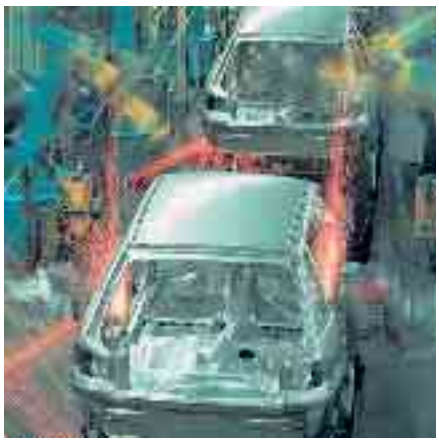
Zwick / Roell

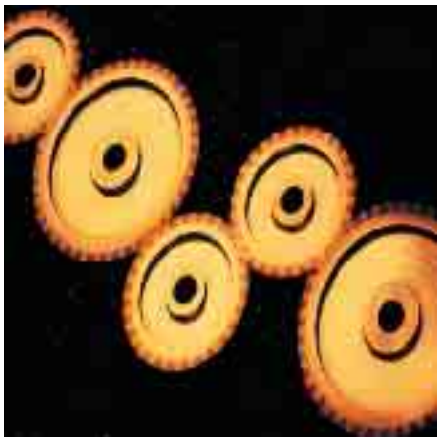
Testing Systems

Testing Machines and Systems for the Automotive Industry









FP 389 2.0905

Intelligent Testing

Zwick / Roell

This catalogue provides an overview of materials testing machines, and component test systems of the Zwick Roell Group used in the automotive and transportation industries for quality control testing and research.

This is only a part of the extensive overall product offerings of the Zwick Roell Group.

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Zwick Roell Group – More than a century of experience in materials testing

Mechanical testing is the oldest discipline of materials testing and its importance has increased steadily until the present day. Leonardo da Vinci , the genius artist, inventor and researcher of the 15th Century made among other things, a simple tensile testing device to for wires – an early predecessor to today's universal testing machine. About one hundred years later, Galileo Galilei, who is considered the founder of materials science and materials testing, conducted theoretical studies on the elastic behaviour of materials. The first machines testing were built about the middle of the 18th century in France.

Since the middle of the 19th century, the company Amsler has been involved in materials testing. The companies Roell & Korthaus (est. 1920) and Zwick (est. 1937) share a similar heritage in the manufacturing and supply of equipment, machines and systems for the testing of materials. These companies along with Toni Technik, a leader in building materials testing, Indentec Ltd. and Acmel Labo comprise the Zwick Roell Group.

Today, the Zwick Roell Group offers a comprehensive product range – from manually-operated hardness testing machines, universal testing machines, fully-automated (robotic) materials test systems, to complex testing systems for production line applications, and for realistic simulation of operational stresses on vehicles. Zwick's extensive expertise in designing high-quality test systems including state-of-the-art electronics and intelligent and reliable application software offers significant solutions to our customer's most-demanding test requirements.

The Zwick headquarters is located in Ulm Germany, between the automotive centers of Stuttgart and Munich

Overview of Automotive Testing

The transportation industry consists of manufacturers and suppliers of passenger cars, trucks, commercial vehicles, buses, motorcycles, trains and even airplanes. Vehicle manufacturers perform final assembly of manufactured components and sub-assemblies mainly from external suppliers, a trend which will continue in the future. These global suppliers are responsible for designing, engineering, manufacturing, verifying quality and delivering value-added components "just in time" at competitive prices.

Additional factors include government regulations and increasing consumer demands for vehicles with improved performance, increased safety, improved fuel economy and reduced emissions. These demands require that delivered raw materials and manufactured components be tested to meet customer specifications, and that the complete assembled vehicle is tested for quality during the vehicle design and development phases.

The Zwick Roell Group supplies a wide range of testing machines and systems to meet the most demanding needs to support product and process development, improve quality and enhance the safety of vehicles. Zwick's long-term expertise with over 60 years in providing well-engineered testing systems and aftermarket services in 55 countries worldwide, allows our customers to be more competitive in today's challenging global automotive market. Automotive companies and suppliers worldwide depend on Zwick when it comes to providing the best value and long-term return on their testing equipment investment.

This brochure provides an overview of Zwick materials and component test systems in the automotive sector as well as a brief summary of the extensive line of testing machines for static and dynamic testing of materials and components. This information should be important and of key interest to individuals involved in the design, research, quality assurance testing or production of automotive systems (including cars, trucks and motorcycles) and to those who need to **consistently meet demanding quality, cost and performance requirements.**

Regardless of how standard or complex your testing requirements, we can likely provide an attractive solution to your testing challenges.

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Testing in the Automotive Industry – Today and in the Future

Today's automotive consumers expect energy-efficient vehicles with comfort, performance and safety features at an affordable cost. Therefore, the quality and behavior of each individual component becomes more critical – and so does the task of conducting stringent tests to verify a components' performance. Furthermore, the determination of basic materials properties is fundamental in the development of constitutive models and finite elemental analysis used in the design and evaluation of automotive components and vehicle systems. Using advanced design and life-prediction analysis allows the product development time to be greatly shortened. Therefore, laboratory testing remains an important and necessary requirement to supply these models the required empirical data.

More sophisticated testing techniques are in demand to simulate the real world conditions of a vehicle. For example, static tensile test results are less useful for high-impact studies to enhance the crashworthiness of an automobile cockpit. Rather, dynamic and impact testing is required to better understand the behavior of materials subjected to high-strain rates.

Research and development testing laboratories conduct tests for the purpose of materials selection, and to verify the durability of components, sub-assemblies and complete vehicles. Applications also extend to Quality Assurance labs which support various stages of production and post-production (E.g. warranty testing).
Vehicle components are subject to high mechanical stresses and demanding operating conditions. These parts have to be realistically tested and the forces generated have to be measured precisely and must simulate their operating environment. The demands for 100% "in-line" production testing continue to increase due to the extreme importance of meeting strict design tolerances and six-sigma-level quality standards. This allows the manufacturer to distinguish precisely between "good" and "unacceptable" components automatically and during the production phase, instead after they have been integrated into the vehicle assembly – a less attractive alternative.

Zwick 5 kN system to test small gas shocks

Precision spring test system

Zwick / Roell

An extensive range of products and applications

Zwick Roell offers an extensive range of testing machines and systems specifically designed for the automotive industry. From portable, palm-sized shore hardness tests for rubber, to universal test machines, dynamic test machines, to computer-controlled testing systems with multiple, digitally-controlled actuators for the simulation of actual road conditions on components or complete vehicles. By understanding and addressing this wide range of testing applications, Zwick can provide common application software, data analysis tools and Laboratory Information Management (LIMS) solutions, which increase the overall value of your test results and your enterprise.

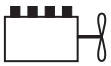
Zwick Roell testing systems are developed to meet a broad range of customer requirements. Mechanical product design, digital electronics and advanced application software are continuously developed and updated. An extensive customer service network providing calibration, preventative maintenance and training ensures a rapid return on the test equipment investment.

Test system to measure tire deformation

Zwick / Roell

Applications Overview

Zwick Roell has extensive experience in providing materials and component testing systems for both static and dynamic applications. Examples of these applications are shown in the following pages and are characterized according their respective location in the automobile. The identified segments in this brochure are identified:



Motor and Drive Train

The motor and drive train include the vehicle's engine, internal components of the engine such as pistons or connecting rods, the clutch, gear box or transmission and drive shafts. These components undergo significant complex loads, and are often subject to significant heat and environmental conditions. Component suppliers in this segment are challenged to reduce weight and improve the performance of their materials to meet new product design and emission goals. Typical customer tests include standard static and dynamic of materials, as well as the testing of the manufactured component to simulate in-service conditions. Frequently, test results are compared between new and components with accumulated service life (E.g. 50,000 km condition) Zwick Roell provides a comprehensive offering of testing solutions for motor and drive train materials and components.

Torsional Testing of Clutch Components

Zwick provides a test machine to verify fatigue life and durability of clutch components in torque. This automated, fully-enclosed unit is suitable for a manufacturing environment, where produced parts are immediately tested. The machine can test the strength of welded clutch components or be used for longer-term durability tests of the entire clutch component.

Close up of welded clutch component

Test stand for clutch torque testing

Zwick / Roell

Axial-Torsion Testing of Clutch Disks

This axial-torsion clutch disks testing machine is utilized for development of new clutch designs and to determine supplier quality of clutch components. The clutch disks' pre- and main spring dampening characteristics, parallelism and friction points are determined using this unique five-component force measurement platform.

Clutch disk set up (l) and load measurement platform (r)

Horizontal system for clutch disk tests

Fatigue Testing of Crankshafts

High-cycle fatigue tests are performed on a crankshaft component using the Zwick Vibrophore “high-frequency pulsator”. Very-high testing frequencies are obtained at low operating costs due to the electromagnetic resonance principal. This system may be used to determine the fatigue life of materials, fasteners and other metal or composite components. Refer to page 36 for more information on Zwick Vibrophores.

Engine components fatigue tested with the Vibrophore

HFP fatigue testing of crankshaft

Zwick / Roell

Torque Durability Test on Drive Shaft Components

Driveshaft components including axles and CV joints are subject to rigorous loading conditions in passenger cars and trucks. These components consist often of metallic and elastomeric components. It is important to test these components in fatigue and durability. Zwick offers a complete line of torsion and rotary test machines called Torsionline designed for these applications with a torque range of 200 to 6000 Nm. testControl and *testXpert*® software are used to control and to obtain and analyze test results from these systems.

Torsonline testing machines to perform rotary fatigue tests on drive shaft components.

Compression and Thickness Testing on Brake Pads

Disc brake pads are one of the most important parts of a wheel braking system. To evaluate the supplied quality of disc brake linings, the pad thickness variation is determined by means of a compressive force applied perpendicular to the brake pad face. Zwick materials testing machines can be equipped with a special compression fixture with an integrated measuring system to perform this test. The force is applied with a compensating pressure plate connected to an aspherical head resulting in a uniform load application. The free suspension allows exactly parallel positioning on the disc brake pad, thus ensuring an absolutely uniform and homogeneous force application. The deformation measurement is conducted with three precision transducers arranged at 120° angles.

Disc brake shoe test fixture for a Zwick UTS

Multi-axial Fatigue of Exhaust System Component

This application illustrates a two-axis (10 kN vertical and 1 kN side load) dynamic test on a muffler component utilizing a Zwick tabletop servohydraulic test machine and *testXpert*® software. The side load is applied with a small structural actuator and integrated into the lower fixturing. This allows a simulation of in-service conditions of the muffler to determine its' structural durability.

Bi-axial Test on muffler component

Zwick / Roell

Torque Fatigue Testing of Gearbox Components

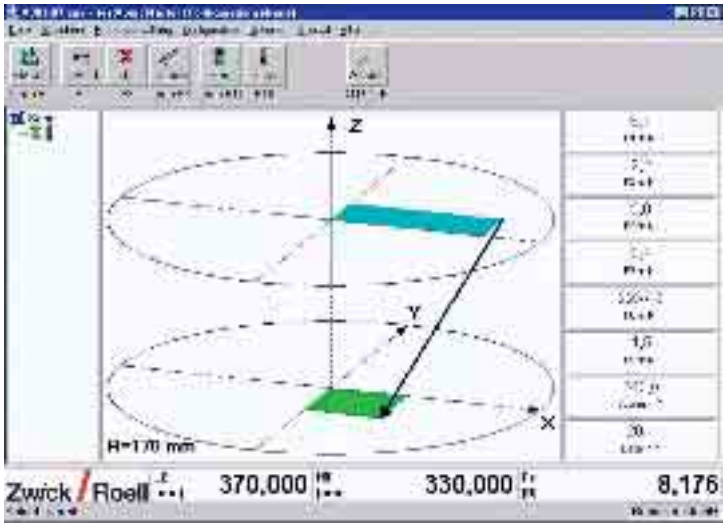
A servohydraulic testing stand has been developed to determine the durability of gear box or axle components. The test system is capable of providing up to 4000 N-m of torque and is mounted on a linear T-slot table to accommodate test specimens of various sizes. The system is capable of 360 degrees of rotation and variable programmable speeds. A selection of system options is available including different size rotary actuators, torque cells, rotary transducers and different speed-performance options.

Servohydraulic test stand to test drive shaft components

Multi-channel Spring Test System

Zwick provides specialized systems designed to determine the mechanical behavior of automotive springs (including valve springs, struts and shocks). This system utilizes a standard Zwick mechanical testing system equipped with a six or nine-component force-measurement platform system. Specifically, the spring "penetration point" can determine the resultant forces from all three axes when the spring is subjected to compression forces. It is important for engineers to understand the behavior of such forces when taking into account quality attributes, friction, wear and durability of springs.

Spring test system with load measurement platform



testXpert® screenshot indicating the penetration points and real time display of complex forces and displacement

Precision Spring Test Fixture

The performance and mechanical behaviour characteristics of springs under service loading conditions need to be understood by automotive manufacturers and suppliers. Zwick offers a device for compression spring testing that can be put to ideal use as a spring testing machine in combination with a single-column testing machine (like the zwicki-line) and testControl electronics. The device is extremely-stiff, both vertically and laterally and is equipped with a precision load cell and an overload protector. Precision guides allow only vertical movement of the compression platens and an extremely-stiff load cell that is insensitive to lateral forces, effectively reduces measurement errors caused by loading compliance or resultant side loads. The precision fixture may be removed to allow standard materials testing to be performed.

Precision Spring testing fixture for forces up to 500 N

Zwick spring testing machine

Zwick / Roell

Chassis

The chassis segment consists of suspension components including shocks, springs, stabilizer bars, control arms, struts, tires and wheels. A significant number of static and dynamic tests are typically conducted on these chassis components to determine supplier quality and to support design and development efforts for improved performance and durability. These components are often constructed of metals and elastoms and require multiple-loading axes (axial-torsional, or bi-axial) to simulate the applied forces in the vehicle. Zwick has significant experience in providing chassis component test systems, several of which are shown below.

Axial Deformation of Wheels

Indentation tests are performed on aluminium wheels using customized Zwick test system to determine the supplier quality components. A special indenter tool is used to deform the wheel (simulating striking a curb), and a custom load cell provides very-accurate, axial load measurement even during non-axial loading of the wheel. This versatile system has an upper testing area which is also configured for tensile testing with grips and extensometer.

Wheel indentation test with t-slot table base

Dynamic Performance Test on a Shock Absorber

Zwick provides test systems to perform dynamic testing on shock absorber in order to determine the shock dampening and seal friction characteristics. These tests are typically conducted on a servohydraulic test system and typically include an additional side load axis, and in some cases a temperature chamber to simulate elevated temperatures. The test system may also be used to determine the durability of shock absorbers involving a high number of test cycles.

Dynamic performance test on a shock absorber

Machine is configured with two testing areas to maximize efficiency

Zwick / Roell

Multi-axial Deformation Test on Tires

Zwick has developed an advanced test system used to measure side stability of vehicle tires with different wheel and tire pressure combinations. This system allows OEM manufacturers to properly select supplier's tires-wheel combinations, and tire suppliers to evaluate tire side stability under static-loading conditions. The unique Zwick load measurement platform allows axial and side loads to be accurately measured while the testControl controls the vertical, horizontal axes and tire air pressure.

Axial, horizontal load and tire pressure are controlled with testControl

Testing rig to measure tire bulge out with horizontal loading table

Multi-axial Static Test on Strut Component

An axial-torsional test with a lateral side load on McPherson Strut is illustrated which simulates three applied force vectors on the strut. The system is used to determine the static load / deflection properties of the strut at various side loads and seal combinations. This characteristic curve can then be compared with other strut data or with struts with accumulated time on a test vehicle.

Axial-torsion test on a strut with a side-loading actuator

Zwick / Roell

Multi-axial Test on Air Bearings

Zwick's customer needed to determine the performance and quality attributes of an air spring under axial and horizontal loading conditions. This system consists of a Zwick floor-standing 250 kN test machine adapted with a horizontal electro-mechanical drive and a load measurement platform with five force transducers to measure the complex loads. Finally, the system is equipped with a horizontal loading carriage which facilitates loading of the test specimen and horizontal articulation.

Air bearing specimen and fixturing

Air bearing test rig axial and horizontal loading

Axial Fatigue of Production Dampeners

A Zwick tabletop servohydraulic test system is used to perform dynamic tests on elastomeric and metal dampener component in a production environment. Typical properties determined may include spring constant, dynamic modulus, phase shift and dynamic performance over a specified frequency range (E.g. sine sweep). The system consists of safety "light curtain" and requires operator to place both hands on starter panel prior to machine operation.

Production system for fatigue testing of elastomer dampers

Zwick / Roell

Interior / Safety

Stricter government regulations and consumer preferences are demanding improved and intelligent safety systems in today's vehicles. These include seats with driver preference settings, passive and active safety systems such as multiple "smart" air bags and improved interior comfort and features. Zwick Roell offers a wide range of testing solutions for testing interior materials such as foams, textiles and plastics and systems to simulate the in-service conditions of interior components such as seats or restraint systems. These systems are used in the quality assurance, product development and design verification phases.

Biaxial Testing of Passenger Seat

A flexible, biaxial servohydraulic testing system capable of simulating vertical and horizontal side loads to determine the durability of a car seat is shown. It features an adjustable load-reaction frame, movable crosshead, adjustable loading axis, horizontal slip table, adjustable seat platen fixture and a t-slot table. The system can be easily reconfigured to test other complex-shaped components in one or multiple axis.

Articulating seat-form fixture for biaxial test system

Static Testing of Passenger Seat

Zwick has developed testing solutions for testing the seats of passenger cars. The systems are designed to determine the quality and durability of the fabricated seat. The system shown is used to test the sensor mat in the seat for proper airbag settings. It has a specimen loading carriage and a position-adjustable load cell to determine the required load to active the embedded sensor.

Seat testing system for testing imbedded-sensor mats

Biaxial test rig for car seat durability

Zwick / Roell

Tension Testing on Safety Belts

Zwick test systems are used by safety belt manufacturers and OEMs to determine the seat belt fabric strength, the release force of the buckle buttons under tension as well as the inertia system hardware of a three-point safety belt / harness system.

Seat belt inertia components to be tested

Tensile test of seat belt material

Test system for torque testing seat belt torsion bar

Durability of Headrest Support Brackets

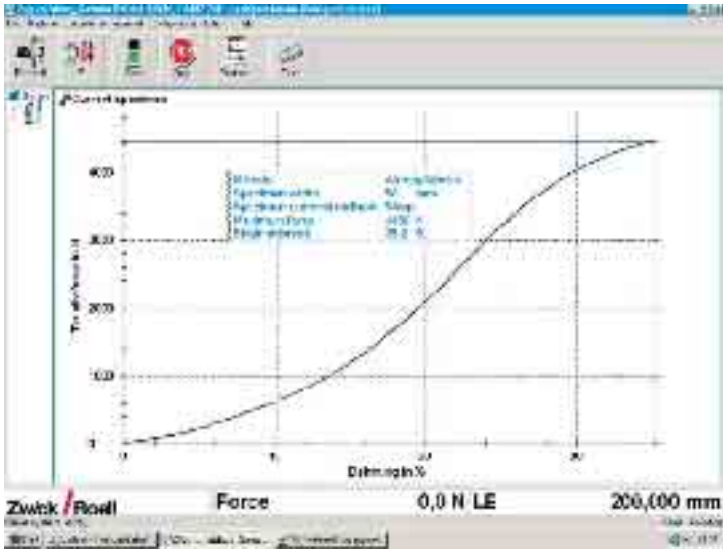
A Zwick electro-mechanical actuator is used to measure the durability of a head rest support of a car. The test may be configured for crash-impact studies or to compare quality of vendor supplied headrest components. The actuator may be configured for other types for structural testing on components (single or multiple axis) Refer to page 40 for more information on structural actuators.

Electromechanical actuator to test neck rest support strength and durability

Tensile test on airbag polymer

Tensile Test of Airbag Material

A standardized test is performed to determine the tensile properties of an airbag material for quality control purposes using *testXpert*® software.



testXpert® screenshot for tensile test

Zwick / Roell

Window and Door Seal Test System

Zwick develops test systems to evaluate the functionality and quality of door and window seals with a built-in automatic crush protection system. These seals are designed to shut off the window or sun-roof motors if a pressure points is detected (such as a passenger's fingers or a head) The system includes a integrated force – electrical resistance measurement system (to determine at what load and resistance the safety system is activated), bar-code reader for specimen identification and horizontally-adjustable loading points (single or multiple units) as shown below.

Door seal test system to test embedded sensors

A system with two simultaneous compression points

Production Testing of Truck Telescoping Steering Linkages

An automated multi-station test system was developed to determine the rotation angle and torque and the axial insertion force and displacement of

Integrated assembly and test system for telescoping steering lingages for trucks

telescoping steering linkage in truck cab production. 100% of the production is assembled and tested with the Zwick test system, which is part of a completed integrated testing line used by a manufacturer of commercial trucks.

Durability Test on Foam for Seats

A universal electromechanical actuator integrated into a wide load frame is used to determine the compressibility properties of foam used in cars seats and interiors. *testXpert*® is

Foam durability test using testing actuator

used to quickly configure the cyclical test and monitor its progression with “at a glance“ test results. There are many other possible applications for this actuator.

testXpert® screen shot from durability test

Zwick / Roell

Car Body

The car body includes all the exterior components – sheet metal panels, bumpers, light lenses and trim. There is continuing emphasis by manufacturers to reduce weight and to thinner, stronger sheet or to replace body panels with light-weight metals, plastics or composites. This requires significant testing to determine strength, formability, and strength of metals joints and bonds. Zwick offers a complete range of test equipment for testing materials for car bodies ranging from standard hardness tests, metal formability systems to automated robotic-assisted tensile testing.

Draw Bead Test on Steels

This test has the purpose of determining the coefficient of friction between sheet steel and the deep-drawing die in order that optimum lubrication can be applied. This allows cracks and folds of the sheet steels to be avoided, but at the same time ensuring an optimum deep-draw process. The draw bead tester is easily installed in a standard testing machine by mechanical and electrical connections. For the test, a typical sheet steel strip (300 mm x 30 mm x 2 mm) is gripped with hydraulic grips, (lateral gripping pressure is accurately controlled during the test). The sheet steel strip is then pulled through the draw bead tester dies. The desired number of automatic repetitions can be preset in the *testXpert*® software. The fixture dies can quickly be exchanged to meet different testing specifications.

Close up view of grip and die configuration

Proof Load Test on Bumper

Buckling strength test system for bumpers

A compression buckling test system for car bumper tests was developed with dual load-cells and vertical deflection sensors to measure the load – deflection characteristics of the bumper. This system is used for both development and quality assurance applications.

Draw bead test systems for evaluation of deep-drawing dies

Zwick / Roell

Buckling Test on Vehicle Door

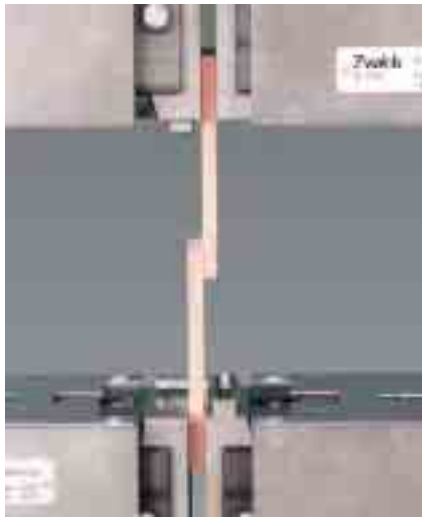
A compression test on a passenger car door to determine the buckling strength is accomplished by equipping a wide version of Zwick mechanical testing machine with two load cells and push rods (load cell signals are summed together). Upper testing area is configured with grips and extensometer for standard materials testing.

Three-point buckling test on car door with upper section of load frame used for tensile test

Tensile Test of Welded Metal Lap Joint

Zwick offers unique mechanical wedge grips with synchronized gripping action. The synchronized action can be switched off when gripping a lap sample ensuring that the resultant tensile loading axis is in the exact center of the bonded samples. Furthermore, the grips ensure secure and uni-axial gripping of straight samples when the synchronization action is engaged.

Tensile test of welded specimen



Tensile test of welded lap joint using special synchronized mechanical grips

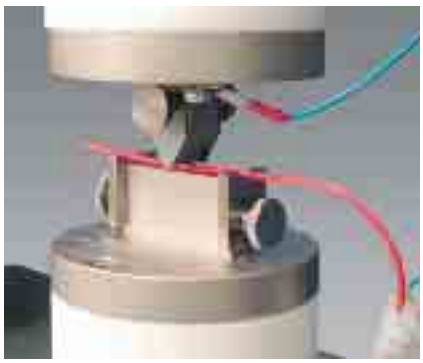
Zwick / Roell

Electronics

The number of integrated circuits, computer systems and complexity of “black boxes“ continually increases in modern automobiles. These are found in engine ignition control, driver stability / handling and navigational systems to name a few. The systems must be ruggedly designed and tested to withstand many years of maintenance free use. Zwick provides a range of mechanical testing systems with options to allow the electrical signal inputs or outputs to be integrated with the test controller and *testXpert*® software.

Wire Insulation Test

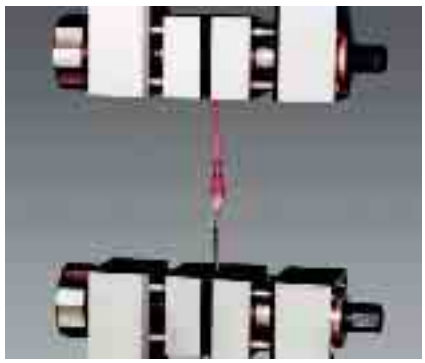
A special anvil die is used to measure the indentation resistance of the wire insulation per automotive industry specifications. At the moment an electrical path is conducted from the wire through the test die, the exact wire insulation penetration force is recorded in the *testXpert*® software.



Wire penetration test with integrated electronics

Wire Connector Tensile Test

This test method allows the determination of electrical connector tensile pull out force as part of a routine quality assurance test on wires and connectors. The proper lateral gripping force is selected to eliminate wire pull out or breakage in the grip faces.



Tensile pull test on wire connector

Testing of Electronic Switches and Instrument Panel Buttons

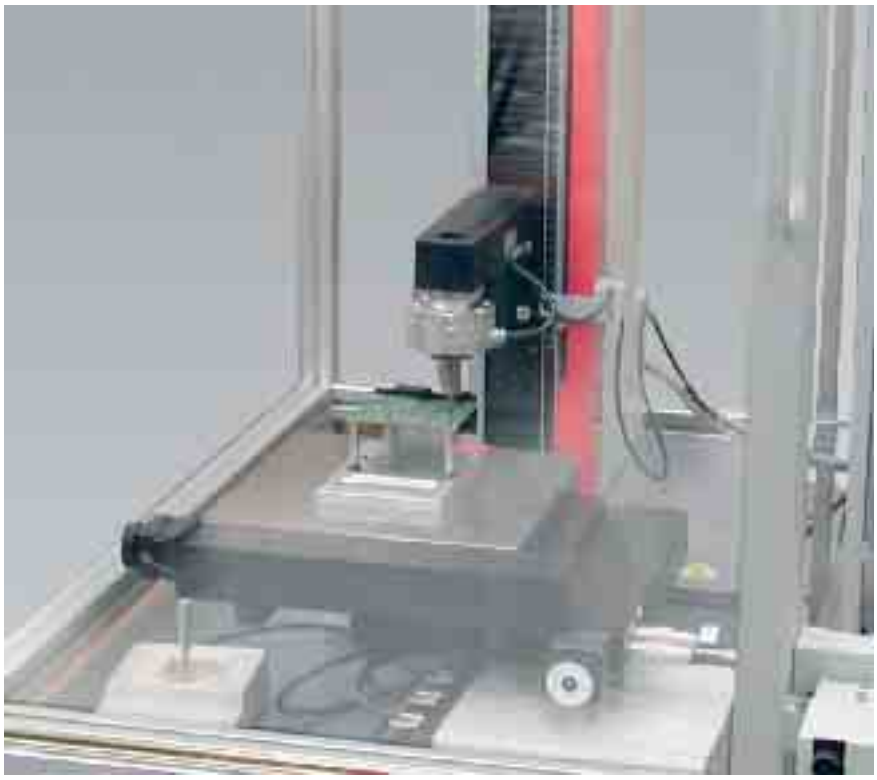
In order to determine the quality and durability of electronic switches and panel buttons, adaptations to Zwick’s standard tensile testing are offered. These include axial or torsion test systems which determine the force or torques required to activate a switch or systems which apply repetitive loads to switches or buttons. Test specimen electronics can be fully integrated with the testControl electronics and *testXpert*® switch contact events (load and displacement) in addition to supporting specimen input / output requirements.

zwicki used for torsion tests on rotary switches

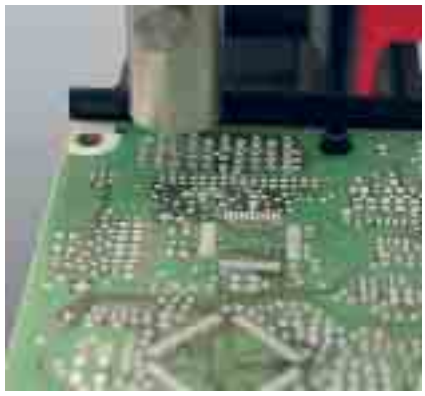
Close up of rotary 3-position switch

Zwick / Roell

Solder Joint Test on Circuit Boards

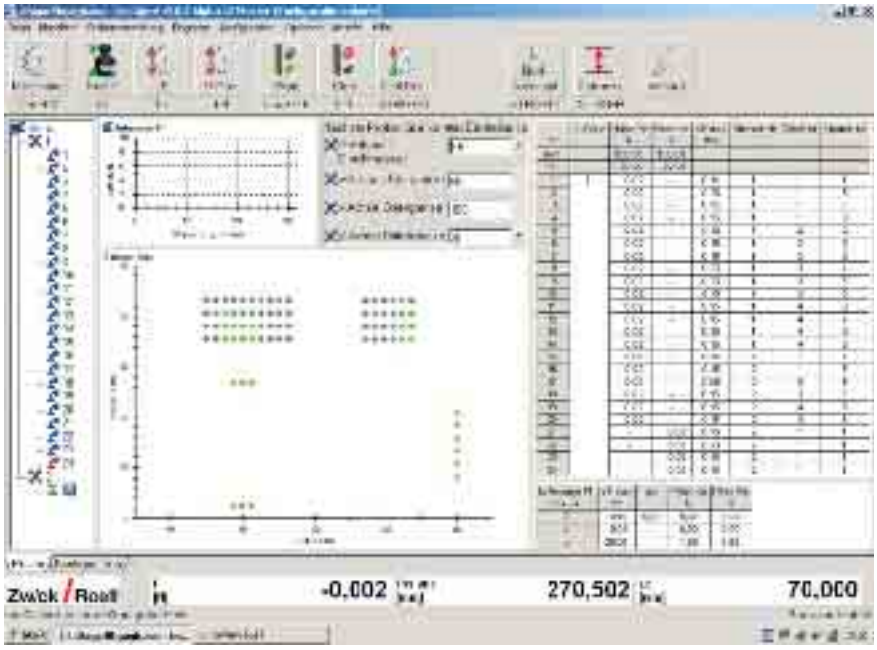


Automated test system to test circuit board soldered pins



Close up of compression stylus tool

Fully automated test system with motorized X-Y table to determine the compressive joint strength of solder pins in a circuit board. The system is fully enclosed in a protective test guard and all test machine and test table position controls are provided by testControl and *testXpert*®. The test can be conducted without the supervision of an operator.



testXpert® software shows “at a glance“ which pins have been tested and if they have passed the minimal strength requirement (indicated in green)

Zwick / Roell

Raw and Pre-fabricated Materials

Zwick test machines are used to determine the quality and mechanical properties of virtually all manufactured components and raw materials used in the production of automobiles. These include screws, fasteners, welded joints and sheet metal provided for forming operations, as well as plastics, rubbers and foams. These tests are performed to verify supplier manufactured quality and also to determine material properties for development of new product designs or processes. Zwick provides a comprehensive offering of products to test raw materials and pre-fabricated components for autos including specimen preparation equipment, hardness machines, universal test machines, fully automatic test machines, fatigue test machines, and component test machines. Some of the most common tests to evaluate the material properties are shown. These include tests on fasteners, foam, rubber, plastics and metals.

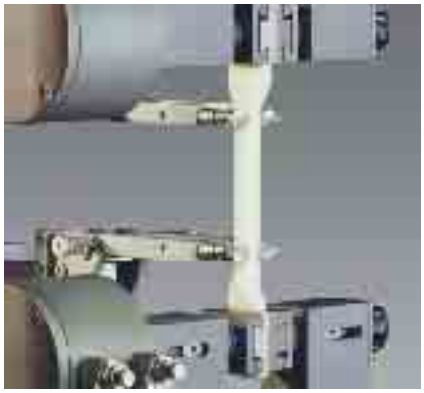
Fastener Testing

Fatigue Test on Vibrophore

Tensile test on Fasteners

Welded sample and bolt specimens

Foam Testing



Tensile test on foam

Peel test

Compression test

Zwick / Roell

Rubber and Plastics Testing

Tensile Test on Rubber

Tensile Test of Plastics

Test machine with environmental chamber

Metals Testing

Tensile test with r & n determination

High-temperature test with strain measurement

Metal formability test specimen

Zwick / Roell

Product Overview

Classical Hardness Testers



Hardness tests on a valve (l), on a camshaft (m) and on a spherical joint bearing (r).

Rockwell Hardness Tester

Rockwell Hardness Tester Zwick/ZHR

The different machines from this product family are designed for:

- Classical Rockwell methods (test loads: 60 - 150 kg
- Super Rockwell methods (test loads: 15 - 45 kg) and the
- Combination of these methods (test loads: 15 - 150 kg)

These testers are characterized by a patented indenter mounting which allows hardness tests at measurement points that are not easily accessible and guarantee simple operation:

- Automatic operation
- Selection of the load weight using a rotary knob or touchscreen
- Automatic load application and removal
- Automatic evaluation including revaluation

Additional Features

- Input of tolerances
- Robust construction with play-free ball bearing spindle
- Work are up to a height of 292 mm for testing large components
- Standard equipped with RS 232 interface
- Versatile standard accessories (intruder, support table, hardness comparison plates)
- Cost efficient model with spring force load

Rockwell hardness tester Zwick/ZHR

Zwick / Roell

Vickers Hardness Testers

Vickers Hardness Testers Zwick/ZHV1m, Zwick/ZHV2m

The manual micro-Vickers hardness tester is compliant with the international standards ISO 6507 and ASTM E92. The tester is available in two upgrade stages. The ZHV1m has test load steps (manual load change): 10, 25, 50, 100, 200, 300, 500, 1000 gf and the ZHV2m has load steps: 25, 50, 100, 200, 300, 500, 1000, and 2000 gf. The tester is equipped with an automatic revolving head for changing between intruder and objective lens. Standard equipment includes a compound table as well as a high-precision vise and other accessories.

Zwick/ZHV1m with PC/*testXpert*®

In addition to numerous (statistical) functions, the tester also has a serial interface and a USB connector. These and the „Small Machine“ test program allow the tester to be connected to a PC running the Zwick test software *testXpert*® In place of the microscope, the manual micro-Vickers hardness tester can optionally be equipped with a CCD camera system for automatic indentation measurement in combination with *testXpert*®.

Vickers Hardness Testers - Zwick ZHV20/Z2,5 , Zwick ZHV30/Z2,5

The hardness testing equipment for optical methods is integrated in a zwicki-Line tester for these machines. The built-in load cell measures applied test loads between 2 and 200 N or 3 and 300 N electromechanically. The CCD camera is mounted on a microscope offset by 90°. Objective lenses and the mounting unit(s) for the indenters are integrated in the revolver head so that the position change between setting and measuring the indentation occurs by revolving the head. A master test plan includes series test to Vickers, Knoop, and Brinell. Options include upgrades for automatic indentation measurement and focusing as well as hardness sequence tests with manual or motorized compound tables.

Semiautomatic Vickers hardness tester Zwick/ZHV30/Z2,5

Universal Hardness Tester Zwick ZHU 250

The universal hardness tester is designed for a load (closed-loop system) up to 250 kg.

This machine is in compliance with international standards DIN EN ISO 6507, ASTM E92 (Vickers HV1 to HV100), ISO 4545, 4546 (Knoop HK1), DIN EN ISO 6506, ASTM E10 (Brinell HBW1/1 to HBW10/250), DIN EN ISO 6508 (Rockwell with all current scales) and is also suited for determining the ball indentation H (49 to 961 N) for plastics compliant to ISO 2039.

Zwick/ZHU250

The standard equipment for the ZHU250 includes a pressure plate. Objective lenses with various magnifications (15x to 520x) as well as various test anvils allow for a broad spectrum of applications.

The serial interface and the “Small Machine“ test program allow the ZHU250 to be connected to a PC running the *testXpert*® test software.

Zwick / Roell

Universal Static Testing

Zwick materials testing machines are not only used for tensile, compression and bending tests on metallic and non-metallic specimens, but also for tests on component parts such as springs, wheels or complete seats. With these machines it is also possible to carry out functional tests, such as tests on door locks, automotive circuit boards or electro-mechanical switches.

A Selection of Load Frames to Best Meet Your Testing Requirements

The Zwick product portfolio includes universal testing machines as table-top and floor-standing designs with different measurement systems, load frames, drives and versatile optional units. To offer the best machine for each requirement, Zwick has developed three machine versions, each of them offering distinct performance features:

- The zwicki Line is based on a single screw design for forces up to 2.5 kN. With advanced testControl electronics and large variety of accessories and with the flexibility of *testXpert*® software, almost every testing requirement in the force range from 1 N up to 2.5 kN can be accomplished.
- The ProLine is particularly suitable for cost effective functional test on component parts and for simple materials tests. With load frames from 500 N up to 100 kN and the choice of well selected accessories a wide range of testing requirements can be satisfied.
- The Allround Line is the basis for a large spectrum of demanding test jobs and can easily be expanded when requirements become more demanding. Therefore, the test machine continues to meet your advanced test requirements for the long term.

Load Frames

Load frames are developed and produced for rated loads up to 2000 kN in our standard procedure. We manufacture special models for special applications, for example for higher rated loads or lateral load frames for long steel cables.

The Single-Column Design of the zwicki Line

This load frame is based on a very bending-resistant extruded aluminium sheet, which was developed especially for the zwicki-Line. The workspace is freely accessible from three directions, so that zwicki Lines find their application in component testing and as Zwick hardness testers. Their low weight and small base make this modular system easy to transport and simple to find room for on any laboratory table. Maximum force capacity options of 1.0 and 2.5 kN are available with a wide selection of ancillary force load cells to meet specific load accuracy requirements.

zwicki Line showing three different height options

ProLine Z050 with floor stand, test guard and special platens for testing elastomer dampers

Zwick / Roell

The Single and Double Column Table-top Machines of the ProLine

The double-column load frames of the ProLine are equipped with two round steel columns which guarantee precise guiding of the crosshead. In addition, the integrated spindle and guide protection guarantees reliable operation in industry or for testing splintering material. Single-column load frame ProLine models are available especially for testing with small loads up to 500 N.

The Table-top and Floor-based Testing Machines of the Allround-Line

The **table-top testing machines** are equipped with two columns made from a patented extruded aluminium sheath. They are light, very bend resistant and also serve as the spindle guide and spindle protection. T-slots on the outer sides allow simple mounting of accessories such as protectors or fixtures free from interference by the moving crosshead.

All table-top testing machines can be equipped with a pedestal to position the workspace at the optimal height for the application or operator.

The **floor machines** achieve a high accuracy from hard chromium-plated guide columns and a precision ball-type linear drive with play-free spindle nuts. Zwick offers different variations on the crosshead installation, so that an upper or lower (or both) workspaces are available. In hybrid drive testing machines, the fixed piston rods serve both as bearing and guiding columns. All load frames with electromechanical drives can optionally be equipped with a second workspace which, for example, makes it possible to quickly change the type of test without having to convert the machine.

Allround Line floor machine Z250 rated at 250 kN

Zwick / Roell

Drives

Electromechanical Drives

All electromechanical drives are based on play-free and low-wear ball-type linear drives and digitally controlled drives. They are equipped with load frames for test loads up to 600 kN. Combined with digital measurement and control systems, they offer the following advantages:

- Extremely-large, infinitely-variable speed range
- Very low speed settings possible (from about 0.5 µm/min up)
- Highly precise and exactly reproducible positioning

Hydraulic Drives

This drive is located in the center of the upper fixed crosshead. The workspace below is therefore easily accessible. A servo or proportional valve regulates the oil flow between the hydraulic unit and differential cylinder. The oil cushion in the upper pressure prevents plunger pistons from „jumping“ when a specimen breaks. The resolution of the piston travel sensor is 1.25 µm (less than 1/400,000th of the maximum testing travel. The hydraulic drive is the most efficient solution particularly for large test loads.

Hybrid Drives

These patented drives combine the advantages of the electromechanical drive – high precision and with those of the hydraulic drive – high-force density. The result: Even cylinders with large strokes and for very large forces can be operated and positioned with high precision. This principle is realized by operating exactly synchronous two parallel cylinders coupled with the crosshead independent of their respective loads, by having them follow precisely and nearly delay free the positions specified by an electromechanical pilot drive. The special features of this drive are:

- Higher testing travel (no adjustment of the fixed crosshead necessary)
- Relatively low headroom of the load frame

zwicki Line Load Frames and Drives

Model	Z1.0	Z2.5
• Max. test load [kN]	1.0	2.5
• Work space height		
* shortened [mm]	-	573
* normal [mm]	-	1073
* increased [mm]	1373	1373
• Work space width [mm]	4	4
• Work space depth [mm]	99.5	99.5
• Max. crosshead speed [mm/min]	1800	800
• Crosshead travel resolution [µm]	0.2265	0.0996
• Max. power consumption, kVA	0.4	0.4

ProLine Load Frames and Drives

Model	Z0.5	Z005	Z010	Z020	Z030	Z050[1)]	Z100
• Max. test load [kN]	0.5	5	10	20	30	50	100
• Work space height							
* shortened [mm]	-	565	-	-	-	-	-
* normal [mm]	590	1065	1045	1045	1370	1370	1360
* increased [mm]	1360	-	-	-	-	-	-
• Work space width [mm]	∞	420	420	420	440	440	640
• Work space depth [mm]	100	∞	∞	∞	∞	∞	∞
• Max. crosshead speed [mm/min]	1500	500	1000	500	300	180/600[1)]	300
• Crosshead travel resolution [µm]	0.226	0.050	0.090	0.045	0.025	0.015/0,016[1)]	0.008
• Max. power consumption, kVA	0.4	0.8	0.8	0,8	0,8	0.8/3[1)]	3

[1)] This testing machine is available in two electronics variations. The first value is for the standard electronics, the second for *testControl*.

Zwick / Roell

Allround Line Load Frames and Drives

Tabletop Testing Machines

Model	Z005	Z010	Z020	Z030	Z050	Z100	Z150
• Max. test load [kN]	5	10	20	30	50	100	150
• Work space height							
* normal [mm] [2)]	1045/1025	1045/1025	1045/1025	-	-	-	-
* increased [mm] [2)]	1445/1425	1445/1425	1445/1425	1355	1355	1355	1535
* extra high [mm] [2)]	1795/1785	1795/1785	1795/1785	-	-	1755	-
• Work space breadth							
* normal [mm]	440	440	440	440	440	-	-
* widened [mm]	640	640	640	-	-	640	640
• Work space depth [mm]	∞	∞	∞	∞	∞	∞	∞
• Max. crosshead speed [mm/min]	3000	2000	1000/2000[3)]	1000	600	750/150[3)]0	900
• Crosshead travel resol. [µm]	0.0410	0.0272	0.0136/0.0543[3)]	0.0271	0.0163	0.0207	0.0123
• Max. power consumption, kVA	2	1.9	2.1/2.6[3)]	2.3	2.3	4/6[3)]	5.5

Floor-standing Test Machines

Model	Z050	Z100	Z150	Z250	Z300	Z400	Z600
• Max. test load [kN]	50	100	150	250	300	400	600
• Work space height [mm]	1825/1760[2)]	1825/1760[2)]	1715/1655[2)]	1715/1655[2)];	1800 1360[4)]	1800	1940
• Work space height							
* Normal [mm]	630	630	630	630	630	630	740
* Widened [mm]	1030	1030	1030	1030	-	-	-
• Work space depth [mm]	∞	∞	∞	∞	∞	∞	∞
• Max. crosshead speed [mm/min]	1000/2000[3)]	500/1000[3)]	900	600	250	250	200
• Crosshead travel resol. [µm]	0.0270	0.0136	0.0123	0.0082	0.031	0.031	0.025
• Max. power consumption, kVA	4/5[3)]	4/5[3)]	5.5	6	7/13[5)]	7/13[5)]	20/26[5)]

[2)] The second value is for the model with the widened work area [3)] Dependent on selected drive and its power
[4)] The last value is for a cost effective special model limited to one work area [5)] Higher power applies for hydraulic grips

Zwick / Roell

Standard frames with hydraulic (H) or hybrid (Y) (Standard program with hydraulic or hybrid drives)

Model	Z400H	Z600H	Z1200H	Z2000H	Z600Y	Z1200Y	Z2000Y
• Max. test load, kN	400	600	1200	2000	600	1200	2000
• Load frame dimensions							
* height, mm	2900	3000	3500	4200	2750	3147	4200
* width, mm	1020	1080	1300	1400	1530	1614	1870
* depth, mm	480	500	880	905	788	790	1100
• Work area							
* max. height, mm	500	500	600	600	1895	2300	2400
• with adjustable fixed crosshead	900	900	1000	1000			
* width, mm	670	670	850	870	790	860	950
* max., mm	500	500	600	600	850	1000	1000
• Crosshead/piston travel resol., µm	1.25	1.25	1.25	1.25	0.05	0.05	0.05
• Max. testing speed., mm/min	200	200	200	200	250	250	250
• Number of support/guide columns	2	2	4	4	2	2	2
• Max. power consumption, kVA	8.5	8.5	15	23	8.5	15	23

The C-Shape Load Frame

This load frame is specially adapted for compression and indentation testing of larger cellular plastic parts as used for seats in cars and aircraft. The table can be opened on both sides in order to get a large anvil surface. In the test area the table is perforated with holes to allow rapid air escape during indentation tests (acc. to ISO and ASTM standards). The test space is accessible from three sides to allow a very comfortable and fast operation. By use of adapters, this load frame can be used for tensile and tear testing as well.

The C-shape frame is used for compression and indentation tests on larger parts of cellular plastics

Zwick / Roell

Measurement and Control for Static Systems

A fundamental component for the testing machines is the measurement and control system. Its design and scope of capabilities determine which drive system it regulates, which measurement system it is connected to, and which functions can be controlled. The testControl controller offers maximum technical performance and long range return on investment through the use of the most current technologies and highest quality standards. Notable characteristics of the electronics are among other things:

- Chronologically-synchronized test data recording with high-resolution and measurement frequency
- 500 Hz real-time processing of the test data for monitoring and event-oriented control of the testing sequence (e.g., speed change upon reaching the yield/proof stress limit) and safety limits.
- Adaptive control for exact reproducible test speeds and positions even under changing material conditions (for example compliance or temperature effects). testControl, and hence the test machine, is operated using a PC and the test software *testXpert*® in the basic model. The system is therefore simple to configure and upgradeable for the most diverse applications as well as extremely flexible and easy to operate.
- A modular design. As your needs change, testControl can be modified to meet them (like adding additional load or strain channels or external input /output channels)

An optional stand-alone variation offers simple, direct operation of the testing machine using a color display, a key pad and a few, intuitively obvious function keys. A printer can be connected directly to output the test results for this alternative to PC operation.

The standard electronic assembly is equipped with an integrated stand-alone functionality which includes the essential functions for performing simple tests. A PC can be connected to this system to allow the advantages of *the testXpert*® software to be applied here as well. Both electronic assemblies are mounted in space-saving, compact housings directly on the load frame and guarantee high accessability and reliability of the testing system.

testControl Controller (standalone option) and optional input / output module to accommodate additional signals (right)

Zwick / Roell

testXpert® II - Intelligent and Reliable, the New Software Generation for Materials Testing

Zwick Roell has set the standard with *testXpert*® for intelligent materials testing software. Unlike other software, Zwick has standardized *testXpert*® for all of its applications, no matter whether static or dynamic tests — so you spend less time learning to handle software and more time conducting tests. With *testXpert*® II, you benefit from over 80 years of testing experience and from over 10,000 successful installations worldwide.

Some Significant Benefits of *testXpert*® II

Ingeniously simple – *testXpert*® II is organized so that you can operate it intuitively. Expressive symbols and a clear menu structure enable users to become quickly oriented and cut the familiarization period to the bone. The menu bar is set up according to the needs of the user, making working with *testXpert*® II ingeniously simple.

Intelligent – Wizards help you to set up or change test procedures and test reports. Should you have any questions, our extensive context-sensitive online help feature will quickly deliver the answer.

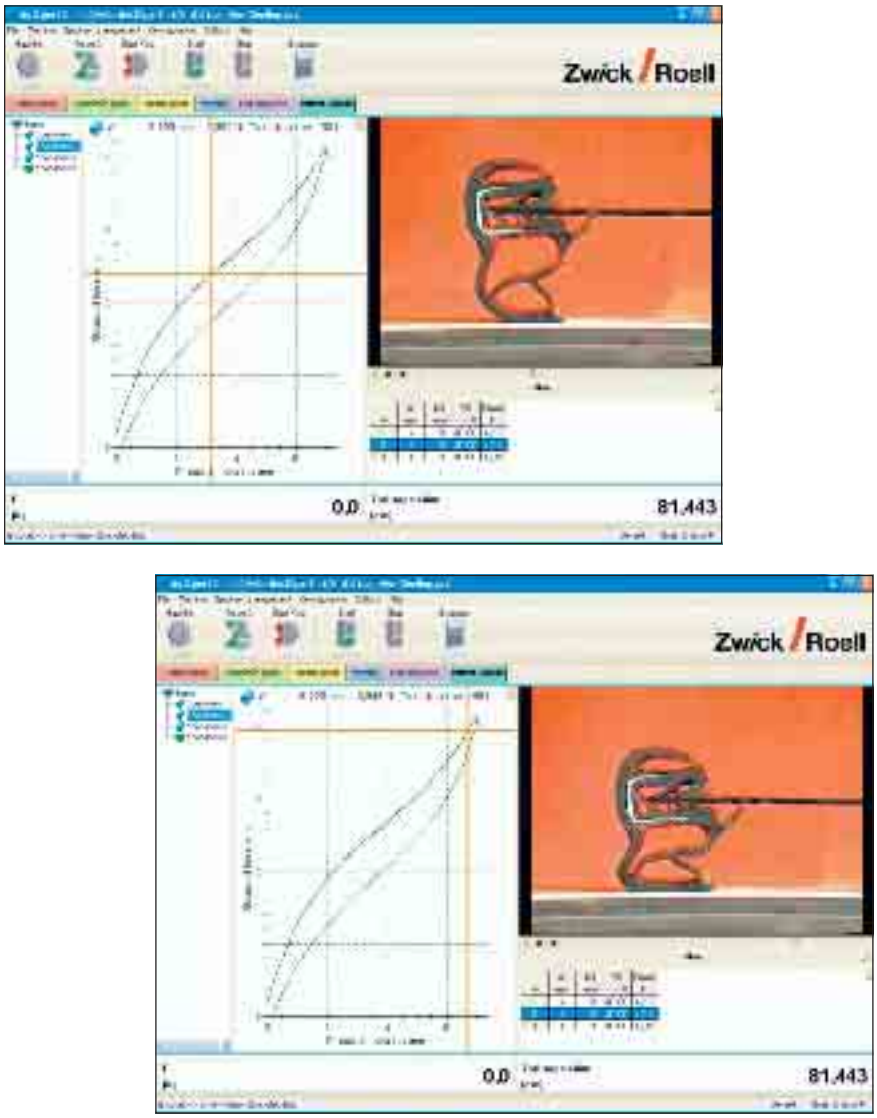
Modular design – This means that we can offer a specific testing solution to meet your particular requirements. Additional testing capabilities can be added as needed.

Compatible with your hardware – Zwick *testXpert*® II is compatible with all commercially available PCs and laptops without the need for an additional interface card! This means it is easy to switch system computers or even to develop test methods or perform analyses in the office at your convenience. You always have access to your test data.

Online language swapping – Needless to say, you can have *testXpert*® II in your language of choice. *testXpert*® II speaks more than one language – all you need to do is click the mouse in order to change the language online. Language swapping is a function which can be changed at any time, e.g., when generating the test report. Flexible *testXpert*® II language swapping offers international teams not only language-neutral operation of their testing machine but also considerably simplified communication.

Industry-oriented terminology and data export capability – And *testXpert*® II not only uses your language but it also adopts your technical terminology. For example, symbols or variables that are specific to your industry (e.g., metals, plastics, rubber) are implemented throughout the software. This provides more relevant meaningful information for your testing application. Today's quality assurance standards necessitate that the test results may be exported to a company's central laboratory database. So we have created *testXpert*® II to communicate reliably with your IT system by providing flexible interfaces and MS Office integration by means of Object Linking Editing (OLE).

Synchronized video recording – Only *testXpert*® II offers you an image-for-image, exactly synchronized video recording of your test. You can interpret the measuring curve of the test efficiently with the help of the recorded image changes of the specimen. You can record the test procedure with a video camera or an USB webcam. And *testXpert*® II saves the recorded images synchronized with the measuring data. The visual recording shows, for example, when, how, and where the specimen necks, buckles, or changes colors. The alterations in specimen dimensions can be measured exactly from the captured images. In addition, before the test, you can determine which events images should be recorded for: such as the point in a cycle when compression switches over into tensile stress. Afterwards you can print out these pictures or integrate them into the test report. Thanks to the synchronized video recording, the test procedure can be recalled or compared at any later time.



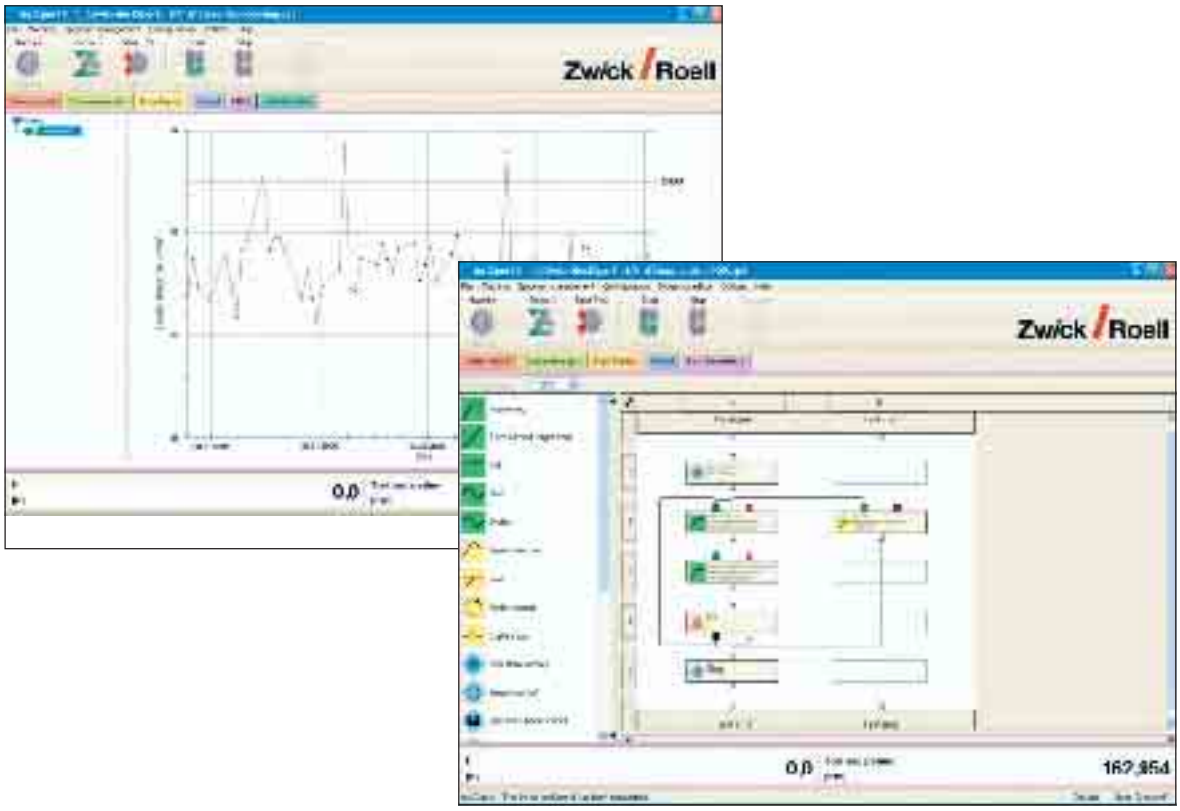
Sequence of *testXpert*® screenshots showing synchronized video feature

Zwick / Roell

***testXpert*® II LIMS –** Only *testXpert*® II offers these features: an integrated Laboratory Information Management System (LIMS). A powerful database is available to administer your test results in order to create and archive long-term statistics and reports. All data acquired by testXpert® II are available from any testing system in your company.

***testXpert*® II LIMS Features only offered by *testXpert*® II**: An integrated Laboratory Information Management System (LIMS) Here you have a powerful database available to administer your test results in order to create and archive long-term statistics and reports. All data determined by *testXpert*® II are available from any testing system in your company.

Graphical Sequence Editor – The *testXpert*® II Graphical Sequence Editor offers all the freedom you could possibly hope for. It enables you to design test procedures of any kind very individually, by combining test events, parameters and results exactly as you require. The intelligent construction of the graphical sequence editor makes your work easy. You do not require any programming knowledge: The graphic base makes for quick familiarization with the functionality. The integrated simulation mode offers you safety: It analyzes the test procedure you have created incorporating a virtual testing machine, with different specimen behaviour (e.g. spring, plastic, metal, etc.). You thus filter out errors from the test procedure in the early stages, and all this without destroying a single specimen.



Zwick / Roell

Software Updates

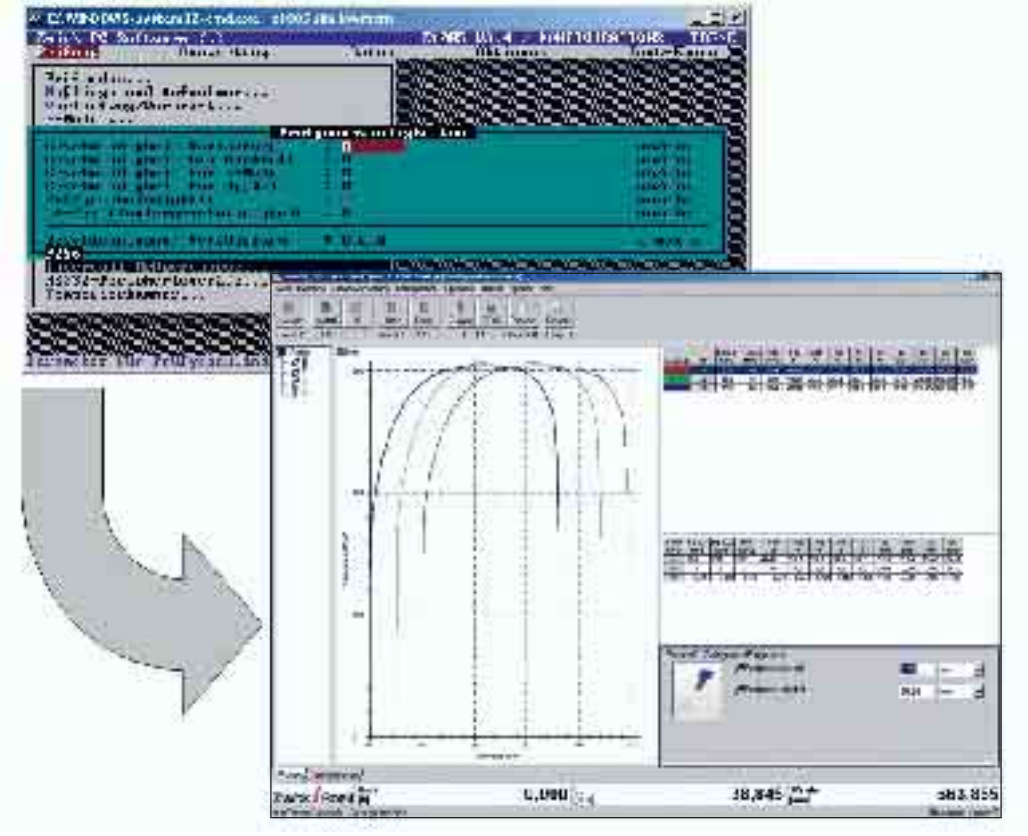
Upgrade your testing system to the latest technology with *testXpert*® II – intelligent and reliable testing software. This allows you to directly benefit from the improvements and the experience gain through over 10,000 installations of testXpert worldwide.

If your tester is already equipped with Zwick digital control electronics, a software upgrade makes it possible to migrate from DOS-based or earlier Windows-based testing software, to the latest *testXpert*® II with all of the features and benefits listed elsewhere in this brochure.

Software-Support Contract

With a Software Support Contract from Zwick you are ensuring that you have the latest testing technology and capabilities including the updated testing standards and test methods.

This service is further enhanced by other attractive *testXpert*® offers regarding training, technical application support by phone or on site as well as special conditions on additional Zwick services. In addition, the software support contract offers a price advantage compared to individual software updates.



Zwick / Roell

Fatigue Testing Machines

Servohydraulic Testing Machines

Application

These machines are used primarily for dynamic tensile, compression, and bending tests. The tests may include standard LCF, HCF or fracture mechanics testing.

Special Features

- Extremely-stiff load frame with a manually or hydraulically adjustable crosshead
- Highly-resilient actuator with high-precision guidance, ensuring maximum stiffness in all testing planes
- Precision strain-gaged load cell for continuous operation at maximum dynamic load
- LVDT transducer (installed centered in the piston rod) with high resolution, linearity, and durability.
- High-performance hydraulic power supply
- Low noise level due to an internal gear pump
- Water or air cooling option for the hydraulic power supply

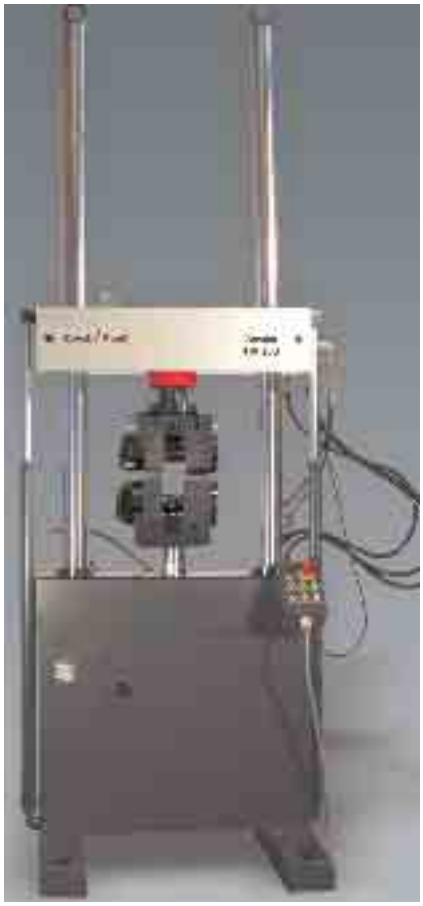
Measurement and Control Electronics

Unrivalled performance is offered using the HydroWin 96xx controller series Features include:

- 10-kHz closed loop, giving high speed, precise control and data acquisition
- 19-bit A/D conversion with real-time linearization
- MIMICS advanced adaptive control for automotive test applications
- Environmental management
- Multi-channel control

The digital measurement and control electronics Zwick HydroWin® 9600 features connections for external sensors as well as extensive application software.

Tabletop Servohydraulic System HC 25



Servohydraulic System HA with base-mounted actuator

Servohydraulic HB with crosshead-mounted actuator

Zwick / Roell

Zwick HydroWin 9600 Electronics

Servohydraulic Testing Machine

Standard Models[1)]

Model[2)]	HC	HB	HA
• Model/Type	Tabletop	Stand-alone	Stand-alone
• Load frame rated force, kN	5 - 25	50 - 1000	50 - 500
• Test stroke, mm	100	100/250/400	100/250
• Specimen length, mm	100 - 700	100 - 1100	250 - 1500
• Hydraulic power pack			
* System pressure, bar	210/280	210/280	210/280
* Throughput, l/min	5 – 23	8 – 270	8 – 270
• Max. power consumption, kVA	4.2 – 11	6.6 – 230	6.6 – 230

[1)] Load frames are available upon request with higher forces and with different strokes
[2)] Actuators are located above the testing area in the HC and HB models, and base mounted for the HA model

Workshop 96: test software for HydroWin 96xx controller

Workshop 96 is universal test software for materials and component fatigue and durability testing. Many application programs are available for standard tests such as fracture toughness determination, low cycle fatigue, damper testing and many more. Upgrade programs are available for the modernization of old frames mode by a variety of manufacturers.

Workshop 96 screenshot

testXpert® screenshot of high-cycle fatigue software

Tasks and functionality

Working together with the HydroWin 96xx digital control and data acquisition system the Workshop 96 software provides a fully integrated testing solution in a user friendly Windows environment that gives the materials test engineer full control of the test system.

Configuration 96

Configuration 96 allows the test engineer to configure and reconfigure the test machine. Analog, digital and derived transducers can be configured and assigned to channels. Plugging and unplugging of transducers is automatically detected by the Amsler HydroWin 96xx controller and the software.

Toolkit 96

Toolkit 96 provides an integrated testing environment with real time graphs and feedback displays that can be defined to monitor current, upper peak, lower peak, peak to peak or mean values.

testXpert® Dynamic

Zwick also offers a selection of *testXpert*® software for specific testing applications including low-cycle fatigue, fracture mechanics, block profiling and elastomer-metal components testing.

Zwick / Roell

High-Frequency Test Machines - Electromagnetic Resonance Drive

Famous for the Vibrophore, introduced to the market in 1945, Zwick now supplies the latest Amsler HFP electro-magnetically driven high-frequency resonance test machines. Automotive test laboratories around the world agree that the Vibrophore offers these significant advantages over other forms of testing:

- Minimal energy consumption due to resonance operation
- No hydraulics or supplementary cooling needed
- Maintenance-free operation
- Fast, accurate test results

Applications

- Dynamic tests to define the fatigue strength of materials, e.g. fatigue tests in accordance with DIN 50100 (S/N curve), in tensile, compressive and alternating load ranges
- Fatigue strength and durability tests on components such as crankshafts, connecting rods, steering joints, fasteners, chains, gears, pistons
- Pre-cracking for fracture mechanics tests on CT or COD specimens.
- Simulation of various environmental conditions (temperature, fluids)
- Torsion and bending tests

All tests can be performed in either load or strain control with loads from 1 to 500 kN and test frequencies in excess of 300 Hz, the Vibrophore is the automotive industry's test machine of choice when testing of metals, ceramics and components.

The machines are controlled by Zwick testControl electronics and *testXpert*® test software.

Testing a connecting rod with an oil-film environment

Vibrophore HFP 100

Vibrophore HFP Specificatons

Model, Amsler HFP	5, 10	20, 50, 100, 150	200, 250	400, 500
• Max. Force (kN)	5 - 10	± 20 to ± 150	± 200 to ± 250	± 400 to ± 500
• Max. Force Amp. kN	5	± 10 to ± 75	± 100 to ± 125	± 200 to ± 250
• Max Spec. Deform. mm	± 3	± 2	± 2	± 2
• Freq. Range, Hz	35 - 300	35 - 300	35 - 300	35 - 300
• Working Space width, mm	350	870	1300	1300
• Max. Power Consumption, kVA	1	1	1, 3	3, 5

Zwick / Roell

High Speed Testing Machine

Application

High-speed testing machines are used especially for penetration and materials tests at high testing speeds. With the appropriate additional equipment, these machines are capable of performing tensile, pressure and bending tests with speedy, cyclic and alternating loads under static, quasi-static and dynamic conditions. Typical applications may include materials characterization at high rates, crash simulation loads or to better understand the behavior of materials during high-strain processing. The systems generally involve high-performance servovalues accumulators, and sensitive load-measurement devices.

Measurement and Control Electronics

The electronic control assembly testControl and test software *testXpert*® allows comprehensive evaluation of the test results as well as report preparation and data management.

Technical Data

High-Speed Testing Machines Standard models*

Model	Amsler HTM 2012	Amsler HTM 2020	Amsler HTM 5004	Amsler HTM 5008	Amsler HTM 5020
• Rated force, kN	20	20	50	50	50
• Speed, m/s	12	20	4	8	20

* Other sizes and speeds available upon request.

High-speed testing machine Amsler HTM 5020

Zwick / Roell

Pendulum Impact Tester

Application

Pendulum impact testers are used to determine the impact energy, impact resistance, and notched impact strength of standardized metal specimens and components, which is of significant interest for automotive crash simulation studies. The equipment assembly is compliant with the relevant construction standards for pendulum impact testers. This pendulum impact tester allows safe and reliable testing compliant with international application standards according to Charpy and IZOD as well as impact tensile tests and tests according to Brügger. Zwick offers pendulums with a work capacity up to 750 J as well as standard compliant specimen supports and jigs which can be exchanged with ease without requiring time consuming alignment are available for testing different materials, specimen cross-sections and testing standards.

Features

- Stiff, torsion-free frame with low friction pendulum bearing (the energy goes into the specimen and not the equipment frame)
- CE-compliant safety fixtures for operator safety
- Good accessibility to the test area
- Easy exchange of accessories
- Optional operator-friendly test software *testXpert*®

Technical Data

See Pendulum Impact Testers Table

Accessories

Partially or fully automatic temperature control, feeding, and testing of Charpy specimens in accordance with EN 10045 and ASTM E23 at negative as well as positive test temperatures. The cooling of the specimens is done using a two-step cooling unit (cooling down to -60 °C) or liquid nitrogen (cooling down to -180 °C). Storage capacity up to 21 specimens. The heating is done electrically. The heat transfer between the specimens and the temperature unit is conductive, solid to solid.

Pendulum Impact Testers

Model	Zwick 5113	RKP 450	PSW 750
• Max. impact energy, J	50	450	750
• Drop angle, degrees	160/124.4	150	161.45
• Impact speed, m/s	2.93/3.46/3.85	5.23	5.42
• Instrumentation	optional	optional	optional

Pendulum impact tester Zwick 5113

Pendulum impact tester RKP 450

Pendulum impact tester PSW 750 with semi-autiomatic specimen feed and temperature control

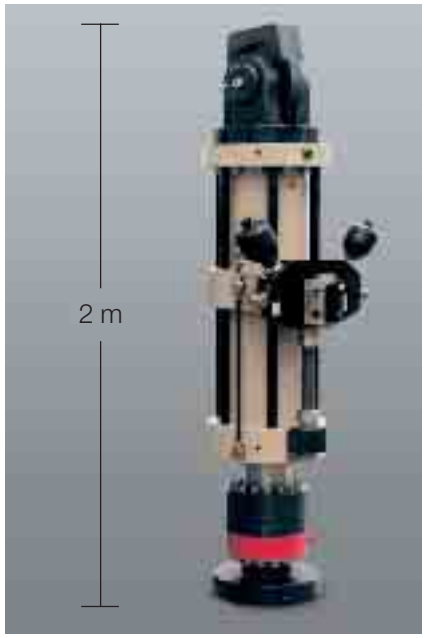
Zwick / Roell

Structural Testing Components

Zwick Roell offers a complete line of structural testing components and consulting services for customers who need to build their own component testing rigs. These include structural actuators (both hydraulic and electromechanical), load frames or tables, mounting hardware, load cells, servovalves, hydraulic power supplies, controllers and data acquisition hardware and testing application software. Hydraulic actuators are offered with hydrostatic bearings (LH Series) and normal bearing actuators. The LH series actuators are specifically designed for high performance dynamic material and component testing. This includes high-frequency applications and high piston speeds. As well as applications that induce side loads and bending moments on the actuator.

LH Series Actuator

Actuator mounted on load frame crosshead



Large Structural Actuator

Zwick hydraulic actuators

Force Capacities	Actuator Stroke Options	Servovalve Manifold Options
± 10 kN, 25 kN, 50 kN, 100 kN, 250 kN, 500 kN, 1000 kN (210 or 280 bar)	100 mm, 200 mm, 400 mm	65 to 250 lpm

Other options include couple accumulators, dual-valve manifolds and mounting options
Contact Zwick for other options

Digital Servocontrollers and Software

Zwick Roell offers digital controllers for testing and simulation applications. These include the K7500, which can be used as a single controller or combined for multi-channel control applications, or the HydroWin 9600 controller which can be configured from up to one to nine controller channels or stations. Zwick offers powerful and flexible test application software to meet your exact test simulation requirements including Workshop 96, *testXpert*®, testXpert-QX and QanTim for more complex, service-load simulation applications.

Zwick / Roell

Electromechanical Actuators

Zwick offers a full line of electromechanical structural testing actuators which offer the versatility, high position accuracy, and large range of force and speed options. These actuators require no special hydraulic equipment or power supplies and are a cost-effective solution for both static and dynamic component testing. The actuators are compatible with Zwick testControl and *testXpert*® and other brands of controllers.

Structural Actuator to Determine "Soft Brake Effect" on Motorcycle

Electromechanical Actuators

Force Capacities	Actuator Stroke Options*	Actuator Speed Options
± 1 kN, ± 2.5 kN, ± 5 kN, ± 10 kN, ± 20 kN, ± 30 kN	200 mm, 400 mm	125 to 500 mm/sec

Other fixture Options: Mounting base, swivels, load cells, and specimen fixturing
* Other stroke and speed options available upon request

Zwick / Roell

Systems and Simulation Testing

Zwick, in cooperation with CaTs[3] (Consultants in Automated Test and Structural-dynamic Simulation Systems), provides advanced system and simulation software-analysis tools.

testXpert® QX

testXpert® *QX* is a comprehensive, modular integrated suite of software tools covering the full spectrum of fatigue, durability testing and analysis specifically designed for single and mult-axis servohydraulic test rigs. *testXpert*® *QX* integrates configuration, control, acquisition and analysis into a single state-of-the-art application. *testXpert*® *QX* is characterized by its extreme ease of use and clever integration of hardware and software. It supports the K7500 controller and new PCI or USB analogue interface hardware in a seamless and integrated manner

Software for Systems Testing

- Supports K7500 and ±10V
- Single & multi-axis rigs
- Components to full structures
- Block program tests
- Many other test types

Single integrated application

- Test project management
- Integrated control & acq.
- Controller config.
- Graphical test edit
- Test execute, trend monitor
- Results analysis
- Training/demo mode

Supports several test types

- Variable amp block test
- Turning point test
- Simulate service loads
- Random vibrations etc.

Test rig/controller config

- Allocate hardware to rig
- Transducer cal
- Safety limits
- PID auto-tune
- Extensive test procedures
- Archive & retrieve config

Procedures

- Start/stop acquisition
- Digital IO
- Test & hydraulics control
- Limit actions, If/Else, etc.

Graphical test editor

- Advanced waveforms
- Ramp, dwell, cyclic
- Procedures
- Nested sequences
- Data & turning point acquisition

Test management

- Test progress
- Trend monitor
- Strip chart
- Test speed

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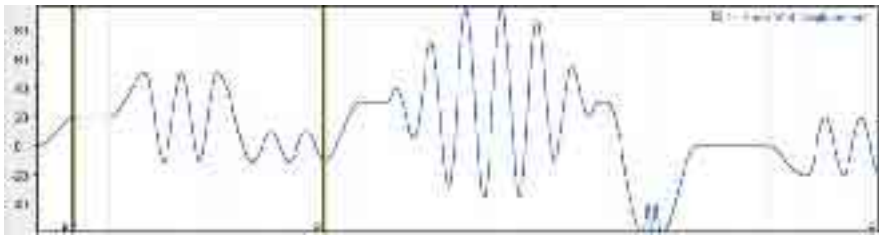
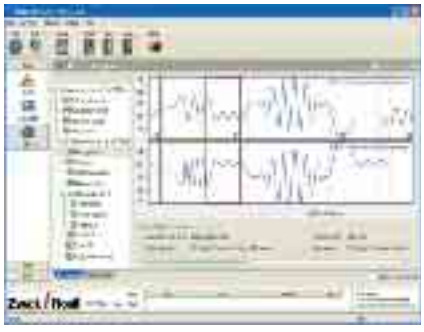
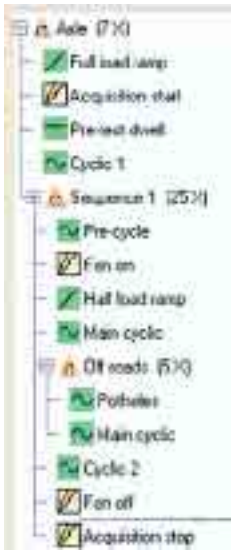




Screen shot of *testXpert*® *QX* showing test sequence

Two-channel block program axle rig



Zwick / Roell

QanTiM® test and simulation software

QanTiM® simulation testing enables brings greater realism, accuracy and repeatability to mechanical testing. Laboratory testing helps shorten the product development cycle for structures or components.

QanTiM® simulation enables the reproduction the actual real-time loading conditions for a vehicle or structure in a test laboratory. Real-time simulation testing offers the only method of reliably conducting interactive multi-axis tests.

A QanTiM® test and simulation system provides a complete laboratory solution with a suite of control and analysis software modules for a wide range of testing.

QanTiM®
· decouples interaction between loading channels
· simulates operational loading
· ensures that you achieve accurate response directly on the specimen
· contains a suite of data preparation, processing and analysis tools

The time-domain based testing system QanTiM® provides state-of-the-art testing technology. QanTiM® allows actual operationally-measured response conditions to be reproduced on the test structure in the laboratory. QanTiM® provides control of randomly-loaded single or multiple-axis fatigue test rigs, particularly for service-load simulation testing. The object is to measure the dynamic response of the test structure during operational conditions and to recreate these conditions in a laboratory on the full-scale. Generally it is not possible to measure the actual loads acting on the structure, and instead the dynamic responses to these loads are measured at positions remote from the load inputs.

Road simulation test rig

Two-axis simulator for motorcycles

Zwick / Roell

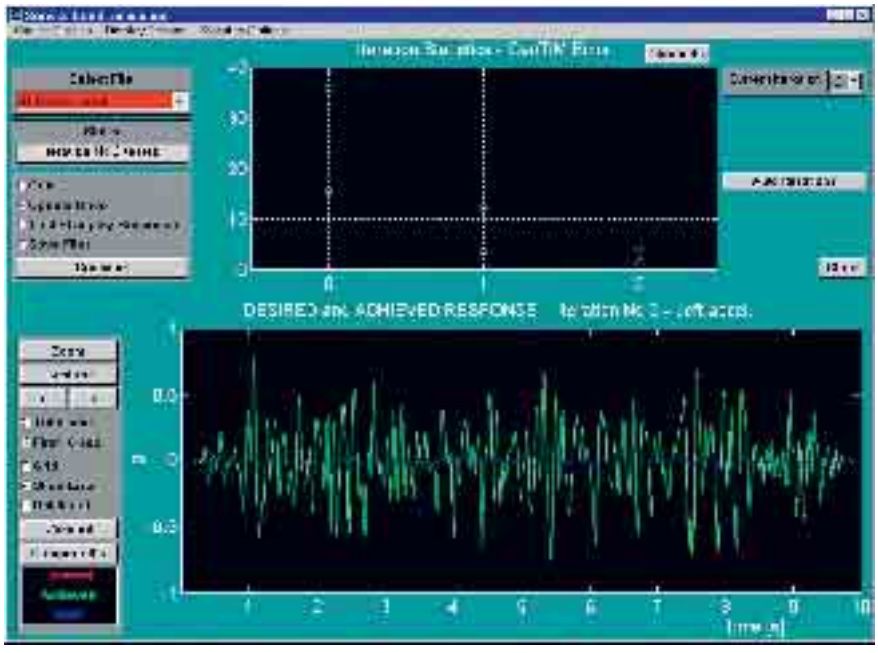
Overview of real-time simulation

The time domain based testing system QanTiM™ provides state-of-the art testing technology. QanTiM™ allows actual operationally measured response conditions to be reproduced on the structure in the laboratory. QanTiM™ provides control of randomly loaded single or multiple axis fatigue test rigs, particularly for service-load simulation testing.

The objective is to measure the dynamic response of the test structure during operational conditions and to recreate conditions in a laboratory on the full-scale structure loaded by servo-hydraulic actuators. Generally it is not possible to measure the actual loads acting on the structure, and instead the dynamic response to these loads are measured at positions remote from the load inputs. These remotely measured responses are subsequently utilized to derive the system input forcing-functions (actuator drive signals).

The use of this new time domain technology has proven to exhibit performance characteristics that have to date been impossible using traditional methods. These include much greater capabilities at the extremes of simulation testing, such as very low frequency events and efficient operation from short duration input data, such as pot holes.

This unique approach to simulation testing also results in a test system that is exceptionally easy to use, compared with traditional simulation products operating in the frequency domain. In spite of its sophistication, QanTiM™ does not burden the user with its clever technology. The technology is hidden to enable the rapid execution of tests. In this way, the efficient gathering of test results remains the prime objective.



QanTiM screenshot showing system response

Zwick / Roell

Zwick Services

Worldwide Service

Customer satisfaction is top priority of the Zwick Roell Corporation. With local service organizations in over 50 countries, we help optimize the return on your investment and to ensure the functionality of your testing machine.

Engineering Consulting Services

Changing specifications, new test requirements, or the installation or modification of a test lab can be optimized by consulting experts. Experienced Zwick engineers can advise you in the planning and implementation of such complex projects to meet your exacting requirements.

Demonstration

The decision to purchase a material testing system and accessories depends on a number of factors. In order to help facilitate this decision, Zwick maintains a fully-equipped Applications Lab to perform trial tests to ensure the selection of the appropriate equipment and accessories.

Pre-Testing

In the course of new, modified, or very complex applications, it is necessary to perform specific tests prior to purchasing or expanding a test system. Zwick's Application Lab is available in conjunction with its numerous experts and extensive selection of machines and fixtures in order to initially verify the testing set-up.

Contract Testing

Whether for new test requirements or tests performed to particular technical specifications, the Zwick Contract Lab provides timely and accurate test results on a contract basis. Please contact us for specific contract testing capabilities and pricing.

Application Technology Seminars

Zwick offers application-oriented courses in the fundamentals of materials testing in cooperation with the Steinbeis Transfer Center for Materials Technology in Ulm, Germany.

Preliminary acceptance

Prior to delivery of your machine, you have the opportunity to conduct a preliminary acceptance checkout at our facility. This will allow you become acquainted with the operation of the machine and confirm the agreed-upon functionality.

Transport

Everything is available from a single source with ZwickService. Upon request within the scope of initial operation, ZwickService will monitor the complete transport. Beyond that, it is also possible to have the machine transported all the way to the installation site. Convenient and professional. You no longer need to be concerned about the transport at your facility.

Retrofit

Converting the old into new – ZwickService specialists professionally perform the upgrade of your existing materials testing machine, regardless of the original manufacturer. This allows the latest digital control technology and software automation to enhance the performance of your testing system at the fraction of the cost of a new system.

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Installation

ZwickService ensures the optimal installation of your testing machine and accessories based on the experience from several thousand installations in the recent past. Functional tests performed prior to final acceptance guarantee a successful installation process.

Hardware Overview

Nothing is left to chance during ZwickService test-machine commissioning. The on-site commissioning is performed systematically and professionally on a checklist basis, and ensures an optimal utilization of the test hardware.

Software Overview

The introduction is performed following a checklist procedure, using a specific example from the operator's daily practice. The results will be saved for later use. Alternatively, ZwickService offers a two-stage introduction which includes an initial basic overview and a final review at a later date.

Machine Relocation

ZwickService provides for the complete relocation of your testing machine as needed. Our experienced management team takes responsibility for the detailed planning, from the disassembly and transport, through to re-installation of the machine.

The machine will be ready for testing at its new location on schedule. Independent of the manufacturer of your testing machine – ZwickService has specially trained and experienced staff for every make or model.

Software Adaptation

Our software engineers have the solid technical expertise from years of experience to quickly deliver programming tailored to your individual needs. The testing requirements are defined in close cooperation and agreement with you and subsequently carried out according to these specific needs.

Product Training

Zwick maintains a staff of qualified, expert trainers, who have extensive practical experience and who conduct product training courses either at Zwick, or specially customized to be performed at the customer's facility.

Hotline

The trouble-free performance of your testing machine is of importance to us. Should any unforeseen malfunction occur with the machine's hardware or software, our competent experts at our Hotline will be happy to assist you. We will call you back usually within thirty minutes time.

Support Desk

Our Support Desk is a cost-saving alternative to on-site visits or training by a service technician. We assist you in questions regarding the operation of hardware and software, adaptation of your test programs or offer further technical support. The extensive application experience enables our service technicians to provide quick and effective solutions to any questions you might have.

Zwick / Roell

Rentals

Whether for temporary testing requirements or to satisfy a short-term need, ZwickService provides the rental of testing grips. Please contact us for further information about the rental service.

Maintenance

Upon request, ZwickService performs the regularly-required maintenance of machine and accessories as described in the instruction manual and monitors the maintenance intervals.

Inspection

ZwickService helps reduce downtime significantly by regularly inspecting your test system. The inspection plan documents the condition of the machine, allows immediate exchange of worn parts as needed, and the recommendation of preventive measures.

Repair Work

Should a failure in your materials testing machine occur in spite of thorough inspection and maintenance, one of the many technicians of the ZwickService network is available on short notice. Delivery of spare parts, from Zwick's large inventory, is possible within a period of twenty-four hours as needed.

Calibration

Our calibration lab is DKD (German Calibration Service) accredited. The reference measurement equipment is recalibrated regularly. Depending on your requirements, we perform either a factory calibration (Zwick calibration certificate), an ISO calibration (Zwick calibration certificate with documentation to verify measurement equipment monitoring in accordance with ISO 9001), or DKD calibration (DKD calibration certificate). If necessary, your testing machine and the appropriate sensors will be adjusted during the course of the calibration.

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Notes