Zwick / Roell

Zwick
Materials Testing

Testing Machines and Systems for textile materials

FP 295 2.0702.202

Zwick / Roell

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

Mechanical-technological testing is the oldest discipline of materials testing. As early as in the 15th and 16th century, Leonardo da Vinci and Galileo Galilei were already considering the flexural stressing and the elastic behaviour of materials. In the course of time further knowledge was obtained. In the middle of the 18th century the first testing machines finally appeared in France.

Since the middle of the 19th century the company Amsler (formerly in Schaffhausen, Switzerland) has been involved in materials testing and the company Roell & Korthaus since 1920. Since 1937 Zwick has been building devices, machines and systems for mechanical-technological materials testing. Long before that time, i.e. in 1876, Prof. Seger had already founded a chemical laboratory as a scientific-technological consulting company for the industry of nonmetallic minerals. During the 20th century, the present company Toni Technik has developed from these fundamentals and is now considered a leading expert for test systems for building materials. Excellent performances were also supplied by the company MFL (Mohr & Federhaff) – a company that was founded in 1870. By the way, Carl Benz was one of the employees.

Haedquarders of Zwick Roell AG and Zwick GmbH & Co. at Ulm, Germany

Since 1992, these companies have formed the Zwick/Roell company group. In the next two years to follow, the companies Dartec, Rosand, Kelsey and Indentec in Great Britain joined the group.

List of Contents

Photos front cover: Pyramid type roof: HOCHTIEF · Heat protection: Tempex GmbH · Airbag: Volkswagen AG

Zwick / Roell

In July 2001, the Zwick Roell company group was converted into a stock corporation: the Zwick Roell AG. Part of this stock corporation are the companies Zwick, Roell Amsler, Toni Technik, Indentec Ltd. and Acmel Labo. These companies supply an extensive program for materials, component, and functional tests - from the manually operated hardness tester up to a complex test system for the process-accompanying application.

Zwick has many years of experience, combined with a multitude of supplied systems. This experience is continuously supplemented by the constant communication with the users. On this solid basis, the company supplies a wide range of high-performance products – from the economical standard machine up to special versions and designs for special test jobs. Modern mechanics, high-performance electronics and the application-oriented software are the prerequisite for the versatility and the high "intelligence" of these modern testing machines and systems.

However, the services of the Zwick Roell AG go far beyond the supply of products. Already in 1994 the company received the certification according to DIN EN ISO 9001 and thus guarantees a consistently high product and service quality. With accredited DKD[1)]- resp. UKAS[2)]-calibration laboratories, the companies of the Zwick Roell AG are in addition entitled to verify and to calibrate test systems and to document that with internationally recognized certificates.

This catalogue provides an overview of devices, machines, and systems of the Zwick Roell AG for the use in the textile industry and in the corresponding research and test institutes and training centers. This is only a part of the extensive overall program of the Zwick Roell AG.

[1)] DKD: Deutscher Kalibrier-Dienst (German Calibration Service)
[2)] UKAS: United Kingdom Accreditation Service

Textile materials application range and characteristic features

Textiles have been accompanying man since thousands of years. Already in 5000 B.C. cloths were woven in Egypt. For this purpose the people used natural raw materials such as cotton, flax fibres, animal hair and silk threads. The people used them as garments and as protection from the cold. As textiles for the home, they made living and work rooms look nicer. can be waterproof, impermeable

Modern textiles, however, are high-tech products that do not have very much in common any more with these basic functions. In specific material compositions they offer qualities we did not dare dreaming of a few decades ago. Here are a few examples: As garments they can be waterproof, impermeable and breathable at the same time, they can have warmth-giving- and warmth-regulating and recovering qualities (so that e.g. a crease stays unharmed even after washing and dry-cleaning) or they can have tearproof qualities. As safety clothing they protect the wearer against heat and flames, dangerous tools as for example chain saws and even against shots from small arms. In conveyor belts and tires they are used as reinforcement. As climbing ropes they are light and have high strength, at the same time they are elastic to control the

Cloth test, stone relief from Hirzweiler, 2nd/3rd century AD, Trier, Rheinisches Landesmuseum (museum at Trier, Germany)

energy of fall. In form of safety belts they should only show a permanent deformation to avoid injuries caused by an elastic resilience. For kites, paragliders, and parachutes they must have a minimum weight and they must at the same time be extremely light and wind-tight. For ship ropes, the light and water-repellent, floatable version is required.

An example of the variety of different requirements are geotextiles which are used for many jobs in road and railway construction as well as for bank stabilization and coastal fortifications. Essential functions here consist of

- the separation of different material layers as e.g. sand and gravels
- the taking up of forces that cannot be transmitted to other elements
- the filtration and drainage whenever those geotextiles are used instead of mineral filters

As different as the fields of application are also the demands on the long-term behavior of textiles. If they are for example used for permanent wear they must be unrottable and without nutritional value for insects, rodents etc. If it is however only a question of a temporarily limited soil stabilization for cultivation, they should have a longer rotting time as soon as the roots of the plants have taken over the stabilization job.

According to the application in question, textiles must have specific properties. Part of this are their resistance to different materials, radiations, temperature influences, and other environmental conditions as well as their mechanical resistance. The multitude of applications and the high demands on these textiles require – particularly in the field of research and development – sophisticated testing possibilities. With a large range of testing machines, modern test software and a large range of accessories the Zwick/Roell Group offers a variety of possibilities for a specific, high-precision testing of these geotextiles with exactly reproducible results.

Modern materials testing machine for the testing of textile materials

Zwick / Roell

Standards and Testing machines

Zwick / Roell

Zwick / Roell

Zwick / Roell

Zwick / Roell

Zwick / Roell

Zwick / Roell

Zwick / Roell

Contents	Test standard	Test means/Test device	Page
Net yarns, extension after immersion in water	DIN 53845, ISO 3090	Materials testing machine	
Fishing nets, tensile tests on net meshes	DIN 53844, ISO 1806	Materials testing machine	
Fishing nets, tensile tests on floater lines with woven floaters	DIN 53847	Materials testing machine	
Safety nets	EN 1263-1	Materials testing machine	18
Air-freight equipment, air-freight palette nets	ISO 4170	Materials testing machine	18
Aircraft equipment, air cargo load devices	ISO 8097	Materials testing machine	18
Thermal insulating materials			
Thermal insulating material for the building trade, compressive loading	EN 826, ASTM C 165	Materials testing machine	18
Thermal insulating material for the building trade, deformation at compression and temperature loading	EN 1605	Materials testing machine	18
Thermal insulating material for the building trade, long-term creep behaviour at compression loading	EN 1606	Creep tester	
Thermal insulating material for the building trade, tensile testsvertical to the panel's plane	EN 1607	Materials testing machine	18
Thermal insulating material for the building trade, tensile tests in the panel plane	EN 1608	Materials testing machine	18
Thermal insulating material for the building trade, flexural loading	EN 12089	Materials testing machine	18
Mineral fibre insulating slabs, compressive stress and compressive strength	DIN 52272-1	Materials testing machine	18
Mineral fibre insulating slabs, tear strength vertical to the insulation plane	DIN 52274	Materials testing machine	18
Insulating plates, load bearing capacity	ASTM E 1803	Materials testing machine	18
Finished parts for pipe insulation, break load and calculated modulus of rupture	ASTM C 446	Materials testing machine	18
Insulating blocks, breaking load and flexural strength	ASTM C 203	Materials testing machine	18
Textile joining systems			
Fasteners, closing and opening methods	EN 1414	Materials testing machine	18
Fasteners, peel strength	EN 12242	Materials testing machine	18
Fasteners, lengthwise shear strength	EN 13780	Materials testing machine	18

The classification of these standards (status August 2001) has been done in cooperation with Dr. Mathias Mägel, Sächsisches Textilforschungsinstitut e.V. (STFI), D-09125 Chemnitz (www.stfi.de)

Zwick / Roell

Examples of textile materials

Fibers

Yarns and threads

Yarns and Rovings

Non-wovens

Wovens

Coated textiles

Geo-textiles

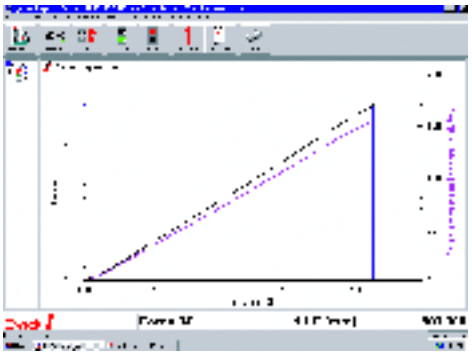
Tapes and beltings

Ropes and cordage

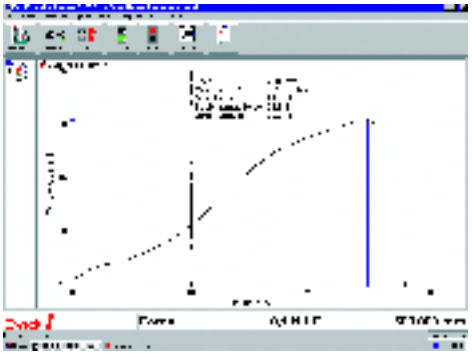
Zwick / Roell

Application	test-curve in *testXpert®*	Example of mounting

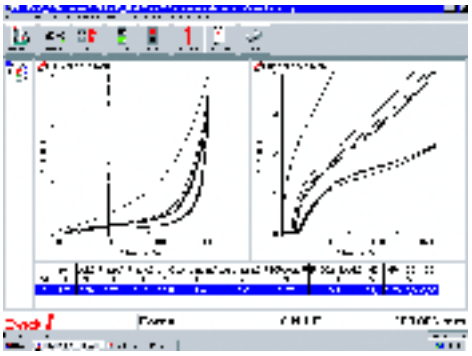
Filaments, Yarns, Twines



Standard: EN ISO 2062
Type of test: Tensile test
Material: Aramid yarn
Extensometer: Crosshead monitor
Grips: Pneumatic grips
Test speed.: 500 mm/min
testXpert®: B069001.06.10



Standard: EN ISO 2062
Type of test: Tensile test
Material: Sewing yarn
Extensometer: Crosshead monitor
Grips: Screw grips
Test speed.: 500 mm/min
testXpert®: B069001.06.10



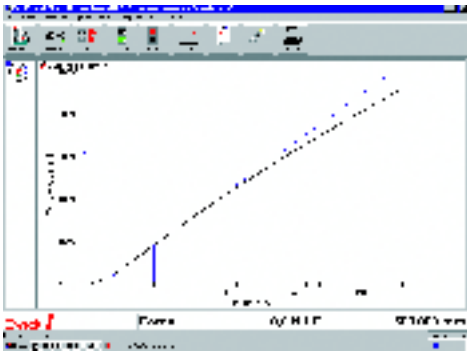
Standard: DIN 53835
Type of test: Elastic behaviour
Material: Elastic yarn
Extensometer: Crosshead monitor
Grips: Spring loaded grips
Test speed.: 500 mm/min
testXpert®: B069005.03.10

Standard: EN ISO 2062
Type of test: Tensile test
Material: Double twine
Extensometer: Crosshead monitor
Grips: Pneumatic grips
Test speed.: 500 mm/min
testXpert®: B069001.06.10

Zwick / Roell

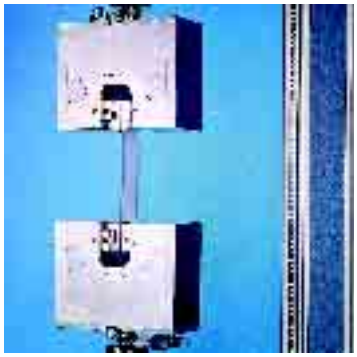
Application	test-curve in *testXpert®*	Example of mounting

Standard: DIN ISO 2062
Type of test: Tensile test
Material: Multifilament yarn
Extensometer: Optical extensometer
Grips: Pneumatic grips
Test speed.: 500 mm/min
testXpert®: B069001.00.10

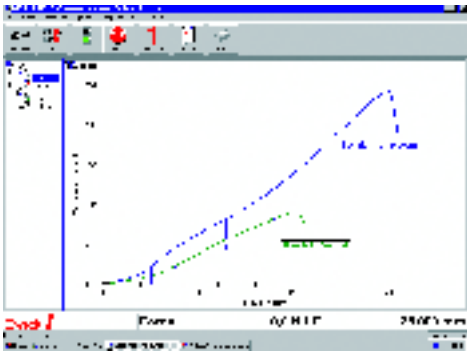


Fabrics

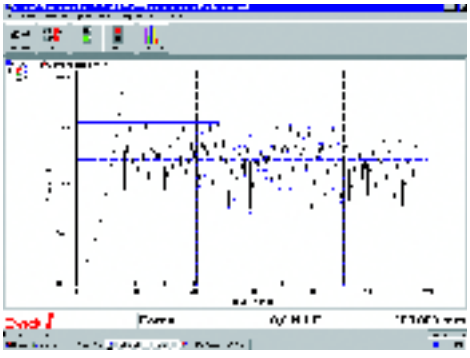
Standard: EN ISO 13934-1
Type of test: Tensile test
Material: Airbag fabrics
Extensometer: Crosshead monitor
Grips: Pneumatic grips
Test speed.: 100 mm/min
testXpert®: B069001.04.10



Standard: Marks & Spencer P12
Type of test: Seam slippage of woven fabrics
Material: Outwear fabrics
Extensometer: Crosshead monitor
Grips: Screw grips
Test speed.: 100 mm/min
testXpert®: B069001.11.10



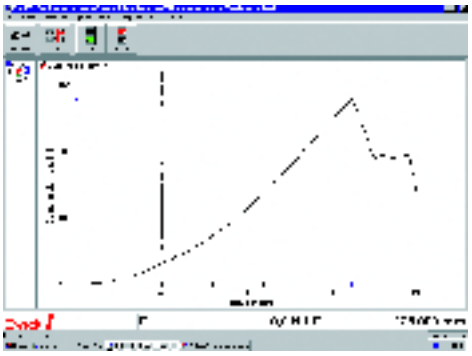
Standard: EN ISO 13937-2
Type of test: Tear properties
Material: Airbag fabrics
Extensometer: Crosshead monitor
Grips: Pneumatic grips
Test speed.: 100 mm/min
testXpert®: B069003.09.10



Zwick / Roell

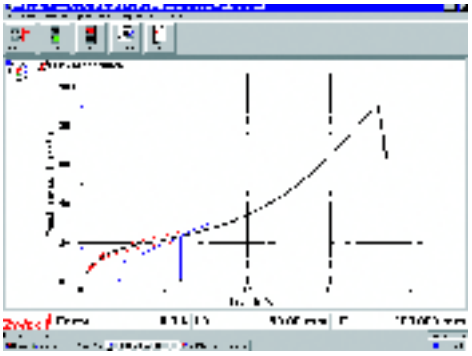
Application	test-curve in *testXpert®*	Example of mounting

Coated fabrics



Standard:	ISO 3303 Methode A
Type of test:	Bursting strength
Material:	Plastic-coated fabrics
Extensometer:	Crosshead monitor
Grips:	Ball burst device
Test speed.:	300 mm/min
testXpert®:	B069002.00.10

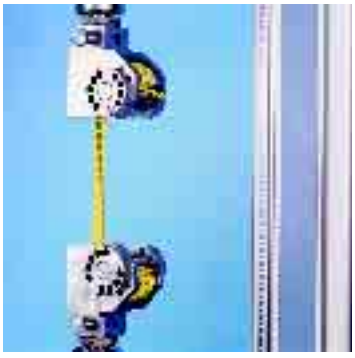
Geotextiles



Standard:	EN ISO 10319
Type of test:	Tensile test
Material:	Geo-non-woven material
Extensometer:	Optical extensometer
Grips:	Hydraulic grips
Test speed.:	20 % of L_0/min
testXpert®:	B069001.09.10

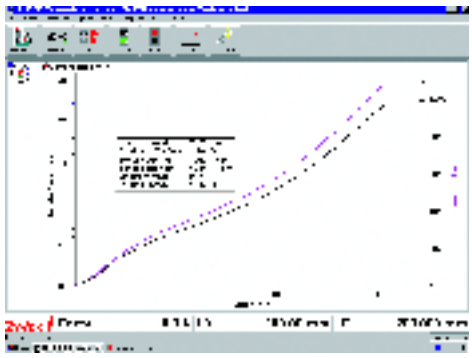
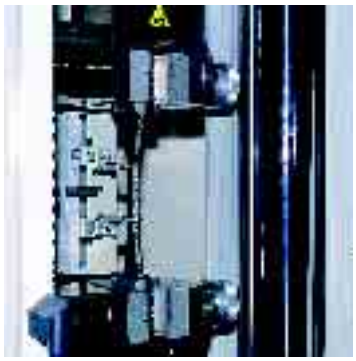
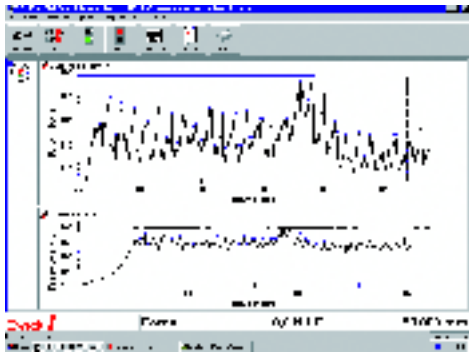
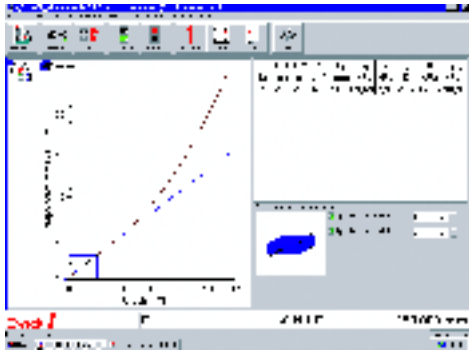
Standard:	EN ISO 12236
Type of test:	Static puncture test
Material:	Geo-fabrics
Extensometer:	Crosshead monitor
Grips:	Static puncture test device
Test speed.:	50 mm/min
testXpert®:	B069002.80.10

Belts, ropes, cordage



Standard:	EN 565
Type of test:	Tensile test
Material:	Belt seal
Extensometer:	Optical extensometer
Grips:	Roller grips
Test speed.:	500 mm/min
testXpert®:	B069001.00.10

Zwick / Roell

Application	test-curve in *testXpert®*	Example of mounting
Standard: EN 919 Type of test: Tensile test Material: Fiber rope Extensometer: Optical extensometer Grips: Rope grips Test speed.: 500 mm/min *testXpert®*: B069001.00.10		
Standard: ISO 283-1 Type of test: Tensile test Material: Conveyer belt Extensometer: Makro extensometer Grips: Hydraulic grips Test speed.: 100 mm/min *testXpert®*: B069001.00.10		
Standard: EN ISO 252-1 Type of test: Adhesive strength between constitutive elements Material: Conveyer belt Extensometer: Crosshead monitor Grips: Pincer grips Test speed.: 100 mm/min *testXpert®*: B069003.00.10		
Thermal insulating products Standard: EN 826 Type of test: Compression test Material: Insulation material Extensometer: Crosshead monitor Grips: Compression plates Test speed.: 10% of d/min *testXpert®*: B069002.56.10		

Zwick / Roell

Materials Testing Machines

Field of application

Zwick materials testing machines are not only used for tensile tests on fibres, tapes, ropes, fabrics etc. or for compression tests on floor coverings or insulating materials, but also for tests on textile fastening systems as e.g. zip-fasteners and similar tests.

Basic concept

The Zwick program includes universal testing machines as table-top and floor standing designs with different measurement- and control systems, load frames, drives and versatile function and supplementary units.

However in order to be able to offer the best machine for each requirement, Zwick has developed a user-related concept. The user can choose among three machine versions, each of them being completely different as to equipment, performance features and also as to the capability of expansion:

- BasicLine
- Standard Line
- Allround Line

The decisive testing machine component is the measurement and control system. Its conception and its scope of performance decide which drive can be controlled, which measurement system can be connected to it and which functions can be controlled with it - and they thus determine the range of application and the testing machine's capability for future expansion.

The advantages to the user of the three different testing machine versions are as follows:

- The BasicLine is particularly suitable for functional tests on component parts and for the simple materials test
- The Standard line is ideal to solve simple test jobs reliably. It is a low-cost, sturdy solution which covers many testing needs
- The Allround line is the basis for a large spectrum of demanding test jobs and can easily be expanded with the requirements becoming more demanding. It is thus a solution that can be relied on for future requirements

Measurement and control system BasicLine

The electronics taken from existing Zwick machine types guarantees a very high availability and reliability of the test system. The measurement and control electronics is compactly packed in a housing. BasicLine testing machines can be operated in the Stand Alone mode without a PC and they can be operated directly via function keys on the testing machine. As standard it is additionally possible to operate the BasicLine with the test software *testXpert*®, thus profiting from all the advantages of standardized test programs and from the many years of experience on the development sector.

Materials testing machine BasicLine Z0.5

Materials testing machine BasicLine Z020

Zwick / Roell

Measurement and control system *testControl*
(for standard and allround version)
By using most recent technologies and by granting highest quality standards *testControl* offers a maximum of technical performance and a long-term investment guarantee. These are the particular features of *testControl*:

- Time-synchronous test data acquisition with high resolution and measuring frequency
- Real-time processing of the test data in a 500 Hz cycle for the monitoring and event-related test sequence control (e.g. speed change when reaching the yield or proof stress) and for safety limit values
- Adaptive control for exactly reproducible speeds and positions
- The measurement and control electronics and the power electronics for the drive system in question are integrated in a housing in a space-saving way. Thus, the usual cabling can be dispensed with

Load frames

Zwick develops and manufactures load frames for nominal loads of up to more than 6,000 kN. Most applications in the textile industry require test loads of less than 250 kN (see table “Load frames and drive systems”)

Single-column load frame (zwicki)
These load frames are designed with very rigid aluminium high-precision extruded profiles. The working area is freely accessible from 3 sides. Thus, it is predestined for the most different function tests on small parts and for Zwick hardness testing machines. It only requires a small floor space. Due to its light weight, it is easy to transport.

Load frames in table-top version
The load frames are designed with patented aluminium high-precision extruded profiles used for guiding. They are light, very rigid, and serve simultaneously as lead-screw guide and protection. T-shaped grooves on the outer sides allow a simple fitting of accessories such as safety devices without being impeded by the crosshead.

All load frames with two profiles - except for the BasicLine – can be equipped with legs. Advantages are:

- Positioning of the working area to an optimum height for the user
- Comfortable seated operation with absolute freedom for leg movement, also suitable for wheelchair users

Load frame as floor standing model
These load frames are equipped with 2 or 4 hard-chrome plated round columns and 2 precision ball screws. They are preferably used for the testing of specimens with large extensions, large specimens or large parts and they are also used with larger temperature- or climatic chambers.

One or (optionally) two working areas are possible.

Materials testing machine Z2.5 (zwicki) with *testControl* Stand Alone variant

Material testing machine Z050 with *testControl* PC variant

Material testing machine Z100 with *testControl* PC variant

Zwick / Roell

Features of the BasicLine, Standard- and Allround-Line

Machine component or function	BasicLine	Standard Line	Allround Line
Load frame			
• Type of set-up			
- Table-top machine (nominal force)	500 N to 20 kN	1 to 100 kN	up to 100 kN
- Floor stand. machine (nominal force)	-	50 to 250 kN	50 to 250 kN
• Support and guiding columns			
- No. of columns	2	2 or 4	2 or 4
- No. of Alluminium profiles	1 (Z0.5)	1 or 2	1 or 2
• No. of working areas	1	1 or 2	1 or 2
• Expanded design (higher and/or larger)	no	yes	yes
Drive system			
• Electro-mechanical			
- No. of ball screws	1 or 2		1 or 2 1 or 2
- DC-Motor	yes	only zwicki	only zwicki
- AC-Motor	no	yes (without zwicki)	yes (without zwicki)
Measurement and control system			
• BasicLine (also usable without PC)	yes	no	no
• *testControl* PC-variant (Standard)	no	yes	yes
testControl Stand Alone variant (Option)	no	optional	optional
Software			
• test software *testXpert*® (with PC)	optional	optional	optional
Transducer			
• Strain gauge load cell	1 (interchangeable)	1 (optional up to 2)	1 (optional up to 3)
• Digital crosshead monitor	integrated	integrated	integrated
• Digital extensometer	no	optional 1	yes (optional up to 3)
• Analogue Extensometer	no	optional 1	yes (optional up to 3)
Connection of external systems			
• Digital extensometer	no	yes	yes
• Analogue extensometer	no	yes	yes
• Analogue reduction-in-width-monitor	no	yes	yes
• Video Capturing	no	yes	yes
• Switch Contact	no	yes	yes
• Switch Control	no	yes	yes
• Further measurement systems	no	yes	yes
Control of external systems			
• Specimen grips (mot., pneum., hydr.)	no	no	yes
• Extensometer systems	no	semi-automatic	full-automatic
Supplementary units for special applications (optional)			
• Torsion drive	no	no	yes
• Torque transducer	no	no	yes
• Multi-channel force measuring system	no	no	yes
• High-temperature testing equipment	no	conditional	yes
• Low-temperature testing equipment	no	conditional	yes

Zwick / Roell

Load frames and drive systems of the BasicLine

Series	Z0.5	Z005	Z010	Z020
Type	zwicki	Table top	Table top	Table top
Max. load, kN	0.5	5	10	20
Working area, max.				
- Height, mm	596	561/1061	1041	1041
- Width, mm	no limit	420	420	420
- Depth, mm	99.5	no limit	no limit	no limit
Crosshead speed				
- min., mm/min	0.001	0.001	0.001	0.001
- max., mm/min	1500	500	1000	500
Crosshead travel resolution, µm	0.226	0.05	0.09	0.045
Max. power consumption, kVA	0.4	0.6	0.6	0.6

Load frames and drive systems of the Standard and Allround Line

Series	Z1.0	Z2.5	Z005	Z010	Z020	Z030
Type	zwicki	zwicki	Table top	Table top	Table top	Table top
Max. load, kN	1	2.5	5	10	20	30
Working area, max.						
- Height, short, mm	-	573	-	-	-	-
normal, mm -	1073	1058	1058	1058	-	
higher, mm	1373	1373	1458	1458	1458	1380
higher and larger, mm	-	-	-	1787	1787	-
- Width, normal, mm	no limit	no limit	440	440	440	440
larger, mm	-	-	-	640	640	-
- Depth, mm 99.5	99.5	no limit	no limit	no limit	no limit	
Crosshead speed						
- min., mm/min	0.001	0.001	0.005	0.005	0.005	0.005
- max., mm/min	1800	800	3000	2000	1000/2000[1)]	1000
Crosshead travel resolution, µm	0.00023	0.0001	0.041	0.027	0.014/0.054	0.0271
Max. power consumpton, kVA	0.4	0.4	2/1.9	1.9	2.1/2.6	2.3

[1)] depending on the selected drive system and its power

Series	Z050	Z050	Z100	Z100	Z150	Z250
Type Table top	Floor stand.	Table top	Floor stand.	Floor stand.	Floor stand.	
Max. load, kN 50	50	100	100	150	50	
Working area, max.						
- Height, short, mm	-	-	-	-	-	-
normal, mm		-	1824	-	1824	1715 1715
higher, mm	1380	-	-	-	-	-
higher and larger, mm	-	1765	1360	1765	1660	1660
- Width, normal, mm	440	630	640	630	630	630
larger, mm	-	1030	-	1030	1030	1030
- Depth, mm	no limit	no limit	no limit	no limit	no limit	no limit
Crosshead speed						
- min., mm/min	0.005	0.005	0.005	0.005	0.005	0.005
- max., mm/min	600	400/2000[1)]	200/1500[1)]	200/1000[1)]	900	600
Crosshead travel resolution, µm	0.0163	0.0270	0.0260	0.0136	0.0123	0.0082
Max. power consumption, kVA	2.3	5	6	5	5,5	6

[1)] depending on the selected drive system and its power

Zwick / Roell

Electro-mechanical drive systems

The basis of all electro-mechanical drive systems are backlash-free and low-friction ball screws and digitally controlled drive systems (load frames for test loads of more than 600 kN are equipped with servo-hydraulic or hybrid drives). Together with the digital measurement and control system they have the following advantages:

- Extremely high, stepless speed range
- Very low speeds adjustable (from about 0.001 mm/min on)
- High-precision and exactly reproducible positions and speeds

The testing machines designed with single-column load frames (zwicki and BasicLine) are equipped with low-cost d.c. drives, all the other ones with particularly low-inertia, brushless three-phase drives.

Force transducer

Strain gauge load cells are available for precise force measurements from 0.04 N onwards. Together with the digital measurement electronics they have the following advantages:

- Automatic recognition of the load cell's serial number
- Automatic recognition of the setting and calibration parameters
- Overload protection
- Automatic zero and sensitivity alignment
- Compensation of temperature fluctuations
- High measuring frequency
- High test data resolution
- Accuracy of 1% of the displayed value (1% error limit) from 1/500 and 0.5% of the displayed value on 1/100 of the nominal load. (Type II load cell, F ≥ 500N)
- Manufacturer's test certificate to give proof of the works calibration

Load cell with one or two sided mounting stud and self-identifying sensor plugs are available for nominal load capacities from 10 N on.

Force transducer including sensor plug

Test software *testXpert®*

Range of application

testXpert® is the universal Zwick test software for materials, component, and functional testing. It's application range goes from Zwick materials testing machines (for tensile, compression, flexure and functional testing) to hardness testers, pendulum impact testers, extrusion plastometers, automated test systems, etc. right up to the refurbishment of testing machines of a variety of makes and models.

Duties and functions

The essential fields of use of *testXpert®* are:

- verification and re-equipping the test machine
- preparation of the test or test series
- performance of the test
- evaluation and documentation
- data management
- quality management and
- data exchange between *testXpert®* and other applications (Word, Excel etc.)

testXpert® supports the user for all tasks with software wizards and editors, explanatory pictures and video sequences, situation-specific user tips, warnings, error messages and online help.

Future-oriented concept

The *testXpert®* test software uses the special properties of the object-oriented programming with respect to a clear grouping in tasks and functions. Structure and contents are determined by the Zwick application and software know-how. The *testXpert ®* concept is therefore a guarantee for highest flexibility, functional safety as well as simple usability.

The essential characteristic features are:
- uniform basic software for all applications
- modular system for test programs
- user support through software tools

Modular system
The test programs are compiled by Zwick from a selection of several hundred software modules. The modules are sub-divided into classes such as test parameters, test sequence phases, screen views etc. They are continuously updated and expanded with respect to new states of knowledge and necessary supplements. This makes *testXpert*® an intelligent software, and thus enables the realization of test programs strictly to test standards and test programs related to practical applications. Thanks to the numerous possibilities of this system, *testXpert*® can be put to universal use for a wide applicational spectrum and for a variety of testing machines.

Test programs
The test programs compiled by Zwick stipulate how tests are to be run. Their basis are selected software modules that are linked to one another and are pre-configured through fixed parameters depending upon the functions required. Thus the user receives from Zwick a "test template" in which only variable parameters must be entered.

There are three variants available for a wide range of requirements:
- Master test programs
- Standard test programs, and
- Customized test programs

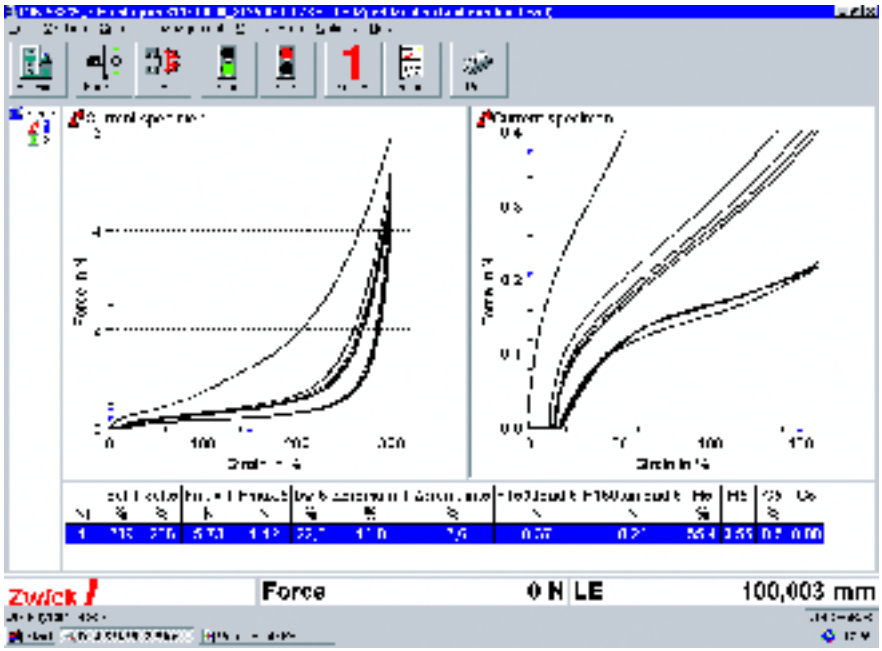
International quality standards
To comply with international quality standards, each and every version must be transparent, documented and archived for 10 years. The *testXpert*® test software fully meets these requirements and even the particularly strict guidelines of the Good Manufacturing Practices (GMP).

The entire software development process and its components are diligently documented and archived from the source code through to the software tools used, for each and every version. This is valid for each phase from the analysis via the specification, design and implementation up to the test. Conformity to the standard ISO 9000-3 for development of *testXpert*® has been confirmed via audit report no. QM-F-96/1016.

Safety in detail
Windows software is normally used in offices. However, *testXpert*® takes over an additional and especially critical task: monitoring and controlling machines. Machine damage and potential danger to persons must be ruled out. That's why *testXpert*® doesn't use any overlapping windows in the test mode to avoid hiding important displays or key fields.

Automatic acceptance of system data
Different test jobs require different test machines with different and usually, interchangeable components. Their specific properties are characterised by the system data (nominal force, travel, speed range, mounting height, calibration factors, etc.). Organisational data also belong to the above, e.g. the series number or the date of the last calibration.

testXpert® accepts this data automatically directly following the program start
- for the necessary settings
- for the determination of safety limit values
- for the correct measurement signal evaluation



testXpert® – the strictly object-orientated test software is available in several language versions; among others in english, french and german

Zwick / Roell

Furthermore *testXpert*® checks whether or not
- the test can be carried out with this configuration
- all settings have been made
- the data have changed for the current test

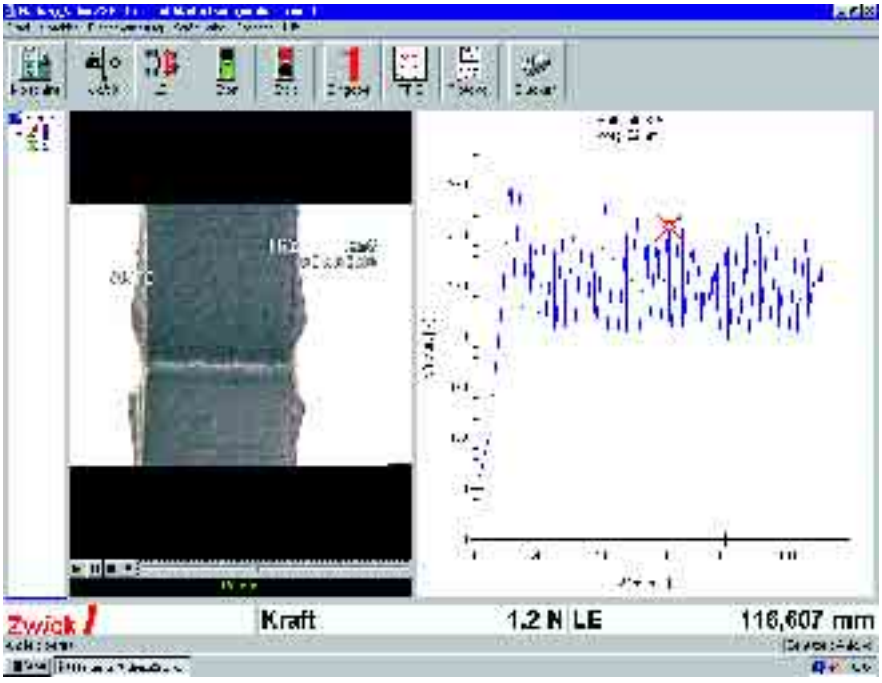
Simplest operation
Operation is reduced to a one-button operation, i.e. activating the start button, for standard applications. This is possible because *testXpert*® automatically records the test data, and dependent upon this, controls and monitors the test sequence and determines and documents the test results.

Only two steps to testing
Preparation of a test series requires only two steps:
- call-up the test program foreseen for the required application
- input or selection of variable parameters

Optimum user information
All displays necessary for carrying out a test and a test series, can be grouped together in a clear and concise manner in one single screen setting.
- input fields for specimen-specific test parameters
- curve diagram (single or multiple curves)
- tables for test results
- tables for result statistics

Data saving for further use
Depending upon the preselection in the test program, not only all data but also selected result data from a test or test series can be saved. Saving of all data offers the possibility of tracing the origin of the result data up to configuration and settings for the test machine. The standardized measurement data, i.e. the data converted to its basic units can be repeatedly displayed in the simulation mode and can also be evaluated according to other criteria.

Video Capturing
The test software *testXpert*® not only supports the user by means of "Help" videos. It is also possible to carry out multimedia tests by using a video camera and a video-capturecard with the video pictures being recorded time-synchronously with the test data.
- With the cursor keys, a "video reticle" can be moved over the test curve and the corresponding picture can be displayed
- The pictures can be captured at a preselected distance of the measuring points or in dependence on the event
- The video can also be played alone, irrespective of testing machine
- Distances between two points and angles between three points, radii, diameters and areas can be measured from the specimen in pictorial representation
- Optionally, the pictures can also be output with dimension lines and test data



With video capturing the test data and the corresponding video pictures of the test configuration are recorded and saved (example: adhesion test of a textile-rubber compound)


Testing machine with video camera

Zwick / Roell

Specimen grips for tensile, creep, and cyclical tests

Textile materials and the specimens taken from those materials are available in many different types. They are e.g. different as to

- the basic materials and their combination (from animal, vegetable, or synthetic products)
- shapes and dimensions (thread, tape, strip etc.)
- structure (fibres, monofil, multifil, spun, braided, woven, knitted etc.),
- treatments (impregnated, coated etc.)
- properties (strength, stretching ability, elasticity, homogeneity)

According to this variety a large spectrum of specimen grips is required to meet the individual requirements.

For specimens from these materials tensile forces can only be transmitted by means of the force-holding principle. The frictional forces between specimen ends and specimen grip are principally applied according to 2 principles:

Principle A – Flat clamping between clamping jaws

The clamping force (standard force) is either applied by an additional, outer force (hydraulic or pneumatic cylinders or screw drive) or by the deflection and amplification of the test force (self-clamping via wedges, eccentrics or lever systems). The force is nearly the same over the entire gripping length. The frictional force acts on 2 opposed sides of the specimen.

Principle B – Clamping by wrapping aroung fixed cam plates or rollers

The standard force depends on the locally acting test force and its angled position and increases from zero as the gripping length increases also. The frictional force only acts on one specimen side.

When combining these two principles, the wrapping around always has priority over the clamping. Its practical realization and the shapes, dimensions and versions (frictional behaviour, elasticity) of the clamping/friction surfaces are particularly important for the field of application of the specimen grips.

When selecting the specimen grips, the following requirements must also be taken into consideration:

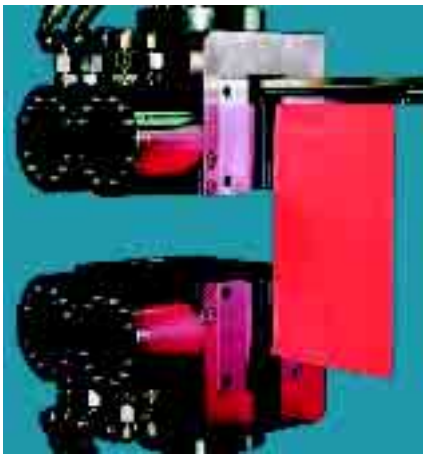
1. Jaw break-free gripping

If the specimen breaks during the tensile test at the place where it is gripped, then smaller values are measured for the maximum force or the tensile strength and the strain assigned to it. According to most standards such tests are therefore evaluated as non-valid tests.

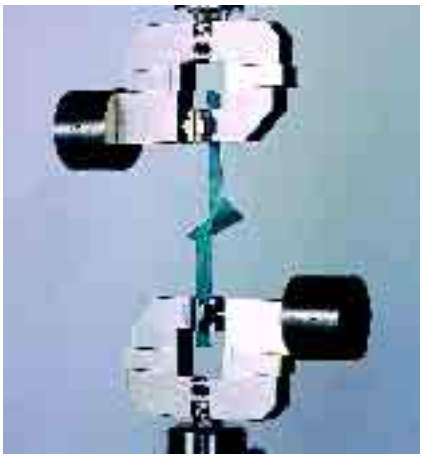
The probability of jaw breaks is considerably higher for a gripping action according to principle A (flat clamping) than according to principle B (wrapping around), because the tensile force is reduced over a relatively short gripping length. The high gripping force already acting at the beginning of the gripping action prevents a partial “slippage” of the specimen. This can lead to a “piling up of the force” at the beginning of the clamping and can thus release a premature break.

2. Accuracy of the strain measurement

For many applications, the strain can be measured indirectly as crosshead travel extension, because the demands on the measuring accuracy are not very high and thus errors through deformation of the testing machine



Hydraulic grips for geo-fabrics



Pneumatic grips

Screw grips

Zwick / Roell

Specimen grips - range of Application

Type of Grips	Force holding principle	Nominal Load	Filaments, fine yarns	Elastic yarn	General yarn	Technical yarn	Non-woven fabrics	General fabrics	Technical fabrics	Geo-fabrics	Strings, ropes	Belts Cordage	Conveyor belts
Hydraulic grips	A	10 kN to 250 kN	-	-	-	-	✓	✓	✓	✓	-	-	✓
Pneumatic grips	A	20 N to 100 kN	-	-	✓	-	✓	✓	✓	-	-	-	✓
Pneumatic grips	B + A	2,5 kN to 20 kN	-	-	✓	✓	-	-	✓	-	✓	-	-
Wedge grips	A	2,5 kN to 250 kN	-	-	-	-	-	-	-	-	-	-	●
Screw grips	A	20 N to 50 kN	✓	-	✓	-	✓	✓	-	-	-	-	✓
Wedge screw grips	A	500 N to 250 N	-	-	-	-	-	-	-	-	-	-	-
Spring screw grips	A	20 N / 50 N	✓	O	-	-	-	-	-	-	-	-	-
Pincer grips	A	500 N to 10 kN	-	-	-	-	-	-	-	-	-	-	●
Toggle grips	B	300 N to 2,5 kN	-	-	-	-	✦	-	-	-	-	-	-
Double toggle grips	B + A	500 N	-	✓	-	-	-	-	-	-	-	-	-
Rope grips	B + A	2,5 kN to 100 kN	-	-	-	-	-	-	-	-	✓	-	-
Curved grips	B + A	10 kN / 20 kN	-	-	-	-	-	-	✓	-	✓	✓	-
Roller grips	B	2,5 kN to 250 kN	-	-	-	-	-	-	✓	✓	-	✓	-

✓ - Suitable for this application
O - Suitable only for cyclic tests
● - Suitable only for test to determine the shear, tear or adhesive properties
✦ - Suitable only for simple tensile tests, specimen width max. 32 mm

can be neglected. This applies particularly to specimen grips where the gripping force is applied by an additional force.

The realization of the test force-gripping force in case of self-gripping specimen grips has the effect that the bending up of the specimen grips and the thickness reduction of the specimen have to be compensated by a considerably larger clamping jaw tracking. This can lead to an inadmissible falsification of the strain measurement.

Grip-sensitive specimens however require specimen grips where the test force is reduced decreasingly over larger gripping lengths, e.g. via correspondingly shaped cam plates. This has the consequence that the gripping length (reference size for the strain calculation) is not exactly defined. The strain is moreover constantly reduced in the range of the relatively long gripping area. Therefore the strain can only be determined exactly if an extension measurement system is used to record the deformation directly on the specimen.

Spring screw grips


Pincer grips


Double toggle grips

Zwick / Roell

Hydraulic specimen grips
- One or two-sided clamping jaw positioning
- Adjustable clamping force (Option: can be controlled by the test software dependant on the test force, for specimens that are sensitive to gripping)
- Exchangeable clamping jaws
- Special version with tandem cylinder for geo-textile speci-mens with a width of 200 mm for a homogeneous gripping force distribution over the entire specimen width
- Special versions for the use in temperature/climatic chambers at -70 ºC to +250 ºC
- Hand or foot control or control via the test software *testXpert*®

Pneumatic specimen grips
- One or two-sided clamping jaw positioning
- Adjustable clamping force
- Exchangeable clamping jaws
- Special versions for the use in temperature-/climatic chambers at -70 ºC to +250 ºC
- Special versions with cam plates
- Hand or foot control

Screw grips
- Clamping force depends on the screw moment and the elasticity of the specimen grip
- Low-cost

Spring screw grips
- Clamping pressure adjustable by pre-stressing a spring.
- Thread guide for a simple, centrical gripping.
- Temperature range - 15 °C to +80 °C

Pincer grips
- Temperature range - 40 °C to +250 °C

Double toggle grips
- Exact strain measurement by adapting the distances of the deflection pulleys to the specimen's elastic behaviour
- Temperature range -15 °C to +80 °C

Rope grips
- With a single or multiple wrapping around and mech., pneum. or hydr. gripping of the rope's end
- Temperature range -70 °C to +250 °C

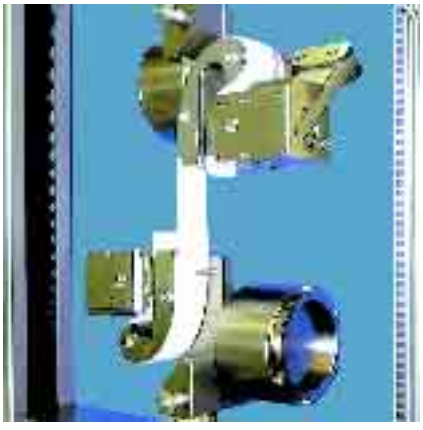
Curved grips
- Mech. or pneum. flat clamp with cam plate
- Temperature range: mechanical 0 °C to +100 °C pneumatic +10 °C to +35 °C

Roller grips
- Gripping by means of a multiple wrapping around
- Temperature range -40 °C bis +250 °C

Note:
The wedge and wedge screw grips used for rigid specimens are not suitable for tensile tests on flexible, textile specimens.

Tools for compression tests for the determination of the compression characteristics of insulating materials according to EN 826
A lot of round, square, and rectan gular compression platens are available in different dimensions. The lower compression platens are always mounted rigidly. The upper compression platens may be mounted spherically (freely movable or alignable) to transmit the compressive force homogeneously over the entire compression platen.

Tools for compression tests
The suitable test configuration may be selected from a large range of different bending tables with rigid and movable supports and bending fins to meet the requirements of nearly every application.


Curved grips with pneumatic end clamping


Rope grips with mechanical end clamping


Roller grips

Zwick / Roell

Extensometer

Crosshead travel monitor

Standard equipment of all universal testing machines are digital crosshead travel monitors for a highly accurate and exactly reproducible measurement of the crosshead travel extension. Thus, the strain can be measured indirectly for many applications (without additional transducer directly on the specimen). This applies practically for all tear propagation, separation, peel, shear, and compression tests and for many tensile tests.

Direct strain measurement

Some test standards as e.g. EN ISO 10319, tensile test on large specimen strips and ISO 283-1, tensile test on textile conveyor belt-dumbbell specimens, require the strain measurement to be carried out directly on the specimen to avoid any measuring errors that are caused by machine deformation, clamping jaw tracking, partial slippage of the specimen out of the gripping position. This applies particularly to the use of specimen grips where the specimens are gripped in the wrap-around principle. The strain is defined as extension of the initial gauge length. The extension can be measure in 2 different ways:

1. Contact measurement
Two sensor arms are attached to the specimen at the distance of the initial gauge length; they record the extension of the gauge length up to the break (the end points of the gauge length are not marked).

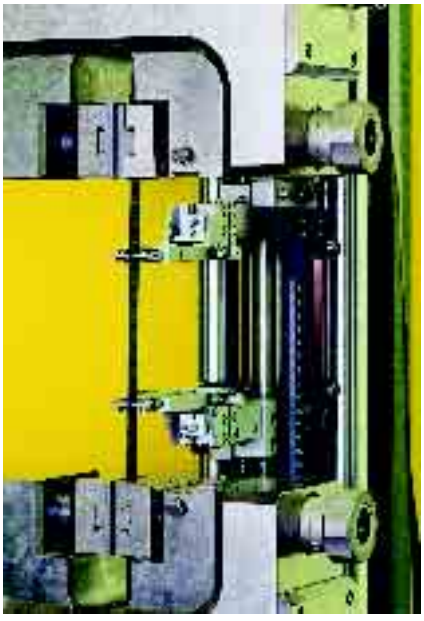
The force to move the sensor arms must be “applied” by the specimen and influences the force measurement. In order to measure also small test forces with a sufficient accuracy, it is necessary to keep the dragging force for the sensor arms as low as possible.

At the specimen break, the energy which is elastically stored in the specimen parts, is converted to a kinetic energy. All of a sudden, the stretched, flexible specimen parts rebound to nearly their initial length just to get bent at a high speed or to deflect laterally. This “whip effect” can damage or even destroy the sensor arms. The longer the specimen parts stretch, the higher the effect. This danger is particularly large when using specimen grips with wrap-around principle.

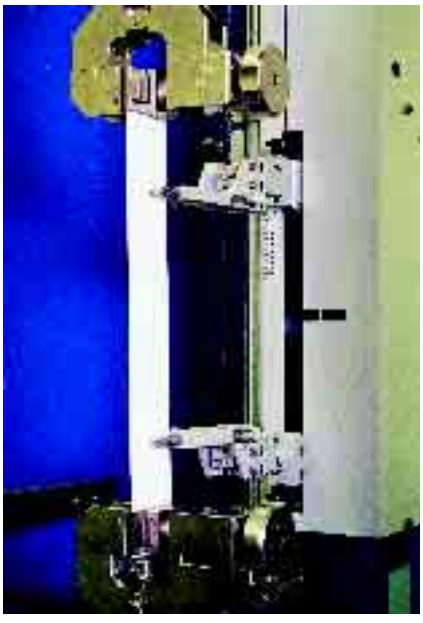
2. Contact-free measurement
The initial gauge length is marked on the specimen with measurement marks. The travel extension of the marks is recorded optically. The measuring system cannot be damaged.

Extension measurement systems

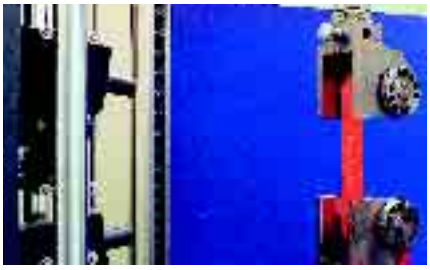
A simple, safe and economic extension measurement is only possible by means of a relatively large technical effort. In addition to electronic or optical test data transducers, also motor-driven sensor arms, measuring slides, control devices, microcomputers and programs, i.e. complete systems might – according to the function principle – also be required.



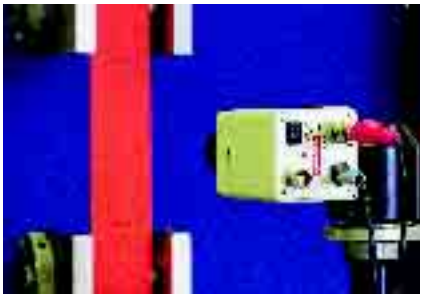
Long stroke extensometer



Macro extensometer



Optical extensometer



Video extensometer

Zwick / Roell

Extensometers – Help for choice

Application	Extensometers											
	Clamping the specimen											
	between clamping jaws						by wrapping around plates or rollers					
Materials characteristics to be determined and the related standards	**Crosshead monitor**	**Macro extensometer**	**Long stroke extensometer**	**Optical extensometer**	**Video extensometer[1)]**	**Laser extensometer**	**Crosshead monitor**	**Macro extensometer**	**Long stroke extensometer**	**Optical extensometer**	**Video extensometer[1)]**	**Laser extensometer**
Tensile modul												
• EN ISO 10618	-	✓	-	-	✓	-	-	-	-	-	-	-
• EN 12562, EN 13002-2, EN 13003-2	✓	●	-	-	●	-	✦	●	-	-	●	-
Secant rigidity and strain at max. force												
• EN ISO 10319	-	-	-	✓	✓	✓	-	-	-	✓	✓	✓
Strain at x% of max. force												
• ISO 283-1	-	✓	-	-	✓	-	-	-	-	-	-	-
Strain at break												
• ISO 283-1	-	✓	✓	✓	✓	✓	-	-	-	-	-	-
Strain at max. force and break												
• EN ISO 10618	-	✓	-	-	✓	-	-	-	-	-	-	-
• EN 12562, EN 13002-2, EN 13003-2	✓	●	-	-	●	-	✦	●	-	-	●	-
• EN ISO 5079, ASTM D 38229, ASTM D 3379	✓	-	-	-	-	-	-	-	-	-	-	-
• EN ISO 2062, DIN 53834-2, ASTM D 2256	✓	●	●	●	●	-	✦	●	●	●	●	-
• ASTM D 885, cords	-	-	-	-	-	-	✦	O	O	●	●	-
• ASTM D 885, fabrics	✓	●	●	●	●	●	-	O	O	✓	✓	✓
• ISO 6939, ASTM D 1578	✓	●	●	●	●	-	✦	●	●	●	●	-
• ISO 3341	✓	●	-	-	●	-	✦	●	-	-	●	-
• EN ISO 9163	✓	●	●	●	●	-	✦	●	●	●	●	-
• EN 13844	-	-	-	-	-	-	✦	O	O	●	●	●
• EN ISO 13934-1, ASTM D 1682	✓	●	●	●	●	●	-	O	O	●	●	●
• EN 29073-3, EN 4606, EN 3342	✓	●	●	●	●	●	-	-	-	-	-	-
• EN ISO 1421	✓	●	●	●	●	●	-	O	O	●	●	●
• EN 1492-1	-	-	-	-	-	-	-	O	O	✓	✓	✓
• EN 61067-2, EN 565	-	O	O	✓	✓	✓	-	O	O	✓	✓	✓
• EN 919, ASTM D 4268, EN 892	-	-	-	-	-	-	-	-	-	✓	✓	✓
• EN 564	-	-	-	-	-	-	-	O	O	✓	✓	✓

✓ - Suitable for this application
✦ - Suitable for this application if the deflection in the specimen grips is max. 180°
O - Suitable for this application if there is no risk that the sensor arms get damaged due to specimen parts rebounding at specimen break
● - Is used if a higher measuring accuracy without clamping influence is required. Mechanical measuring systems can only be used if there is no risk that they get damaged at specimen break. When using contactless measuring systems, a specimen marking is required

[1)] The objectives of the video measuring system cannot be changed during the test. Optionally the determination of variations in width are also possible

Zwick / Roell

Extensometer with sensor arms – Technical data / special features

	Macro extensometer	Long stroke extensometer
Measurement system	Incremental	Incremental
Gauge length L_0	10 to 100/205 mm	10 to 1000 mm, manual setting
Measuring range	80/120/160 mm	1000 mm – L_0
Resolution	0.3/0.6/0.9/1.2 µm	5 µm
Accuracy	Class 1 acc. to EN 10002-4, better than ISO 5893, grade A	1% of reading or 0.01 mm, whatever is greater
Inertia force	< 0.05 N	< 0.2 N
Special features	motorized senor attachment motorized gauge length setting (allround version)	motorized senor attachment
Applications	textiles and compounds With low or medium strain	textiles and compounds with max. forces > 20 N
Advantages	• robust and simple to use • low inertia force • crosshead contact protection • exchangeable sensor arms for different measuring ranges • convenient for measurements in temperature chambers	• robust and simple to use • strain measurement until fracture without lifting the sensor arms (rotatable knife edges) • exchangable sensor arms convenient for measurements in temperature chambers

Non-Contacting Extensometer – Technical data / special features

	Optical extensometer	Laser extensometer	Video extensometer
Measurement system	Incremental, 2 cameras	Rotation laser, 0.5 W He/Ne	Digital video camera with image processing system
Gauge length L_0	10 to 900 mm	10 mm (tension) 20 mm (compression)	min. 5 mm
L_0-marking	circular reflectors	line reflectors	line reflectors
Measuring range	1000 mm – L_0	ca. 400 mm	Field of view[1]: i.e. 50/200/1000 mm
Resolution	5 µm	12 µm	0.5 / 2 / 10 µm1)
Accuracy	1% of reading or 0.03 mm Whatever is higher	Class 1 acc. to EN 10002-4, better than ISO 5893, grade A1 for extensions > 5 mm	Class 1 acc. to EN 10002-4, better than ISO 5893, grade A1 (depends on lenses)
Advantages	• simple-to-use measurement for materials with high strain • secure and accurate measurement until fracture • convenient for measure-ments in temperature chambers through a heated optical glass window • automatic gauge length recognition	• convenient for measure-ments in temperature chambers through a heated optical glass window	• Very adaptable for different materials and test procedures • automatic gauge length recognition • convenient for measure-ments in temperature chambers through a heated optical glass window

[1] Measuring range and resolution depends on lenses

Zwick / Roell

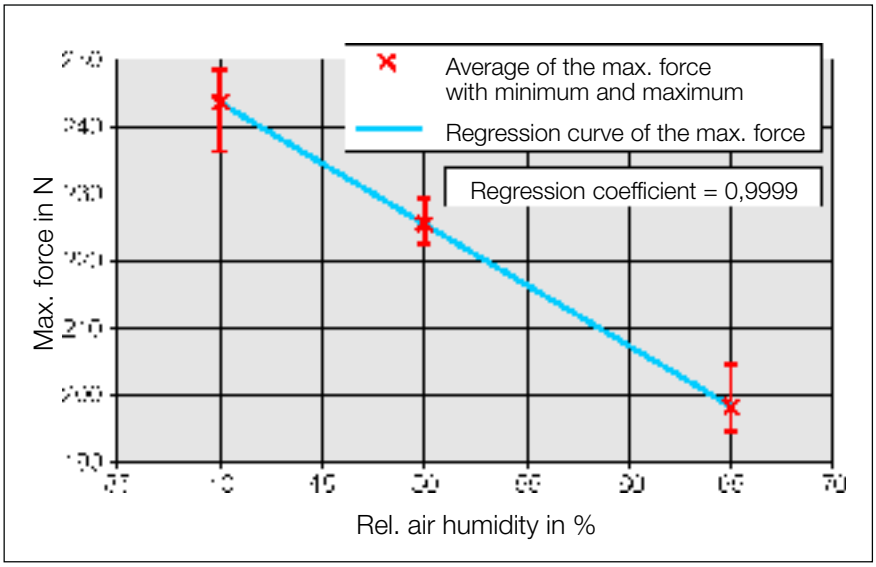
Temperature and climatic chambers

Temperature / climate

Many textile and textile-related materials strongly change their mechanical properties depending on the humidity of air and ambient temperature. One of these influences is illustrated by the following graphic. It shows how the maximum tensile force of a viscose fabric is reduced as the relative humidity of air increases.

According to the later use of the material, particularly in the geotechnical, automobile, and aeronautics industry, it may be very important to know the behaviour of materials under different environmental conditions.

The mechanical properties of textile and textile-related materials in an extended temperature and climatic range are predominantly tested for research and development purposes.



Maximum tensile force depending on the relative humidity of air for a viscose fabric

Zwick offers a complete product range of temperature devices corresponding to the multitude of different requirements.

Temperature chambers

Zwick temperature chambers show the following characteristics:

- Aperture for sensor arms on the rear left side (45°)
- Eurotherm temperature controller with digital display for actual and set value
- Illumination inside the chamber
- Front door with insulated window

* Sliders for removing the chamber without dismounting the grips

- Insulation and electrical design according to the CE safety regulations

Temperature chamber

Used with Table	**top and floor standing machine**		**Only floor standing machines**	
Height	normal	higher	normal	higher
Width	normal	normal	larger	larger
Dimensions (external/internal)				
Height, mm	650/500	850/700	800/650	1000/850
Width, mm	400/260	400/260	600/450	600/450
Depth, mm	825/360	825/360	1150/645	1150/645
Temperature range (from/to)				
No cooling	amb./250 °C[2) 3)]	amb./250 °C[2) 3)]		
Cooling with				
• CO_2	-60/250 °C[3)]	-60/250 °C[3)]	-60/250 °C[1) 3)]	-60/250 °C[1) 3)]
• LN_2	-80/250 °C[3)]	-80/250 °C[3)]	-80/250 °C[3)]	-80/250 °C[3)]
• Air cooled refrig. unit	-40/250 °C[3)]	-40/50 °C[3)]	-40/250 °C[3)]	
	-40/250 °C[3)]			
	-70/250 °C[3)]	-70/250 °C[3)]	-70/250 °C[3)]	-70/250 °C[3)]
•Water cooled refrig. unit	-40/250 °C[3)]	-40/250 °C[3)]	-40/250 °C[3)]	
	-40/250 °C[3)]			
	-70/250 °C[3)]	-70/250 °C[3)]	-70/250 °C[3)]	-70/250 °C[3)]

[1)] The depth of the chamber is 1080/540 mm
[2)] Without opening for mechanical or optical extensometers, without removeable sliders
[3)] Chambers with further temperature ranges on request

Zwick / Roell

Climatic chambers

Temperature chambers with control of the relative humidity of air are called climatic chambers. Since the requirements for the humidity and temperature range strongly vary, climatic chambers are specified on request.

Available options

Several options are available according to the specification of the testing machine and the needs of the laboratory.

- heatable optical glass insert to ensure a homogeneous temperature distribution when using optical extensometers
- guiding rails or trolley to move the chamber out of the test area
- recording and control of the temperature by the testXpert(r)-Software via RS 232-interface
- direct temperature measurement and control on the specimen
- liquid nitrogen tank, 100 litres, with pressure device, control valve, filling level indicator and safety device

Cooling with liquid nitrogen (LN_2) or carbon dioxide (CO_2)

This type of cooling is used if tests below room temperature are to be carried out from time to time. The cooling effect generated by vaporizing the liquid nitrogen or carbon dioxide. These gases are non-toxic. A sufficient ventilation of the testing laboratory is required, however.

The optional 100 litres liquid nitrogen tank (3/8"-connection) is sufficient for several hours of tests.

Cooling by use of a refrigeration unit

Cooling is generated by a compressor. This method is used if tests below room temperature are frequently required, if procurement of liquid nitrogen or carbon dioxide is too difficult or if the use of liquid nitrogen or carbon dioxide is forbidden for safety reasons.

The energy transmission can be realized by the use of air-cooled heat exchangers (the energy stays in the room) or by a water-cooled heat exchanger (the energy does not heat up the laboratory, but more expensive since cooling water is needed). Refrigeration units generate more noise than vaporizing systems.

Temperature chamber with pneumatic grips (door opend)

Temperature chamber mounted on guide rails

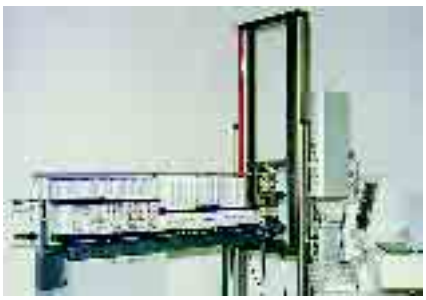
Sliders for removing the chamber without removing the grips

Special testing machines and systems

These testing machines are developed according to the field of application in question in close cooperation with the customer. They are mainly based on the components of standard testing machines.

Examples of special testing machines for textile applications

Materials testing machine Zwick Z010 with unit for the determination of the unrolling resistance of medical bandages.



Fully automatic materials testing system with circulating specimen magazine for up to 200 strip-shaped specimens

Materials testing machine in horizontal position for hill climbing ropes, test loads up to100 kN and a test travel up to 3.7 m, with optical extensometer

Materials testing machine in horizontal position for conveyor belts, test loads up to 2,500 kN, test travel up to 1. 5 m, gripping length up to 10 m

ZMART – Zwick Modernization and Retrofit Technology

Modernization packages

With the two modernization lines ZMART.KIT(and ZMART.PRO) both electromechanical and hydraulic materials testing machines of different manufacturers can be upgraded and brought to the most recent state-of-the-art.

A modernization guarantees spare parts supply for modernized components, and makes available the most recent version of the test software *testXpert*®, as well as the entire accessory program of extensometers and specimen grips.

The decision whether to purchase a new machine or a modernization depends primarily on the value and technical condition of the machine components to be taken over. Due to the fact that in addition to the load frame other components can

Modernization of an electro mechanical materials testing machine with ZMART.PRO *testControl*-M

Zwick / Roell

also be used furthermore, as e.g.: load cell and extensometer, the costs for a modernization remain relatively low compared to the costs incurred for the purchase of a new machine.

The modernization packages are composed of the following components:

- Digital measurement and control electronics
- Test software *testXpert*®
- Maintenance-free AC-drives
- Proportional valves or servovalves and hydraulic units for hydraulic testing machines

Special features or services	ZMART.KIT	ZMART.PRO				
		testControl®-		Allround (DUPS)		
		M	H	M	H	I
Connection to						
• Electro-mechanical testing machines	●	●	-	●	-	-
• Quasi-static hydraulic testing machines	-	-	●	-	●	●
• Can also be used without Personal Computer (PC)	●	●	●	-	-	-
• Up to 3 hydraulic testing machines	-	-	-	-	●	-
Test data acquisition and display						
• test force and crosshead or piston travel resp. Further connection of	●	●	●	●	●	●
• Analog extensometers (inductive)	-	●	●	●	●	●
• Analog extensometers (strain gauge system)	-	●	●	●	●	●
• Incremental extensometers	-	●	●	●	●	●
• Several load cells (Changeover via *testXpert*®)	-	●	●	●	●	●
Test data storage and processing						
• Display of max. force and travel when reaching the test end criteria (without PC)	●	●	●	-	-	-
• Optional display of test force or stress, travel and/or deformation or strain (only with PC)	●	●	●	●	●	●
• Output of XY-curves with the coordinates force/stress, travel and /or deformation/strain or test time (only with PC)	●	●	●	●	●	●
• Automatic determination and documentation of materials characteristics data and statistical data (only with PC)	●	●	●	●	●	●
Test sequence control and test speed control						
• Automatic recognition of the test end (specimen break, force-, travel- or time-limit value or number of test cycles reached)	●	●	●	●	●	-
• Automatic stop at test end or return to start position	●	●	●	●	●	-
• Automatic speed changes according to the test program (only with PC)	●	●	●	●	●	-
• Test speed control in dependence on the measured force or deformation (“closed loop” control (only with PC and optional program)	●	●	●	●	●	-
Monitoring of satety limit values						
• Test force	●	●	●	●	●	-
• Crosshead resp. piston travel	●	●	●	●	●	-

Zwick / Roell

Services

Customer satisfaction is given top priority at Zwick/Roell. Therefore, nearly one third of the employees are active in the service field. Extensive services guarantee the best use possible and a high availability of the supplied testing machines and -systems.

Advice and support
Our technically competent and experienced service personnel support the user directly at site or by phone, fax or e-mail. Detailed information may also be looked up in the internet or may be downloaded in case of need.

Maintenance and repair
A service contract with individually agreed service intervals for a careful and thorough maintenance and calibration guarantees the correct and trouble-free operation of the supplied testing machines and systems. Whereby it is not important which manufacturer supplied the testing machine. In case of a malfunction, a service-engineer or – technician is quickly available at site. Modern auxiliary means such as a telediagnostic service via modem allow a quick and exact fault localization at an early stage. Different reaction models guarantee the availability of a technician within the shortest period of time possible.

Calibration service according to ISO 9000
The Zwick/Roell maintenance- and calibration service is accredited as DKD[1)]- and as UKAS[2)]-calibration laboratory resp. Thus, it is authorized to check the testing machines and -systems at the place of installation and to issue DKD- or UKAS calibration certificates for the measured quantities force, extension, energy and hardness. These calibration certificates are not only recognized within the European Union, but also in almost every country of the world.

Particular advantage:
The technicians of the calibration service can, on the occasion of their service visit, not only service, adjust and calibrate the Zwick/Roell testing machines and systems, but also the machines and systems of other manufactures. This saves time and costs.

The regular maintenance and calibration of the testing machines is also a prerequisite for a quality management system according to QS-9000 and VDA 6.1.

Hotline – Quick assistance in case of malfunctions
For Zwick/Roell, the perfect functioning of the testing machine is very important. Should, in spite of the high quality standard, any malfunctions occur on the machine or within the software, then competent specialists are available on the free hotline.

Creation and adaptation of test programs
With the test software of the Zwick/Roell Group already many different test programs can be acquired. The test requirements are however not always standardized. Experts will adapt your existing test programs individually or will create a new test program which is tailor-made to comply with your requirements.

Seminars
Studies have shown that more than half of the problems with technical systems are not caused by the technology itself, but rather by the user. A good training of the users helps to avoid troubles and, as a result, to reduce the costs.

The Zwick/Roell seminars inform about theory and practice of the materials- and component part testing, the evaluation and the valuation of the test data, test results and the operation and maintenance of the testing devices. These seminars either take place directly at the user's place or at the locations of Zwick/Roell companies or representations.

Support line – Assistance for operation and application
Alternatively to the visit of a seminar or to the service visit of a technician at site, you can talk to our experts on the support line – against charge – whenever you have any questions. They will assist you with the adaptation of the test software, with the creation of test programs, when having questions regarding the operation of the software or the machine and they will give you an application-specific support.

Spare parts
Standard components are mostly available on stock and will be sent to you by courier service on the day of order. Special components, not being carried on stock, will be manufactured "just in time" by means of the latest production technology.

[1)] DKD = Deutscher Kalibrier-Dienst (German Calibration Service)
[2)] UKAS = United Kingdom Accreditation Service