquisition and clock rate of **10 kHz**.
- The **ergonomic display-equipped remote control** enables you to work efficiently and comfortably.

testXpert® Research – A convenient and user-friendly interface

Helpful navigation bars, status bars, and toolbars are available to the user during setup and configuration of the test:

Intelligent wizard

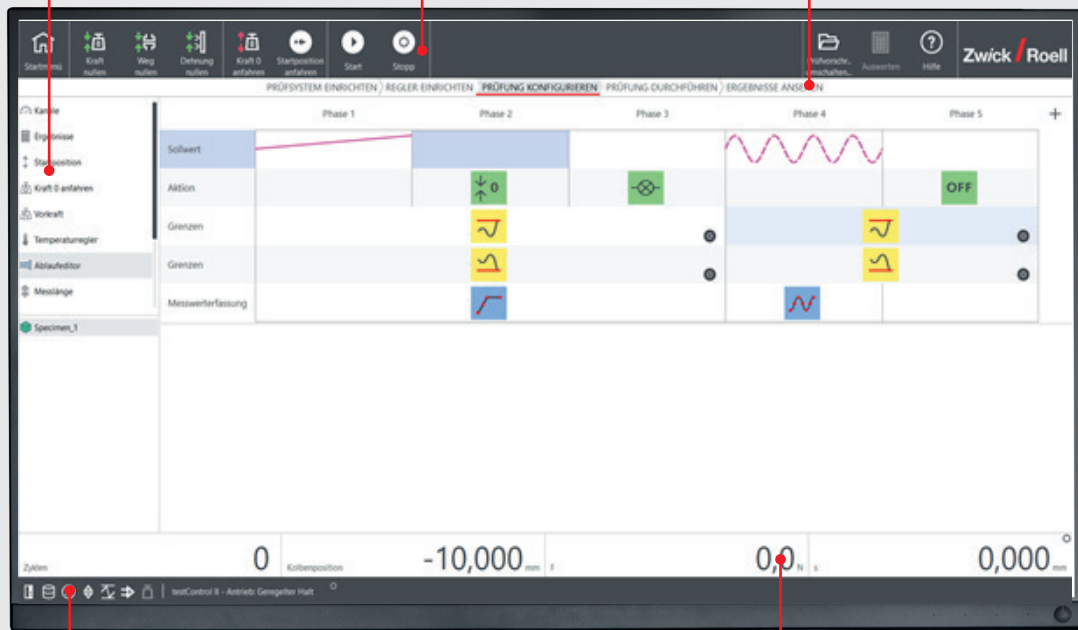
Shows the user which test parameters must be configured and automatically checks all entries for plausibility

Toolbar

Key functions at a glance

Workflow

Software system structure in line with the test process



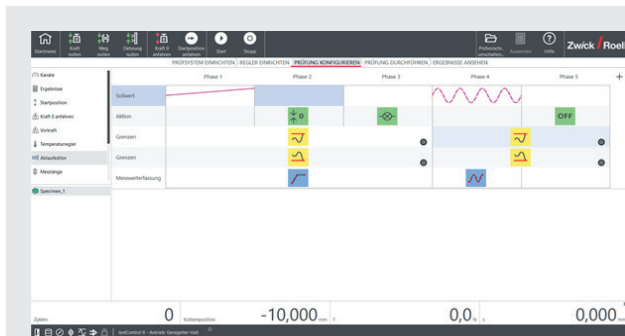
Status display

Provides the operator with detailed information on the current status of the testing system and the test sequence

Digital display

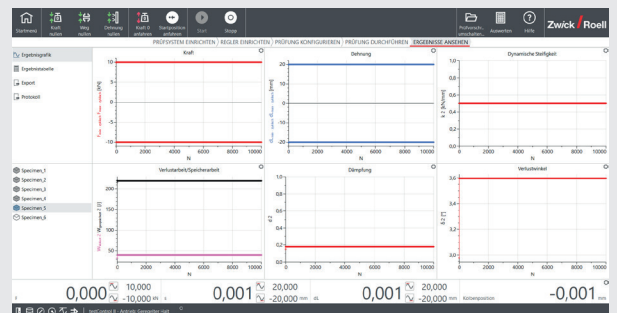
All key measurement channels are presented clearly and the display is freely configurable

testXpert® R test programs available to be freely defined



testXpert® R - Sequencer

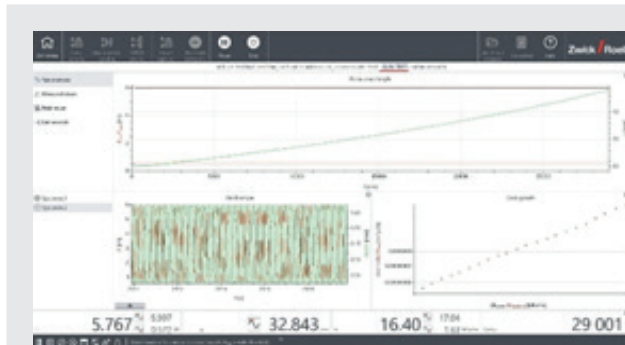
Freely definable block program for generating individual test sequences with one or two channels



testXpert® R - Single stage

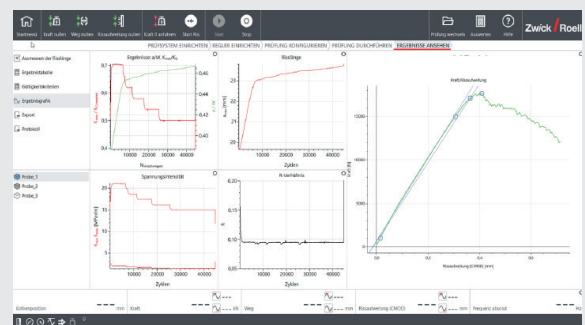
For efficient performance of single-stage test sequences

testXpert® test programs according to standard



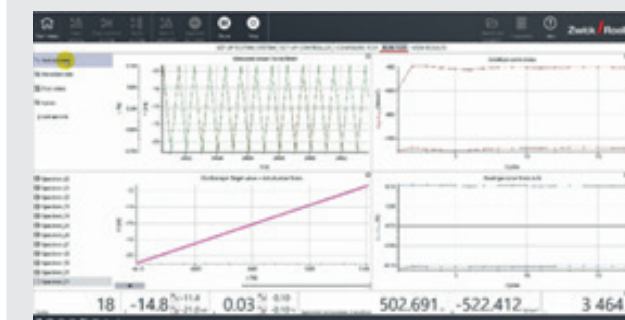
testXpert® R - Fracture mechanics

For determination of the crack growth curve ("Paris-Line") and dK_{th} according to **ASTM E647**



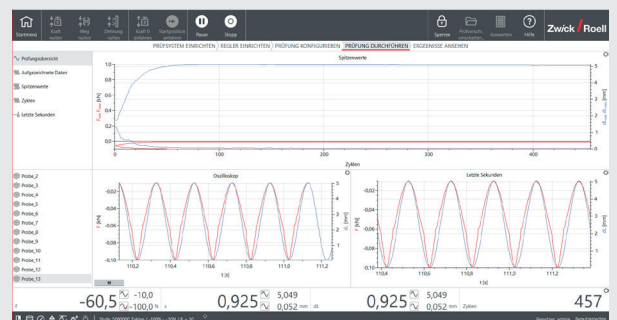
testXpert® R - Fracture mechanics

Determination of K1C value to **ASTM E399**



testXpert® R - Low cycle fatigue

For strain-controlled determination of low cycle fatigue (LCF) to **ASTM E606**



testXpert® R - Standard test programs

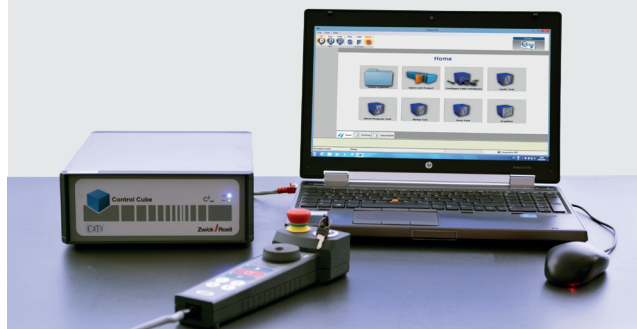
For example for testing spinal implants to **ASTM F1717**

3.2 ControlCube control electronics and Cubus testing software

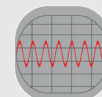
The Control Cube servo controller and Cubus testing software are employed with multi-channel and/or complex testing systems. The Control Cube servo controller is also the optimum solution where frequent test arrangement changes are involved. As well as established standard tests, Control Cube is also used in conjunction with component and assembly testing. The system's modularity and flexibility make it ideal for multi-channel applications and simulation tests.

Added to this is a multitude of helpful functions to simplify everyday use of the testing system. These include automatic optimization of control parameters, together with adaptive control, which allows control parameters to adapt automatically to changing requirements during the course of the test. There is also a wide range of useful options for data acquisition, measured-value display and data export. To enable interface with the testing environment, connections for servo valves, hydraulic supply, remote control and Emergency STOP are available. These are complemented by universal measurement amplifiers and analog and digital inputs and outputs. These can naturally also be retrofitted.

Advantages of Control Cube technology



- 19-bit resolution for reliable, highly accurate test data acquisition
- Optimized 4kHz data acquisition frequency for accurate measurements
- 4kHz control frequency plus up to 32 control channels deliver precision control for rapid response
- Reliable PC connection and high data transfer rate via Ethernet



Control Cube interfaces and functions

PC connection
Industry-standard Ethernet port

Multi-channel connection
CNet connects up to 32 control channels

Digital I/O connection
Digital inputs and outputs

Channel identification
LED indicates channel currently configured

Remote control
Change from Setup or Test mode using key switch

Universal measurement amplifier
For AC or DC sensors (strain gauge, inductive etc.)
Fully synchronized data acquisition for control and monitor channels

Jog wheel
Can be used to change the position of the actuator in the respective control mode

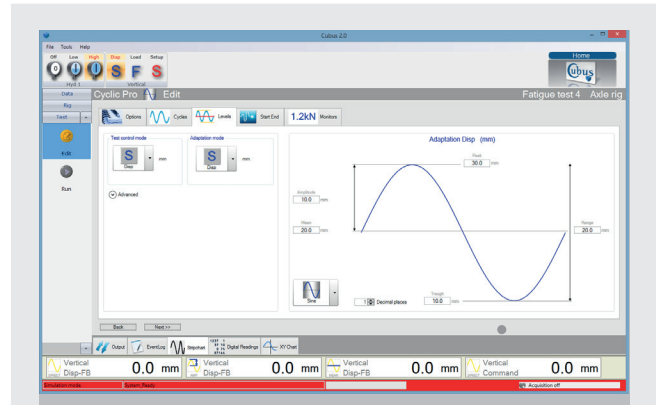
Channel switching
With multi-axis systems user-friendly switching between individual channels is possible

System connection e.g., for safety door or flow-limiting valve

Interface panel for expansion options
Example with two analog outputs and four analog inputs

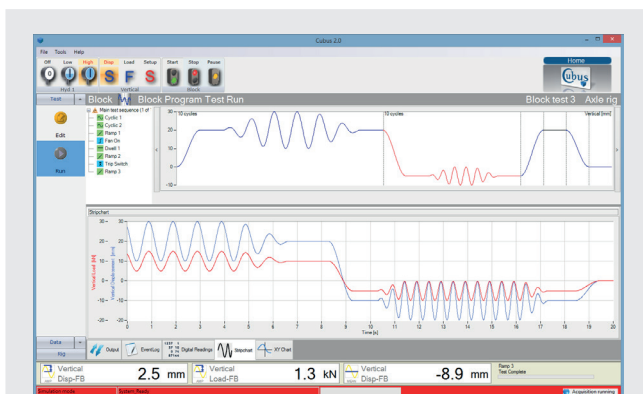
Cubus testing software and test options

Whether you wish to test a complete product, a component or a single material specimen, Cubus testing software provides professional, highly efficient support. Cubus is a modular software environment specifically developed for single and multi-channel servohydraulic test tasks. It is available in two versions: Cubus^{light} basic software for routine cyclic tests and Cubus testing software for a wide variety of customized test tasks. Thanks to the simple, intuitive, well-structured user interface, only a short familiarization period is required. In a single integrated application, Cubus enables full configuration of the testing environment, at the same time meeting all the demands placed on modern test-bench control systems.



Cyclic Pro

- Cyclic single-stage tests
- Peak-value control, acquisition, trend monitor



Block program

- Graphical editor for creating test sequences
- Cycles, ramps, hold times, I/O, data acquisition



Durability test

- Playback of iteration data
- Dynamic and quasi-static trend monitoring

Testing applications with Control Cube



Fig. 1: Multi-axis test rig for follow-up tests (Image: © IABG)

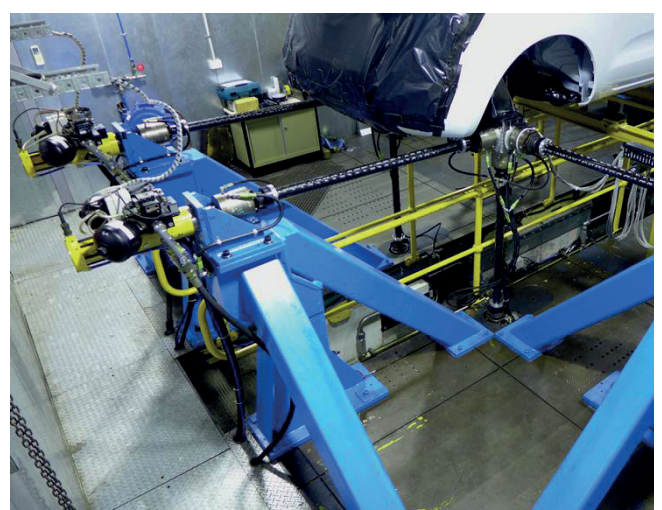


Fig. 2: Multi-axis test rig (Image: © Ford)

4 Modernization of dynamic testing machines

Advantages of modernizing with ZwickRoell

- Warranty for newly installed components
- Renewed long-term service reliability
- testControl II measurement and control electronics satisfy the most demanding safety requirements
- Enables validation of the testing machine in accordance with the latest quality standards
- Expert, long-term service partner with over 20 years of experience in manufacturer-independent modernization of materials testing machines

4.1 RetroLine modernization packages for resonance pulsators

The standardized RetroLine modernization packages for resonance pulsators are manufacturer-independent and can easily be tailored to individual needs and testing requirements. Modernization includes renewal of the static drive motor, new testControl II measurement and control electronics, as well as the installation of current testXpert Research testing software. Modernization is generally carried out directly on-site at the customer's premises and is undertaken by our service technicians.

4.2 RetroLine modernization packages for servohydraulic testing systems

Modernization with testControl II measurement and control electronics is an ideal match for single-channel testing machines. Our modular, manufacturer-independent modernization packages include new testControl II measurement and control electronics plus the latest



Fig. 2: Modernization of a Vibrophore with testControl II

version of our testXpert Research testing software. If necessary, modernization can involve a complete solution with replacement and modification of the hydraulic components.

Additional sensors, specimen grips and test tools from ZwickRoell's accessory portfolio can be retrofitted.



Fig. 1: Modernization of a servohydraulic testing machine with testControl II as well as testXpert Research testing software

5 ZwickRoell services

5.1 Laboratory for Materials and Components Testing

For companies with a testing requirement but no suitable testing option, our Laboratory for Materials and Components Testing is ready to provide expert assistance.

We can also help you out in the event of capacity bottlenecks or perform cross-validation tests. It makes no difference whether just a single test is involved or an entire test series. With the latest technology and modern testing machines, we guarantee fast, standard-compliant testing. Naturally we can also perform tests in accordance with your factory standards.

Our contract testing laboratories perform testing services of all kinds, on all static and dynamic materials testing machines. We completely customize for all branches of industry and materials, whether metals, plastics, rubber or composites, in the automotive, medical or other industry—you will find yourself in good hands.

Contact us: Call +49 7305 10 11440 or email auftragspruefung@zwickroell.com



Fig. 2: Static testing machines and instruments in the ZwickRoell testing laboratory



Fig. 1: An excerpt of the dynamic testing machines in the Laboratory for Materials and Components Testing

5.2 Applications technology

Our technical advisors and experienced application engineers are here to provide for this purpose.

Whatever your needs, our qualified engineers will draw on their solid expertise to provide support during the planning and implementation of all or any test sequences and projects.

Our Applications Testing Laboratories are equipped with permanent materials testing machine displays and instruments including a comprehensive portfolio of accessories such as specimen grips, test tools, sensors, and temperature chambers.

5.3 Overview of services

Our service technicians guarantee successful, trouble-free commissioning—from pre-acceptance and installation, to initial calibration, to instruction on hardware and software, including full safety briefing.

Inspection and calibration

Naturally, we will also carry out the required annual inspection and calibration. Our checklist-based inspections and calibrations provide a sound basis for reliable test results. They also extend the life of your materials testing machines and instruments, saving operating costs in the long term.

Customer support

We are always ready to help whenever our customers need additional support. Our Hotline staff will assist you in questions relating to hardware and software malfunctions, while the Support Desk guarantees individualized consulting/advice or rapid assistance, also via remote access.



Fig. 2: Experienced application engineers will advise you on individually tailored testing options

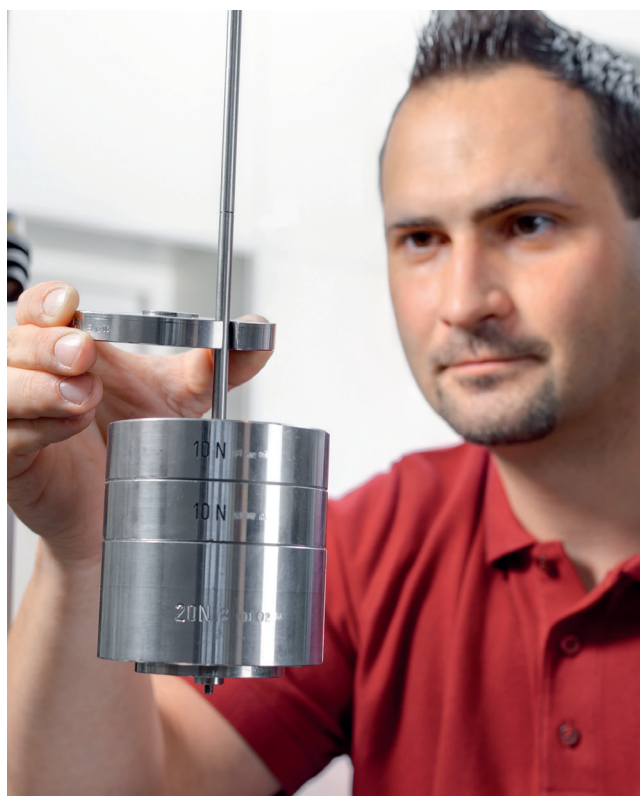


Fig. 1: ZwickRoell operates a DAkkS-accredited calibration laboratory. With over 10,000 calibrations performed annually, this is the largest calibration laboratory in Germany.

Software services

Once you have purchased your testing software, we are ready to provide additional software services upon your request, regardless of whether it is software trials, updates, upgrades, or training.

Training courses at ZwickRoell Academy

Our ZwickRoellAcademy offers a comprehensive, modular training program—whether you attend at ZwickRoell's headquarters in Ulm, at a ZwickRoell location near you, or directly on-site at your premises. Course topics range from our testing software to applications training and workshops, to courses customized to your company's specific requirements.

Other services

Particularly for testing systems in the medical and pharmaceutical industries, ZwickRoell provides assistance with DQ/IQ/OQ qualification in the form of comprehensive qualification documentation (individually tailored if required) and through on-site performance of qualification.

If you need to move your materials testing machine to a different location, ZwickRoell's removal and relocation service will assist with technical and organizational planning, together with transport and full recommissioning.



Fig. 2: ZwickRoell Academy offers a diverse and informative training program for beginners and advanced users.

Professional verification of the alignment of your testing machine using standardized alignment transducers is a fundamental component of our service portfolio. The alignment of the test axis is documented, ensuring reliable test results. We can also produce a customized alignment transducer for individual geometry data.

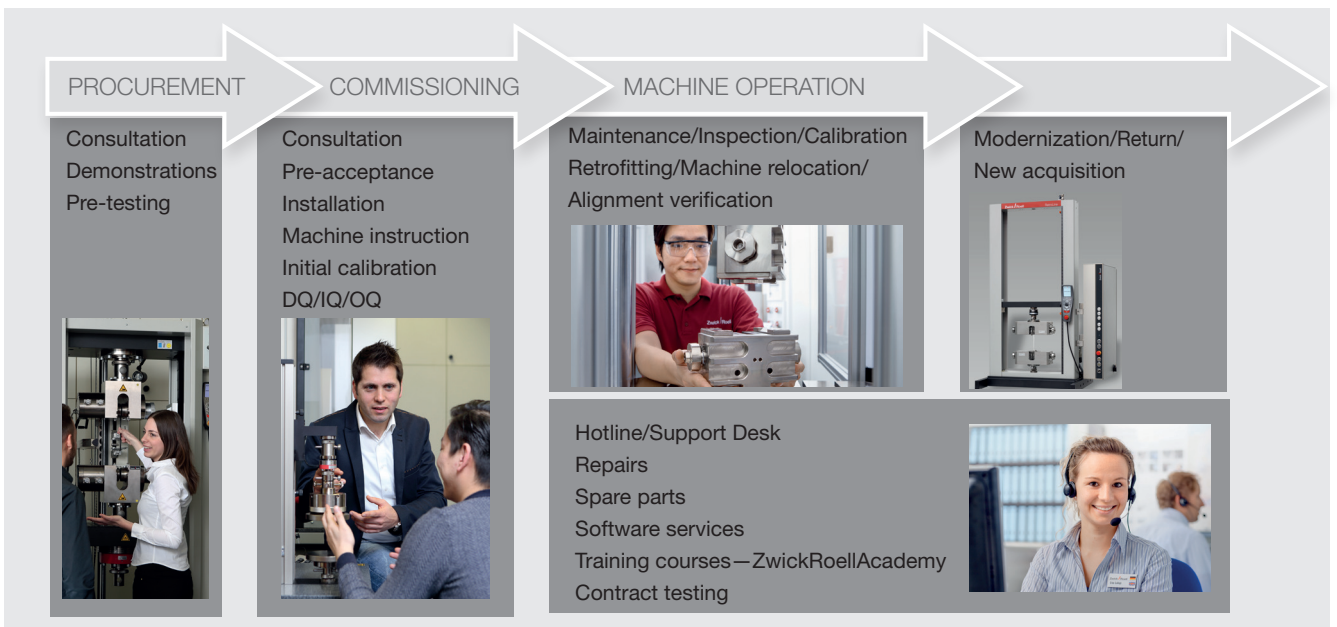
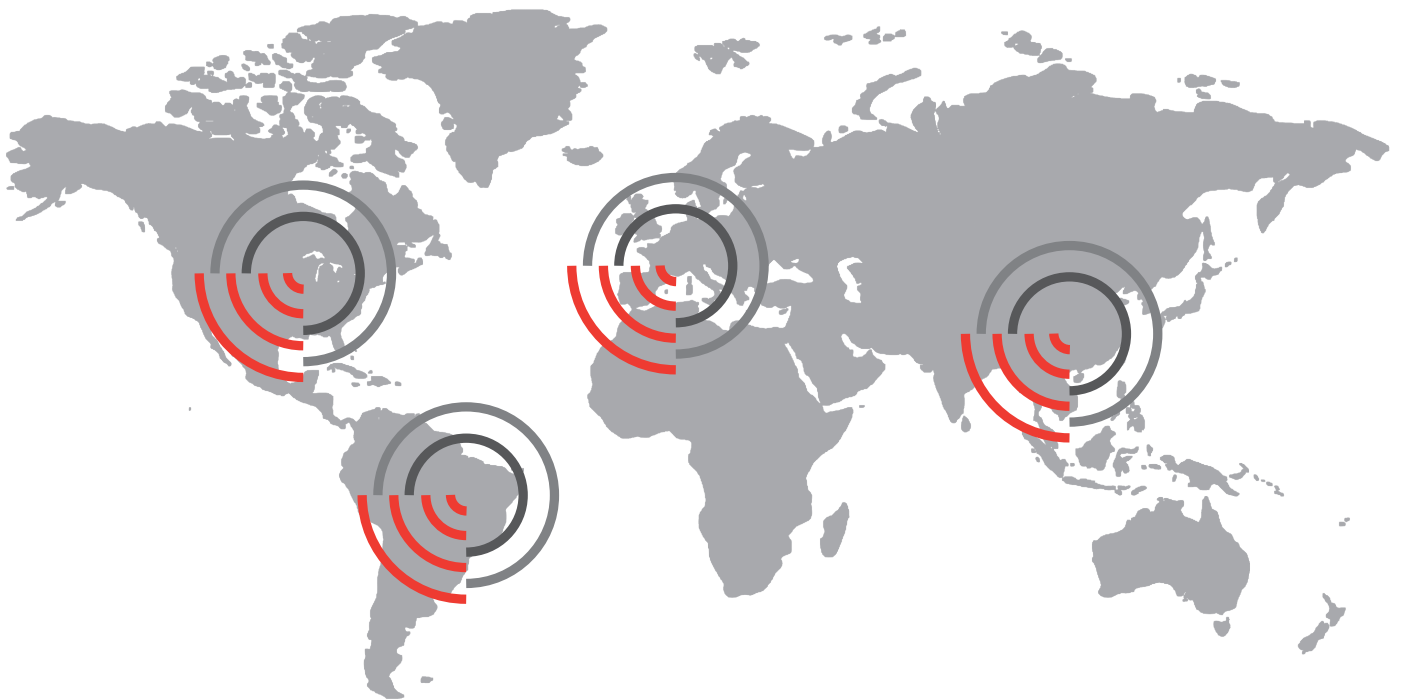


Fig. 1: ZwickRoell provides continuous support throughout the entire life cycle of materials testing systems.

Zwick / Roell

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