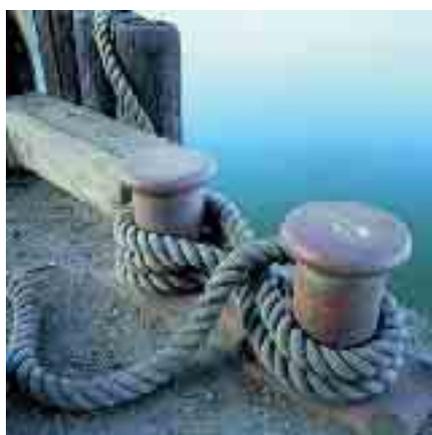
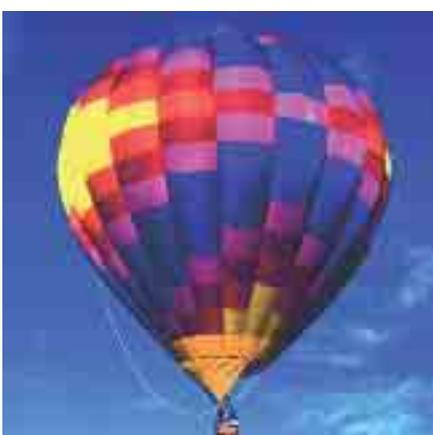


Testing Machines and Systems for Textile Materials



Intelligent Testing

This catalog 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.

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

Mechanical-technological testing is one of the oldest disciplines 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 1920 the company Roell & Korthaus has been involved in the materials testing business. In 1937 Zwick built its first testing machines and systems for mechanical testing of materials. Many years prior to that in 1876, a Professor Seger had already founded a chemical laboratory as part of a scientific technological consulting company for nonmetallic materials. During the 20th century, the present company called Toni Technik has evolved from these origins and is now considered a leading expert in test systems for building materials. Another predecessor of the Zwick Roell is a company MFL (Mohr & Federhaff) – a company that was founded in 1870. Interestingly enough Carl Benz (of Mercedes Benz fame) was one of their employees.



The headquarter of the Zwick Roell AG and the Zwick GmbH & Co. KG at Ulm, Germany

Since 1992, these companies have formed the Zwick/Roell company group. In July 2001, this company group was converted into a stock corporation: the Zwick Roell AG. Part of this stock corporation are the companies Zwick, Toni Technik, Indentec Ltd., and since May 2002 Acme 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 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.

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.

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. Even medical substances can be absorbed by skin through particularly treated textiles – a method that has been developed by German scientists. Skin caring and skin regenerating substances to treat sun burn or neurodermitis can for example be applied broadly with the garments without restricting the freedom of movement – after all, you are wearing clothes all day long.

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 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 such 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.



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

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.



Materials testing machine for the testing of textile materials

Textile Materials, Examples



Fibers



Yarns and Threads



Yarns and Rovings



Non-wovens



Fabric



Coated Fabric and Textiles



Geotextiles



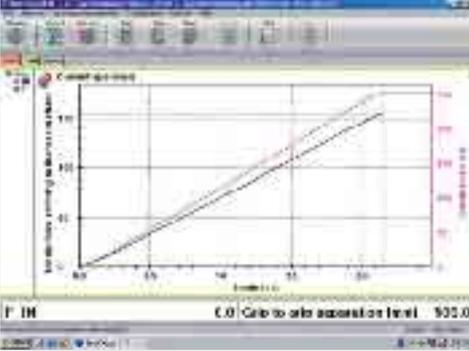
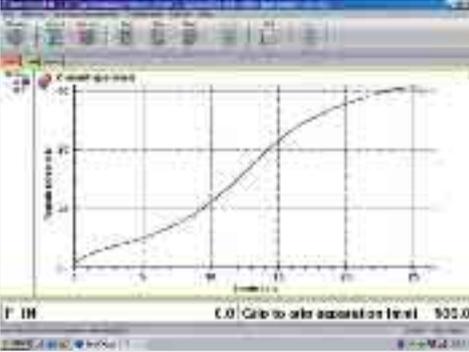
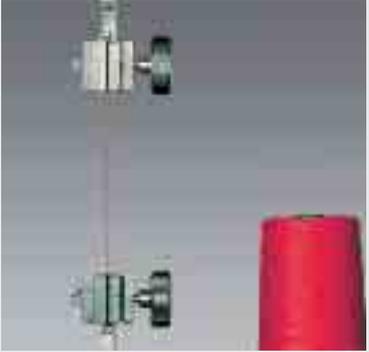
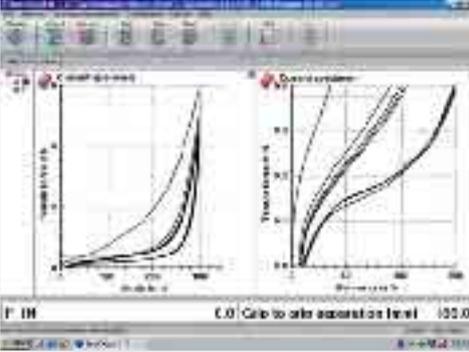
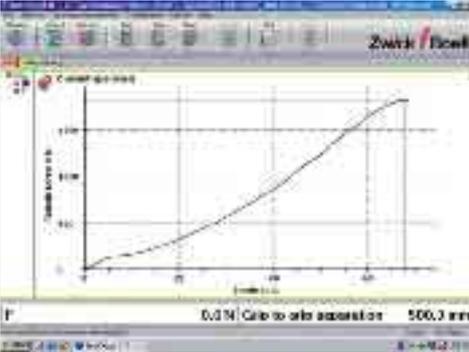
Tapes and Belts

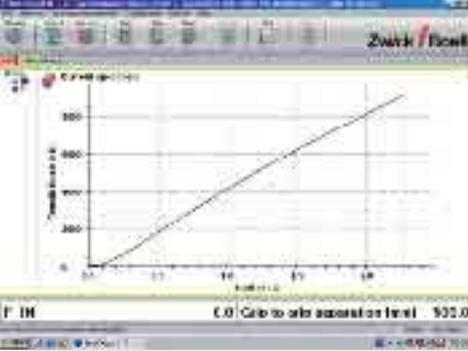
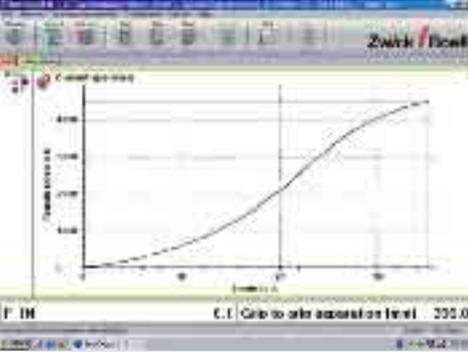
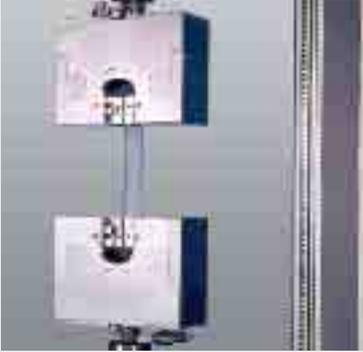
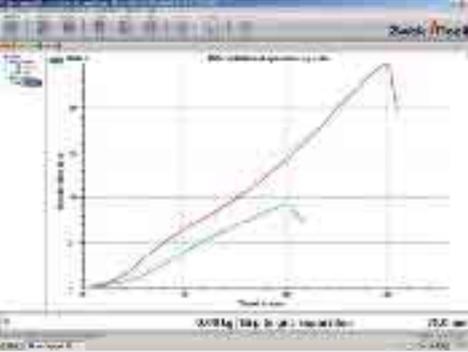
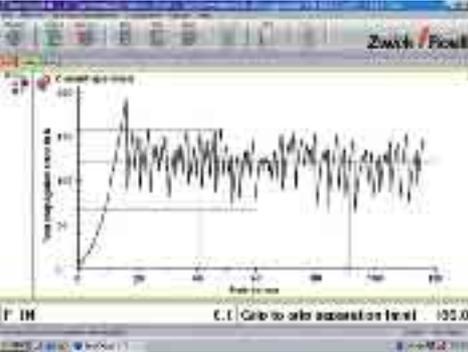
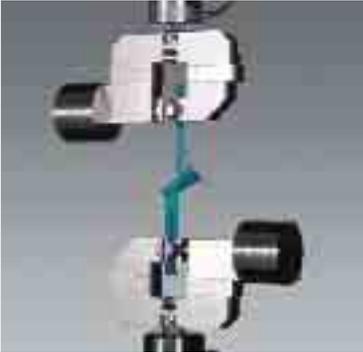


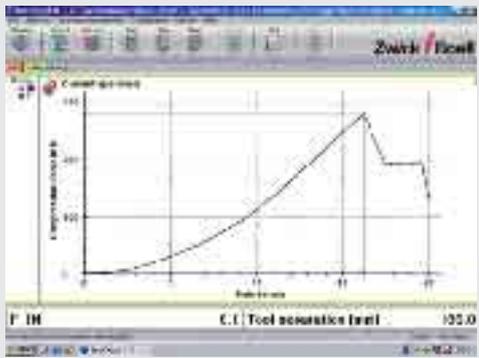
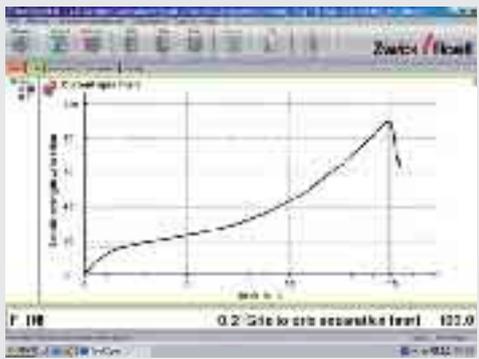
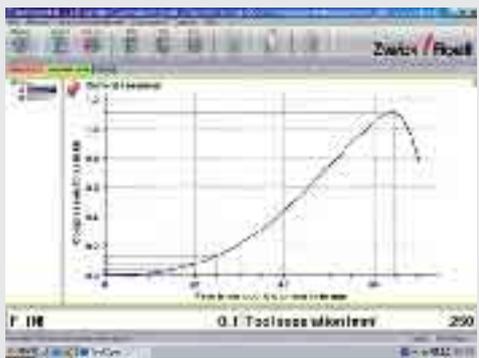
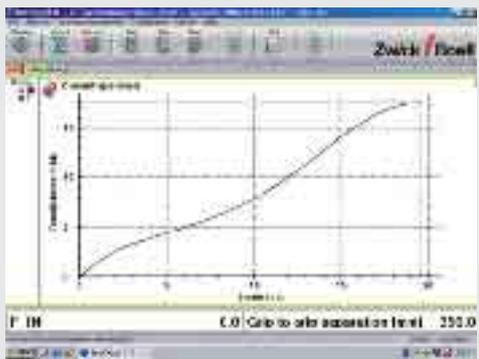
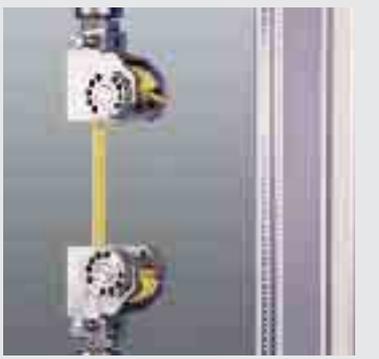
Ropes and Cordage

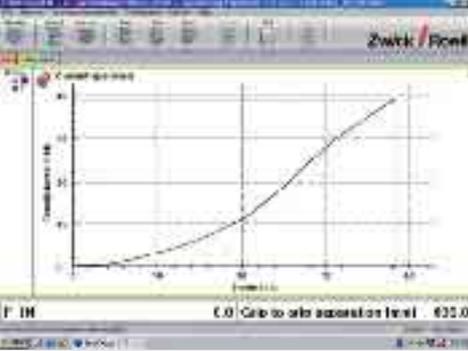
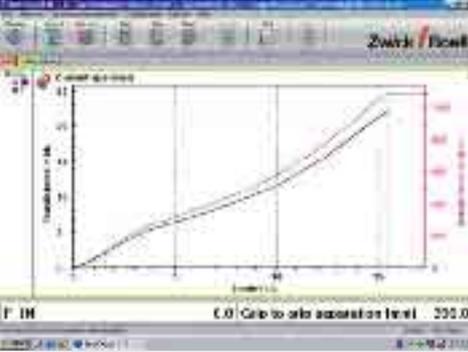
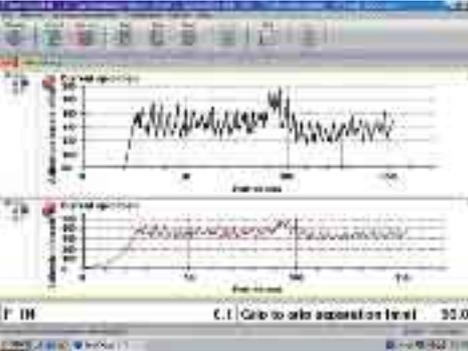
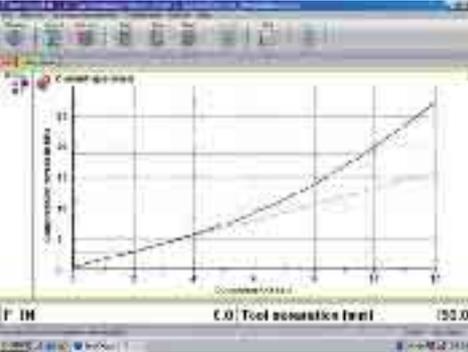


Material for Safety Belts

Application	Graph in testXpert®	Test Arrangement
<p>Yarns, Threads, Twines</p> <p>Standard: ISO 2062 Type of Test: Tensile Test Material: Aramid Yarn Extensometer: Crosshead travel encoder Grips: Pneumatic Grips Test Speed: 500 mm/min testXpert® II: B269051.18</p>		
<p>Standard: ISO 2062 Type of Test: Tensile Test Material: Sewing Yarn Extensometer: Crosshead travel encoder Grips: Screw Grips Test Speed: 500 mm/min testXpert® II: B269051.18</p>		
<p>Standard: DIN 53835-2 Type of Test: Tensile Test Material: Elastomeric Yarn Extensometer: Crosshead travel encoder Grips: Spring loaded grips Test Speed: 500 mm/min testXpert® II: B269054.xx</p>		
<p>Standard: ISO 2062 Type of Test: Tensile Test Material: Double Thread Extensometer: Crosshead travel encoder Grips: Pneumatic Grips Test Speed: 500 mm/min testXpert® II: B269051.18</p>		

Application	Graph in testXpert®	Test Arrangement
<p>Standard: EN ISO 2062 Type of Test: Tensile Test Material: Multifilament Yarn Extensometer: Optical extensometer Grips: Rope Grips Test Speed: 500 mm/min testXpert®II: B269051.00</p>		
<p>Textile Fabrics</p>		
<p>Standard: ISO 13934-1 Type of Test: Tensile Test Material: Airbag Fabric Extensometer: Crosshead travel encoder Grips: Pneumatic Grips Test Speed: 100 mm/min testXpert®II: B269051.17</p>		
<p>Standard: Marks & Spencer, P12 Type of Test: Seam Slippage Resistance Material: Garment Extensometer: Crosshead travel encoder Grips: Screw Grips Test Speed: 100 mm/min testXpert®II: B269051.20</p>		
<p>Standard: ISO 13937-2 Type of Test: Single Tear Method Material: Airbag Fabric Extensometer: Crosshead travel encoder Grips: Pneumatic Grips Test Speed: 100 mm/min testXpert®II: B269053.09</p>		

Application	Graph in testXpert®	Test Arrangement
<p>Coated Fabrics</p> <p>Standard: ISO 3303 Method A Type of Test: Bursting Strength Material: Coated Fabric Extensometer: Crosshead travel encoder Grips: Ball Burst Device Test Speed: 300 mm/min testXpert® II: B269052.xx</p>		
<p>Geotextiles</p> <p>Standard: ISO 10319 Type of Test: Tensile Test Material: Geotextile Extensometer: Optical Extensometer Grips: Hydraulic Grips Test Speed: 20% of L_0/min testXpert® II: B269051.23</p>		
<p>Standard: ISO 12236 Type of Test: Static Puncture Test Material: Geo-non-woven Extensometer: Crosshead travel encoder Grips: Static Puncture Test Device Test Speed: 50 mm/min testXpert® II: B269052.17</p>		
<p>Tapes, Belts, Rope, Cordage</p> <p>Standard: EN 1492-1 Type of Test: Tensile Test Material: Belt Seal Extensometer: Optical Extensometer Grips: Roller Grips Test Speed: 500 mm/min testXpert® II: B269051.xx</p>		

Application	Graph in testXpert®	Test Arrangement
<p>Tapes, Belts, Rope, Cordage</p> <p>Standard: ISO 2307 Type of Test: Tensile Test Material: Fiber Rope Extensometer: Optical Extensometer Grips: Rope Grips Test Speed: 500 mm/min testXpert® II: B269051.xx</p>		
<p>Standard: ISO 283-1 Type of Test: Tensile Test Material: Conveyor Belt Extensometer: Makro Extensometer Grips: Hydraulic Grips Test Speed: 100 mm/min testXpert® II: B269051.xx</p>		
<p>Standard: EN ISO 252-1 Type of Test: Tensile / adhesive strength Material: Conveyor Belt Extensometer: Crosshead travel encoder Grips: Pincer Grips Test Speed: 100 mm/min testXpert® II: B269053.xx</p>		
<p>Thermal Insulation Material</p> <p>Standard: EN 826 Type of Test: Compression Test Material: Mineral wool Extensometer: Crosshead travel encoder Grips: Compression Plates Test Speed: 10% of d/min testXpert® II: B269052.24</p>		

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.

In order to be able to offer the best machine for each requirement, the comprehensive product range includes three machine versions for static materials testing, each of them offering different equipment, performance and expansion capabilities:

- The **zwicki-Line** consists of top-quality space-saving testing machines. These simple-to-use and easy-to-transport single column machines have been designed for test forces to a maximum of 2.5 kN.
- The **ProLine** is particularly suitable for functional tests on component parts as well as for standard materials tests. A broad range of standard accessories provides for comprehensive testing capability at a reasonable price.
- The **Allround Line** is the basis for a large range of demanding testing. It can easily be expanded in the future as the requirements also grow.



Zwick ProLine testing machine

Measurement and control system

The 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 of 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 test sequence and for safety limits. (e.g. speed change upon reaching the yield or proof stress limit)
- Adaptive control for exactly reproducible speeds and positions.

testControl and hence the testing machine, is operated by using a PC and the test software *testXpert*® II. The system is therefore simple to configure and upgradeable for the most diverse applications as well as extremely flexible and easy to operate.

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



Zwick ProLine table-top testing machine

Load frames

Different load frame versions for test loads up to 2000 kN are available as standard. For special applications special versions can be developed and manufactured, e.g. load frames in horizontal position suitable for the testing of long ropes.

Table-top testing machines, zwicki-Line

These single column load frames are designed with very-rigid aluminium high-precision extruded profiles. The working area is freely accessible from 3 sides. It only requires limited space and fits on most laboratory tables. Due to its low weight, it is easy to transport.

Table-top testing machines, ProLine

The load frames of the ProLine are designed with 2 round steel columns ensuring exact guidance of the moving crosshead. The integrated protection of lead screws and guide columns allow reliable testing even for very brittle materials.

A single column version is available within the ProLine range for testing at forces of up to 500 N.

Table-top and floor standing models, Allround-Line

The table-top version is constructed using two aluminium, high-precision extruded profiles (patented design). They are light, very rigid and serve simultaneously as lead-screw guides and protection. T-shaped grooves on the outer sides allow a simple fitting of accessories as e.g. safety devices without being impeded by the crosshead.

All load frames with two columns can be equipped with legs to position the working area at an optimum height for the operator. This allows a comfortable seated operation with absolute freedom for leg movement thus making the testing system suit zwicki-Line Load Frames and Drives.

The high precision of the **floor testing machines** results from their hard chrome-plated guide columns and precision ball lead screws with play-free pre-stressed nuts. The testing machines can be equipped in different ways. For example, there is a choice of how the crossheads can be mounted, i.e. as upper or lower crossheads, thus resulting in a lower, or an upper or upper and lower test areas.

An optional second test area can be setup for all load frames with electro-mechanical drives. Thus enabling rapid switching between two types of test without any tedious reequipping.



Zwick zwicki-Line testing machine



Zwick Allround-Line table-top machine



Zwick Allround-Line testing machine

zwicki-Line, ProLine and Allround-Line at a glance

Machine Components/Function	Zwicki-Line	ProLine	Allround-Line
Load Frames			
• Type			
Table-top testing machine (nominal load)	1...2,5 kN	0,5...100 kN	5...150 kN
Floor testing machine (nominal load)	-	-	50...250 kN
• Support and guide columns			
Number of round columns	-	2 (Z005 bis Z100)	2 or 4 (floor testing machines)
Number of aluminium profile columns	1	1 (Z0.5)	2 (table-top testing machines)
• Number test areas	1, optional 2	1	1, optional 2
Drive system			
• Elektromechanical			
Number of ball screws	1	1 or 2	2
DC-Motor	Yes	up to Z050	-
AC-Motor	-	from Z050 (with <i>testControl</i>)	up to Z600
Measurement and Control Electronics			
<i>testControl</i>	Yes	Yes (from Z050)	Yes
Standard electronics	Yes	Yes (up to Z050)	-
Software (Option)			
Testing software <i>testXpert</i> [®] - Standard test programs	Yes	Yes	Yes
Testing software <i>testXpert</i> [®] - Master test programs	Yes	-	Yes

ProLine Load Frames and Drives

Serie	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]	-	570	-	-	-	-	-
* normal [mm]	590	1070	1050	1050	1370	1370	1360
* increased [mm]	-	-	-	-	-	-	-
• Work space width [mm]	×	440	440	440	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	0.039	0.095	0.047	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 testControl.

zwicki-Line Load Frames and Drives

Series	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]	×	×
• 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

Allround-Line Load Frames and Drives

Table-top Testing Machines

Series	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 width							
* 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	750/1500 ³⁾	900
• Crosshead travel resolution [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

Series	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		1800	1940
						1360 ⁴⁾	
• Work space width							
* 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 resolution [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

Load cells

Load cells are available for accurate load measurement of forces from 0.04 N onwards. They offer the following advantages in conjunction with the digital measurement electronics:

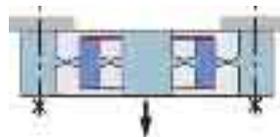
- Automatic identification and acquisition of all setting and calibration parameters via sensor plug. An exchange of the load cells neither requires a calibration nor a modification of the setting data.
- Automatic zero-point and sensitivity balancing
- Temperature compensation
- High measurement frequency
- Very high test data resolution
- Accuracy:
Class 1 (1 % of reading) from 0.2 to 120 % of full scale load. Class 0.5 (0.5 % of reading) from 1 % to 100 % of full scale load.
- Overload protection
- Manufacturer's test certificate to certify the factory calibration

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

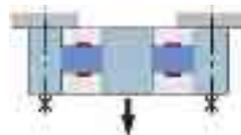
Types and recommendations for their use

Depending on the test job, the accuracy of the load cells and other features are important. For the use with temperature devices, these are the temperature sensitivity of zero-point and measured value. Particularly during compression and flexural tests, transverse forces and moments may occur which should not falsify the value in an inadmissible way and which should not damage the load cell. For this reason, Zwick offers different types of load cells.

- GTM Load cell
The body of this circular load cell is a bending ring with ring-shaped strain gauges on the face sides. It is very insensitive to excentric load applications and overloads.



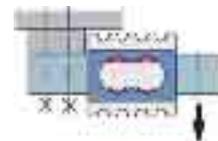
- KAF Load cell
The outer and the inner ring of this load cell are linked by spokes on which the strain gages are applied to. This load cell is relatively insensitive to excentric load applications.



- KAP Load cell
The body of this flat, S-shaped load cell is a double beam. It is relatively sensitive to excentric load applications.



- Type Z6
This load cell consists of a double beam-shaped body. The centrally acting test load is traversed laterally and transmitted to the crosshead of the testing machine. Therefore it is quite sensitive to excentric load applications.



Note:
The measurement body of the load cell is illustrated in dark blue and the strain gauges applied onto them are illustrated in red.

Type/test conditions	GTM	KAF	KAP	Z6
Tension force with axial load application	+++	+++	+++	+++
Compressive force with safe axial load application	+++	++	++	++
Compressive force with excentric load application	+++	- 1)	- 2)	- 2)
Bending tests	+++	++	++	++
Extended temperature range	+++	++	++	++
Creep tests	+++	++	++	++
Axial alignment under load	+++	+++	++	+

1) Limited measuring accuracy
2) Risk of destruction



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 contextsensitive 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.

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.



Adhesion test of a textile-rubber-compound, synchronized video recording



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-user interface allows 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.



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.

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 around 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 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



Hydraulic Grips



Pneumatic Grips



Screw Grips

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	String, 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	✓	○	-	-	-	-	-	-	-	-	•
Pincer grips	A	500 N to 10 kN	-	-	-	-	-	-	-	-	-	-	•
Capstan grips	B	300 N to 2,5 kN	-	-	-	-	+	-	-	-	-	-	-
Double capstan	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
 ○ - 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

errors through deformation of the testing machine 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 reduc-

tion 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 Loaded Grips



Pincer Grips



Double Capstan Grips

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 specimens 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 °C to +250 °C
- 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 °C to +250 °C
- 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, central gripping.
- Temperature range -15 °C to +80 °C

Pincer grips

- Temperature range -40 °C to +250 °C

Double capstan 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

Capstan action 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

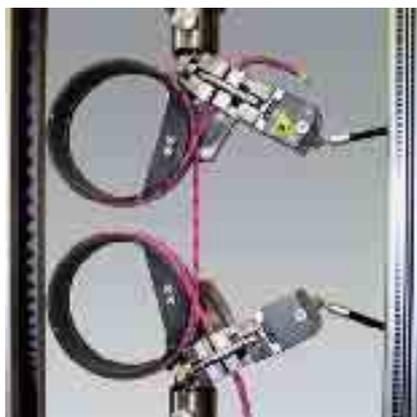
A lot of round, square, and rectangular compression platens are available in different dimensions. The lower compression platens are always mounted rigidly. The upper compression platens may be mounted spherically (freely movable or alignable) to transmit the compressive force homogeneously over the 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.



Pneumatic action capstan grips



Capstan and clamp grips for rope



Capstan webbing grips

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 measured 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.



Video measurement system



Long stroke measurement system

Extensometers – Shortlist

Application	Extensometers											
	Clamping the specimen						by wrapping around cams or rollers					
	between clamping jaws											
Material properties to be determined and related standards	Crosshead monitor	Macro extensometer	Long stroke extensometer	Optical extensometer	Video extensometer ¹⁾	MultiXtens	Crosshead monitor	Macro extensometer	Long stroke extensometer	Optical extensometer	Video-Extensometer ¹⁾	Laser extensometer
Tensile module												
• ISO 10618	-	✓	-	-	✓	✓	-	-	-	-	-	-
• EN 12562, EN 13002-2, EN 13003-2	✓	●	-	-	●	●	+	●	-	-	●	-
Secant rigidity and strain at max. force												
• ISO 10319, ASTM D 4595 ASTM D 4885	-	-	-	✓	✓	-	-	-	-	✓	✓	✓
Strain at x% of max. force												
• ISO 283-1	-	✓	-	-	✓	✓	-	-	-	-	-	-
Strain at break												
• ISO 283-1	-	✓	✓	✓	✓	✓	-	-	-	-	-	-
Strain at max. force and break												
• ISO 10618	-	✓	-	-	✓	✓	-	-	-	-	-	-
• EN 12562, EN 13002-2, EN 13003-2	✓	●	-	-	●	●	+	●	-	-	●	-
• ISO 5079, ASTM D 3822	✓	-	-	-	-	-	-	-	-	-	-	-
• ISO 2062, prEN 14621, ASTM D 2256	✓	●	●	●	●	●	+	●	●	●	●	-
• ASTM D 885, Cords	-	-	-	-	-	-	+	○	○	●	●	-
• ASTM D 885, Fabrics	✓	●	●	●	●	●	-	○	○	✓	✓	-
• ISO 6939, ASTM D 1578	✓	●	●	●	●	●	+	●	●	●	●	-
• ISO 3341, ASTM D 2343	✓	●	-	-	●	●	+	●	-	-	●	-
• ISO 9163	✓	●	●	●	●	●	-	-	-	-	-	-
• ISO 13934-1, ASTM D 5035	✓	●	●	●	●	●	-	○	○	●	●	●
• EN 29073-3, EN 4606, EN 3342	✓	●	●	●	●	●	-	-	-	-	-	-
• ISO 1421, ASTM D 751	✓	●	●	●	●	●	-	○	○	●	●	●
• EN 1492-1, ASTM D 6775	-	-	-	-	-	-	-	○	○	✓	✓	✓
• EN 61067-2, EN 565	-	○	○	✓	✓	○	-	○	○	✓	✓	-
• ISO 2307, EN 892	-	-	-	-	-	-	-	-	-	✓	✓	✓
• EN 564	-	-	-	-	-	-	-	○	○	✓	✓	✓

✓ - Suitable for this application

+ - Suitable for this application if the deflection in the specimen grips is max. 180°

○ - 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

Non-contacting Extensometers - Technical Data / Special Features

	Optical Extensometer	Laser Extensometer	Video Extensometer
Measurement system	Incremental, 2 cameras	Rotation laser, 0,5 W He/Ne	Digital video cam with image processing system
Gage length L_0	10 to 900 mm	10 mm (tension), 20 mm (compression)	≥ 5 mm
L_0 -marking	circular reflectors	line reflectors	line reflectors
Mesuring range	1000 mm - L_0	approx. 400 mm	field of view ¹⁾ : e.g. 50/200/1000 mm
Resolution	5 μ m	12 μ m	0,5 / 2 / 10 μ m ¹⁾
Accuracy	class 1 acc. to ISO 9513 from 3 mm	class 1 acc. to ISO 9513, from 5 mm	class 1 acc. to ISO 9513, with field of view < 100 mm class 2 acc. to ISO 9513, with 8 mm objective
Advantages	<ul style="list-style-type: none"> • proved, good to use deformation measurement system for very elastic material • secure and accurate measurement until break • convenient for measurement in temperature chambers due to heated optical glass • Automatic gage length recognition 	<ul style="list-style-type: none"> • convenient for measurement in temperature chambers due to heated optical glass window. 	<ul style="list-style-type: none"> • Flexible adaptation to materials and test procedures • automatic gage length recognition • secure and accurate measurement until break • convenient for measurement in temperature chambers due to heated optical glass window

¹⁾ Measuring range and resolution depends on objective used

Extensometers with Sensor Arms - Technical Data / Special Features

	Macro Extensometer	Mechanical Extensometer	MultiXtens
Measurement system	Incremental	Incremental	Incremental
Gage length L_0	10 - 100/205 mm	10 to 1000 mm, manual adjustment	from 10 mm continuously adjustable
Measuring range	80/120/160 mm	1000 mm, minus gage length L_0	700 mm, minus L_0
Resolution	0,3/0,6/0,9/1,2 μ m	5 μ m	0,02 μ m
Accuracy	Class 1 acc. to ISO 9513, class 1 acc. to ISO 9513 from 1 mm	Class 2 acc. to ISO 9513,	Class 0.5 acc. to ISO 9513
Sensor arm traction	< 0,05 N	< 0,2 N	< 0,02 N
Special features	Motorized sensor attachment Autom. gage length setting (Allround-Version)	Motorized sensor attachment	Motorized sensor attachment Autom. gage length setting
Applications	For textiles and compounds, with low or medium strain textile/plastic compoundswith max. forces from approx. 20 N	For textiles, textile/ rubber, textile/elastomer and	For textiles and compounds from low to high strain
Advantages	<ul style="list-style-type: none"> • robust and easy operation • low sensor arm traction • crosshead contact protection • exchangeable sensor arms for different measuring ranges • convenient for measurement in temperature and climatic chambers 	<ul style="list-style-type: none"> • robust and easy operation • strain measurement until break without lifting sensor arms • exchangeable sensor arms • convenient for measurement in temperature and climatic chambers 	<ul style="list-style-type: none"> • high precision even at long displacement and in temperature chambers • convenient for cyclic tests • easy sensor changing and automatic sensor recognition

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.

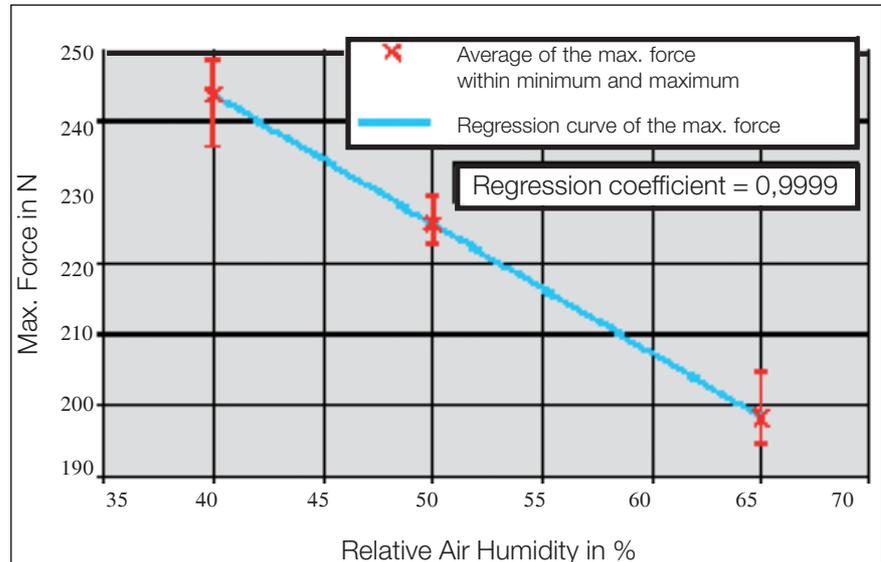
The mechanical properties of textile and textile-related materials in an extended temperature and climatic range are predominantly tested for research and development purposes.

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



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

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*®-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 (LN₂) or carbon dioxide (CO₂)

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 Chambers

Used with Table	top and floor standing machines		only floor standing machines	
Test area height	normal	higher	normal	higher
Test area 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)}			
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 / 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⁾
• 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⁾ Chamber depth 1080/540 mm

²⁾ Without lateral slot for duct of mechanical or optical extensometers, without removable slides.

³⁾ Temperature chambers with other temperature ranges on request.

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



Zwick Z010 with unit for the determination of the unrolling resistance of bandages.



Fully automatic materials testing system with circulating specimen magazine



Materials testing machine in horizontal position for alpine ropes.



Materials testing machine in horizontal position for conveyor belts.

Speed in research, development and quality assurance of components with textile elements

- Electro-mechanical testing actuator
- Servo-hydraulics

The **electro-mechanical testing actuators** are designed for flexible use. Linear units are available for the load ranges 1 kN, 2 kN and 5 kN. These linear units apply loads to certain defined points at a speed of up to 0.5 m/s in both the tensile and compression directions. This performance range encloses almost the entire spectrum as required for textile testing.

Decisive advantages of this modular system are the control of the actuator via the Zwick electronics *testControl* and input of parameters via the Zwick

test software *testXpert®*. Whereby all functions of a standard testing machine are available, e.g. defined, high precision approach to positions, an adjustable force control or smooth switching between types of operation within a test.

Our **servo-hydraulic testing machines** are suitable for tensile, compression and flexure tests with increasing, continuous, pulsating and alternating loading through zero for static, quasi-static and dynamic loading. The palette of tests is seemingly unending, e.g. textile-elastomer compounds, ropes, laminates and adhesive tapes, etc., to name but a few.



Testing of visco-elastic properties on textile reinforced car components.



Dynamic fatigue test on snowboard boot.

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 materials 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

Active collaboration with partners from research and technology qualifies us to impart knowledge in principles of materials testing and expertise within Application Technology Seminars.

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, and where applicable, 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.

Installation



ZwickService ensures the optimal installation of your testing machine and accessories based on the experience from several thousand installations. 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.

Customer Support



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. If you are not able to speak to someone immediately, we promise to return your call as soon as possible.



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.

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. Spare parts, from Zwick's large inventory, will be dispatched within short term.

Calibration

ZwickService calibrates your testing machine and testing systems compliant to the current national and international standards, including ISO and ASTM. Zwick has associated calibration laboratories in different countries, all of them accredited in accordance with ISO/IEC 17025. Consequently we are authorized for on-site calibration of testing machines and testing systems according to the relevant standards (DKD, UKAS, COFRAC, A2LA) and to issue the corresponding calibration certificates which are internationally accepted.

Software Upgrade

Upgrade your *testXpert*[®] software to the latest version. This allows you to take advantage of the most recent developments and the enhanced functionality of *testXpert*[®]. The latest changes of relevant materials testing standards are also incorporated in the latest *testXpert*[®] version.

When upgrading your outdated DOS software to the latest Windows technology you can take advantage of improved performance and benefits. With an upgrade from *testXpert*[®] to *testXpert*[®]II you benefit from the latest significant developments in application software.



Software-Support Agreement

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

¹ DKD: Deutscher Kalibrier-Dienst

² UKAS: United Kingdom Accreditation Service

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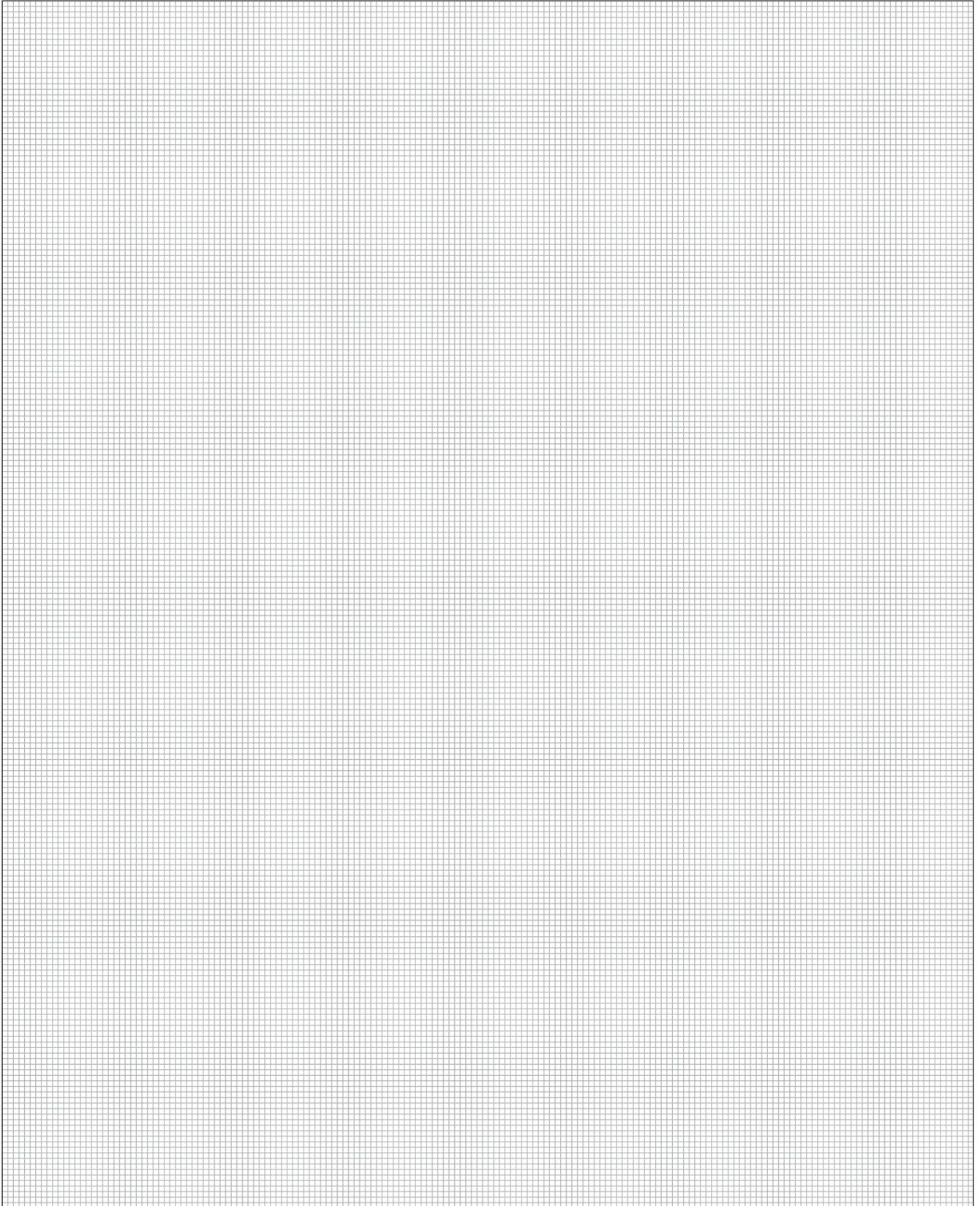
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Notes



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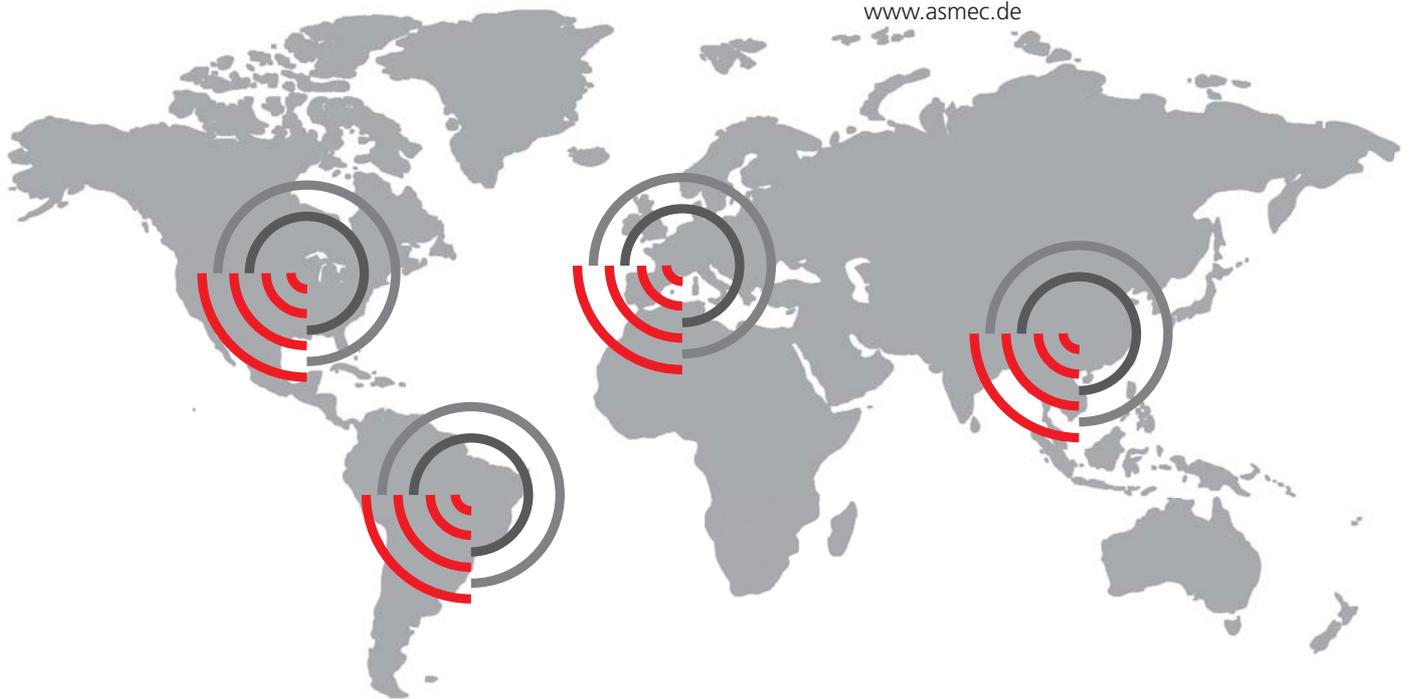
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