



„Trudne” materiały włókiennicze w badaniach wytrzymałościowych – jak poradzić sobie z nowymi wyzwaniami

Kolegium Sekcji Przemysłu
Tekstylnego i Skórzanego Klubu
POLLAB

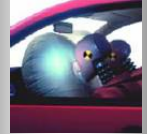
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Mechanical Testing of Textiles

Specimen gripping for reliable test results

Interesting applications





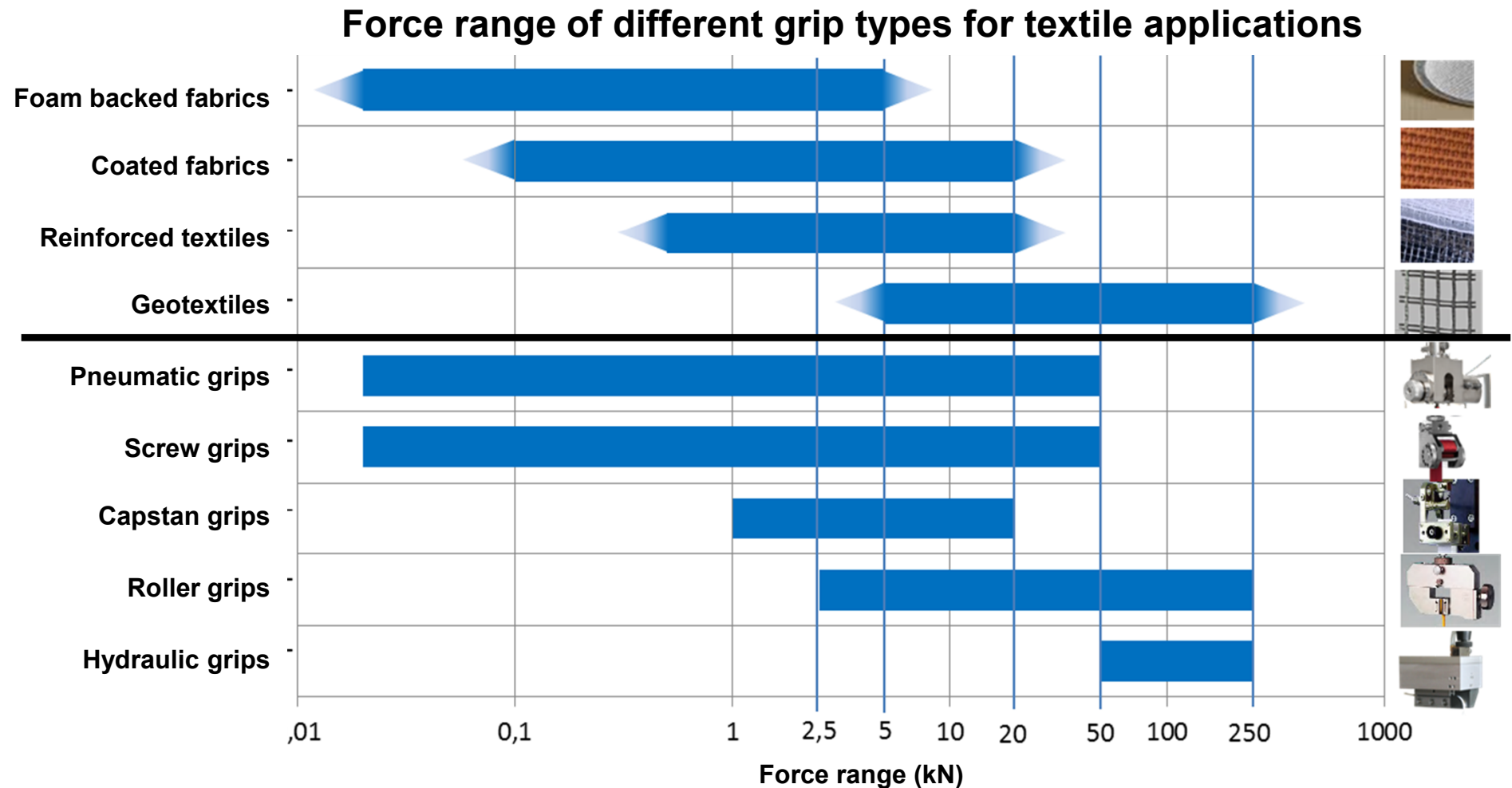
Pro Line → 100kN



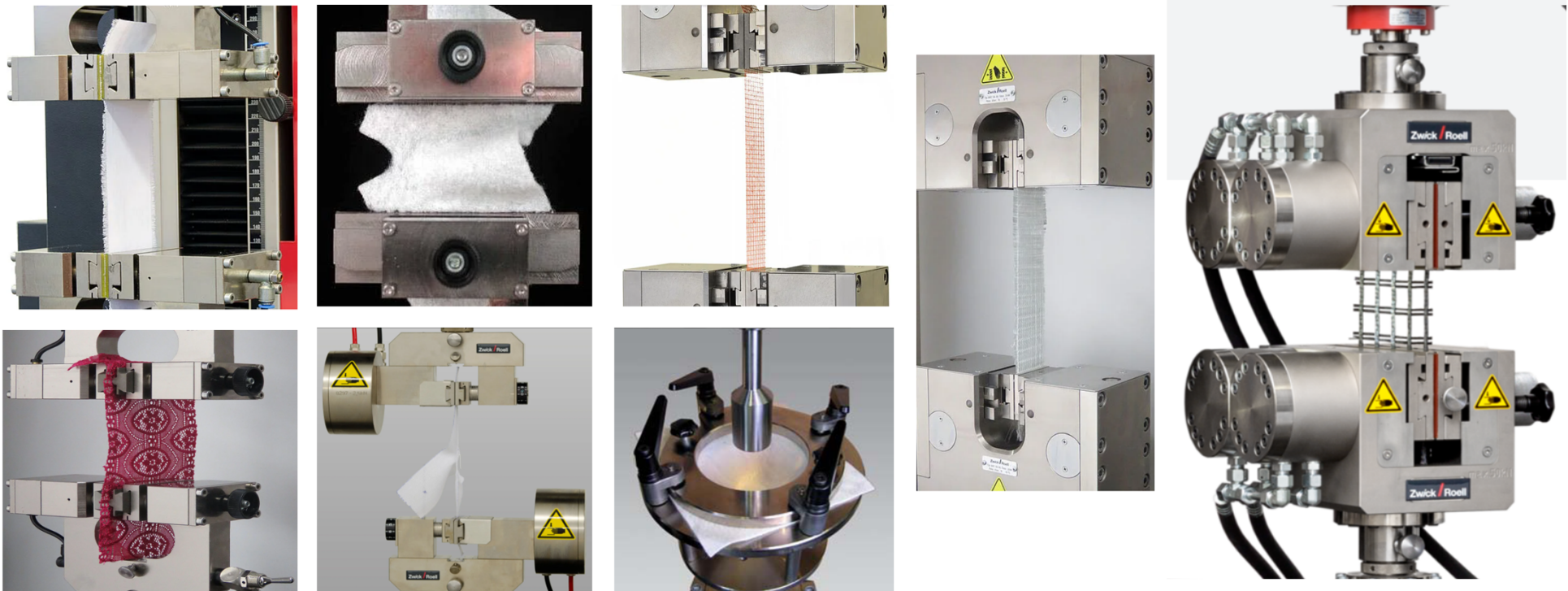
Allround Line 50 kN → 250kN



Grip force range and required test force for textiles



The tests carried out on textile fabrics are just as varied as the uses found for their finished products.



Real-world conditions require complex test arrangements, special specimen grips, and reliable results for quality characteristics and safety functions



Important types of mechanical tests for textiles are:

Compression Test:

Insulation material

Typical results:

Compressive strength
at a defined position



Static Puncture Test:

Geotextiles, non-wovens

Typical results:

Burst and puncture
strength
Travel at maximum force



Burst Strength:

Coated fabric

Typical results:

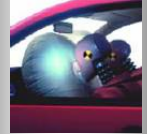
Burst and puncture strength
Travel at maximum force



Mechanical Testing of Automotive Textiles

Specimen gripping for reliable test results

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Reliable Test Results rest on 4 key overriding themes.



Reliable test results in textile applications depend on several factors:

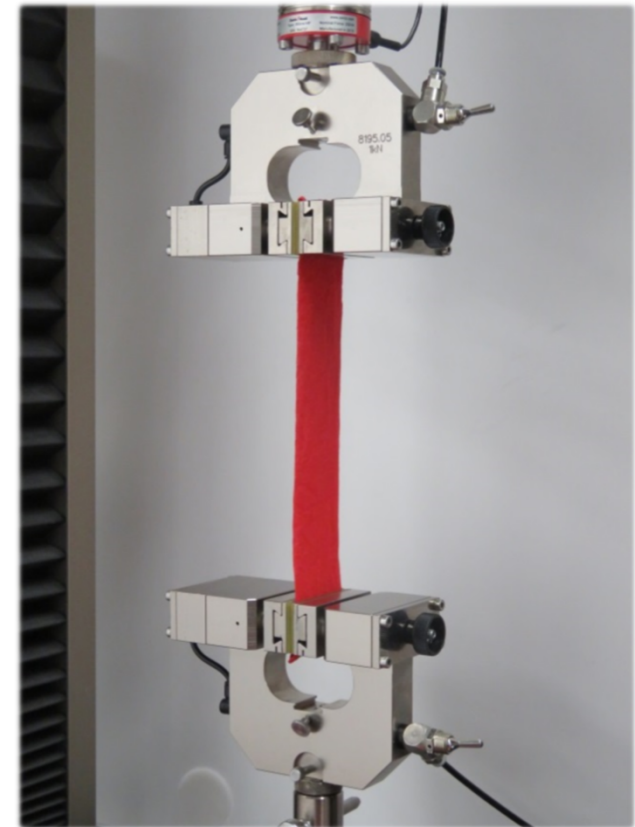
- **Test methods**
 - Required, clear and to be followed
- **Test specimens**
 - Prepared and conditioned according to test method
- **Operators**
 - Well trained, experienced and concentrated
- **Test equipment**
 - Equipped, up-to-date, calibrated, maintained, mastered
 - Adapted sensors, software
 - Use of extensometer highly recommended
 - Suitable grips

Grips for foam backed fabrics

Foam backed fabrics are best gripped with single-acting pneumatic or screw grips



Screw grips 2,5 kN



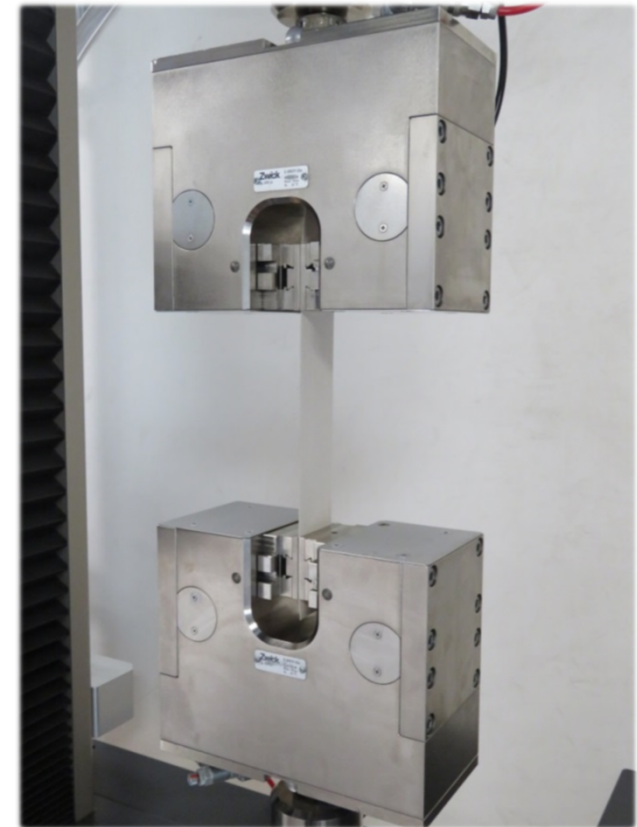
Pneumatic grips 1 kN

Grips for coated fabrics

Coated fabrics are best gripped with double-acting pneumatic or screw grips



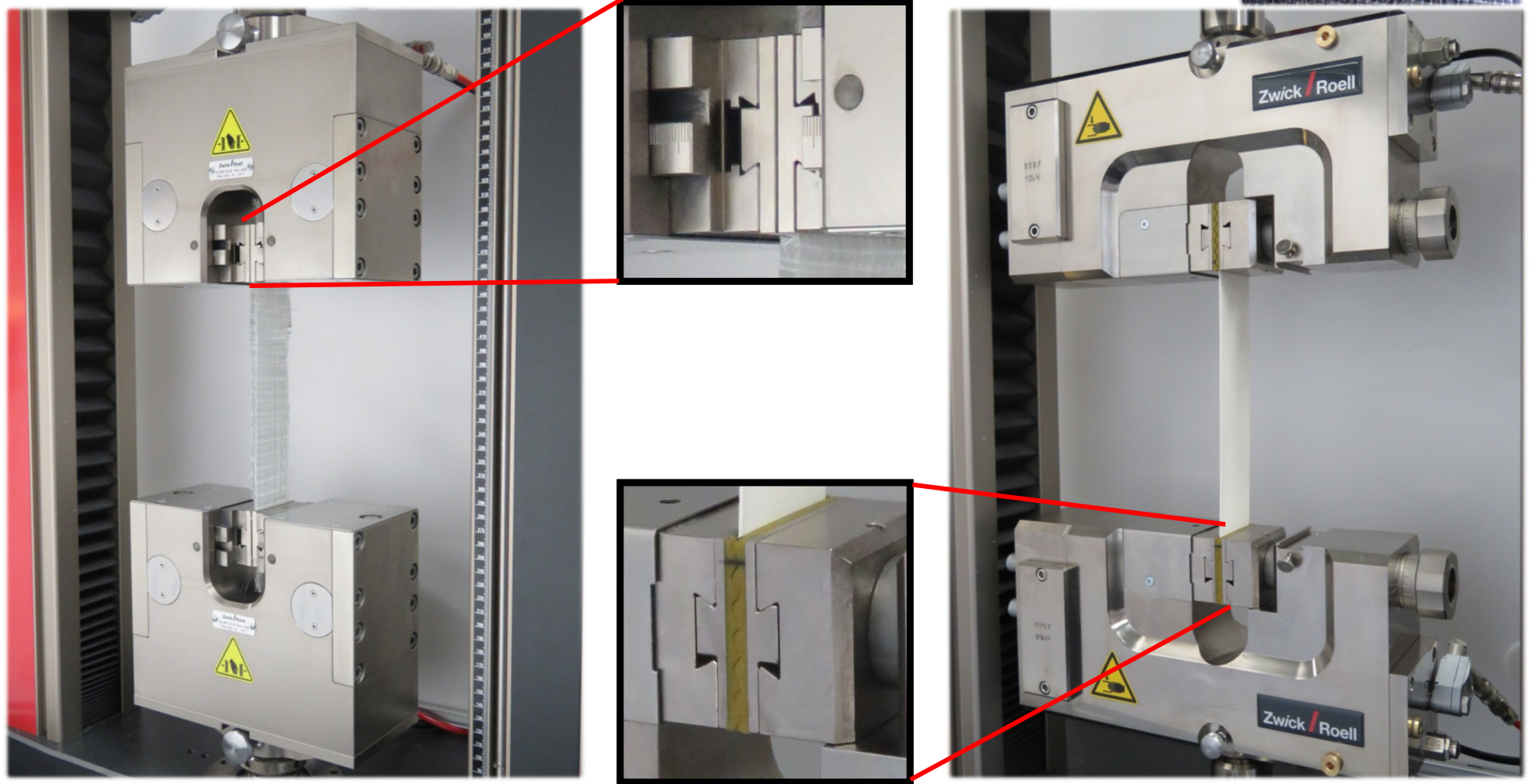
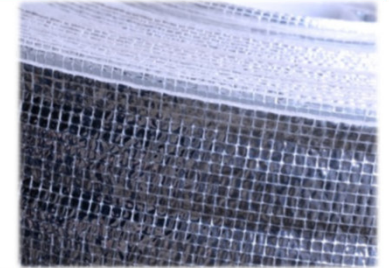
Screw grips 20 kN



Pneumatic grips 20 kN

Grips for reinforcement textiles

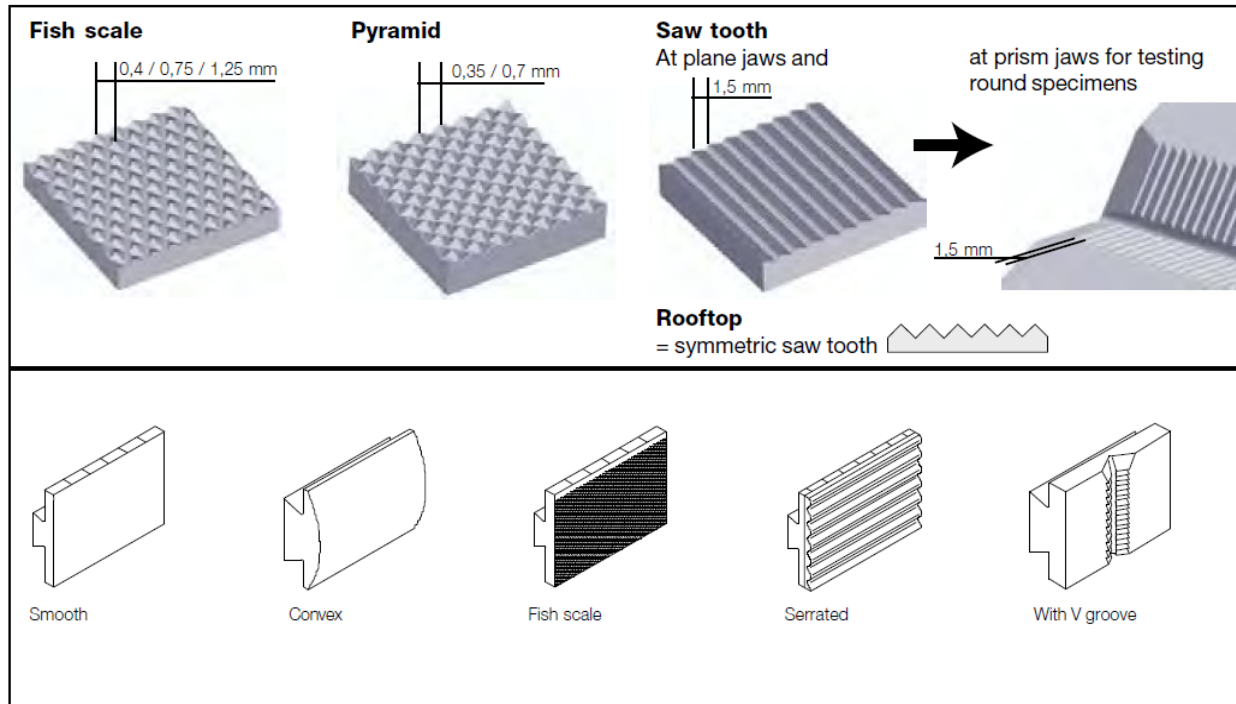
Reinforcement textiles are best gripped with single- or double-acting pneumatic grips



Choice of jaw inserts

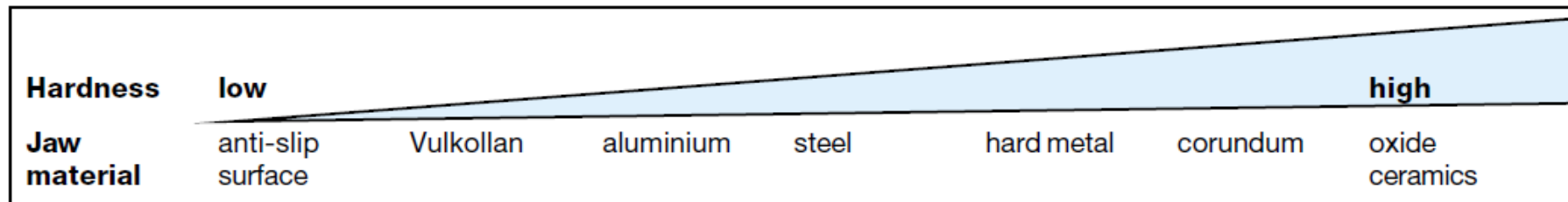
Each material requires specific jaw inserts

- Gripping surfaces of jaw inserts



Textiles	
Fabric	Steel smooth / corrugated, Vulkollan smooth / corrugated, corundum
Fine fabric	Vulkollan, smooth
Knitted fabrics	Vulkollan smooth, steel smooth against steel convex
Felt	Vulkollan smooth / corrugated
Yarns general	Vulkollan, smooth
Grip sensitive yarns	Brass / Vulkollan, smooth
Elasto-yarns	Vulkollan, smooth
Filaments	Plexiglass with cross grooves / smooth, alu with cross grooves
Fibres	Vulkollan smooth / corrugated, glas, polyamide
Non-woven materials	Steel corrugated / smooth, Vulkollan corrugated / smooth
Artificial leather	Steel Fsc / smooth, Vulkollan smooth / corrugated
Stitched fabric strips	Special jaw inserts, see table Type 8287
Geo-textiles	Steel smooth, Vulkollan smooth / corrugated
Geogrids	Steel smooth, Vulkollan smooth
Technical textiles	Steel smooth, Vulkollan smooth / corrugated

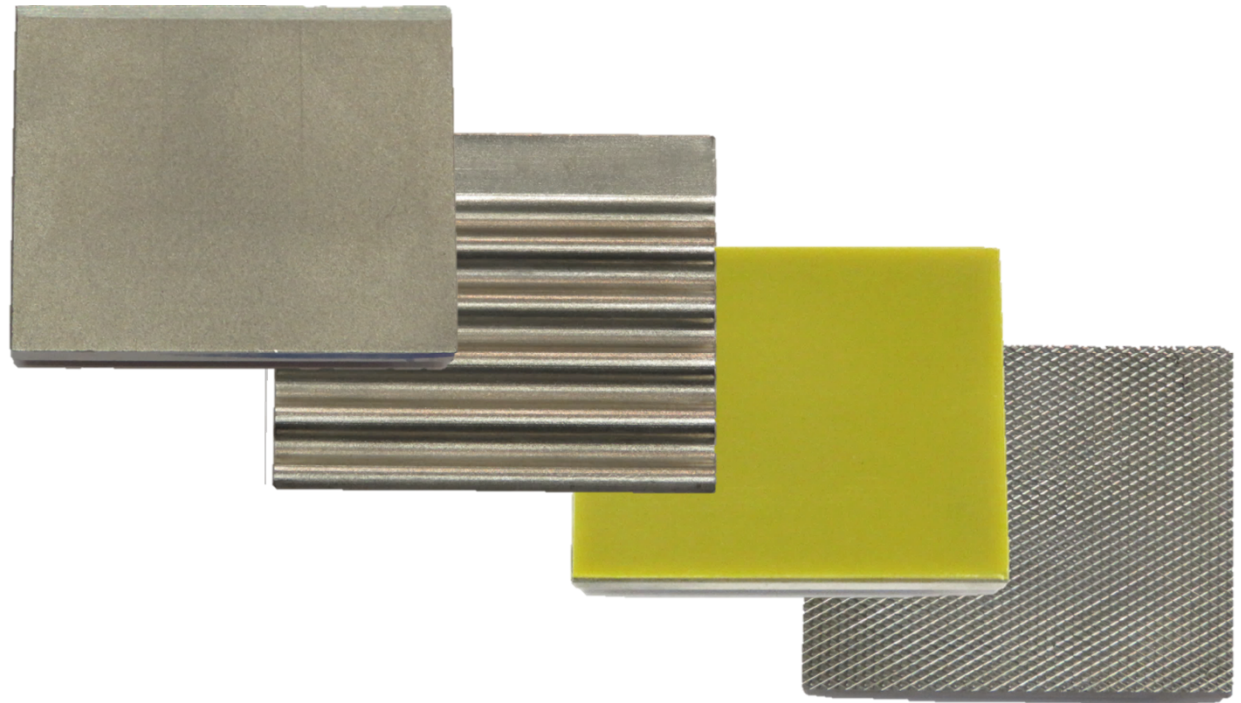
- Hardness of jaw inserts



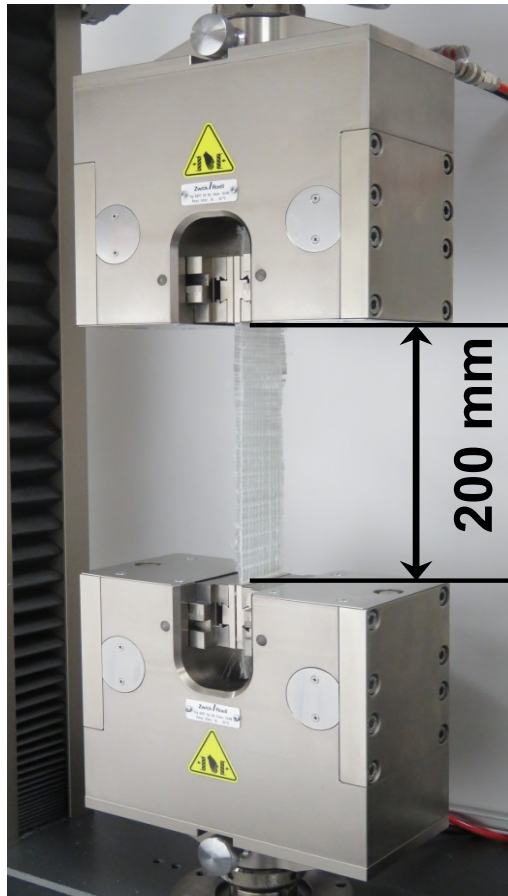
The right choice of suitable jaw inserts is crucial to ensure reliable test results

Coated fabrics are typically best gripped with the selection of the following inserts:

- **Steel smooth**
- **Steel corrugated**
- **Rubber smooth/corrugated**
- **Steel pyramid (rare)**



The determination of the correct gage length (grip to grip separation) is essential to ensure a correct strain measurement (when extensometer not available)



The grip to grip separation is mainly determined as follows:

- Between upper and lower jaw insert
- Between upper and lower gripping point
- Between upper and lower grip

Not all grip types are allow the correct determination of the gage length (grip to grip separation)

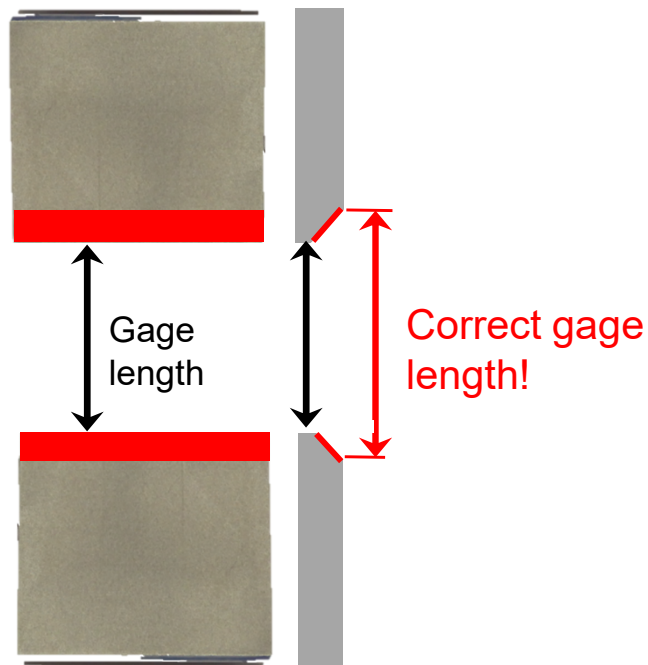
Using jaw faces that use chamfers for stress reduction requires for correction of the gage length. Grip to grip separation is not enough

Example 1:

Gage length 200mm

Chamfer 2x 1mm

Error not considering chamfer = 1%



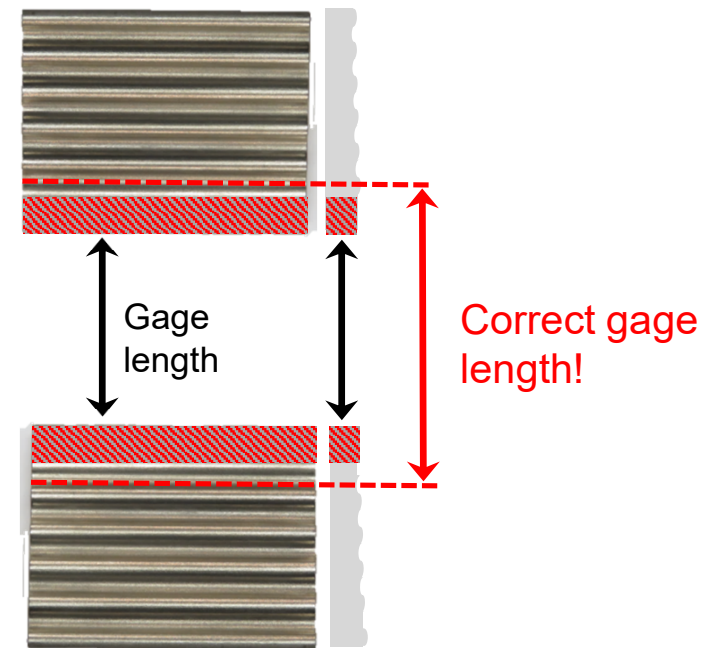
Jaw inserts: Steel smooth

Example 2:

Gage length 200mm

First contact line 2x 7mm

Error not considering chamfer = 7%

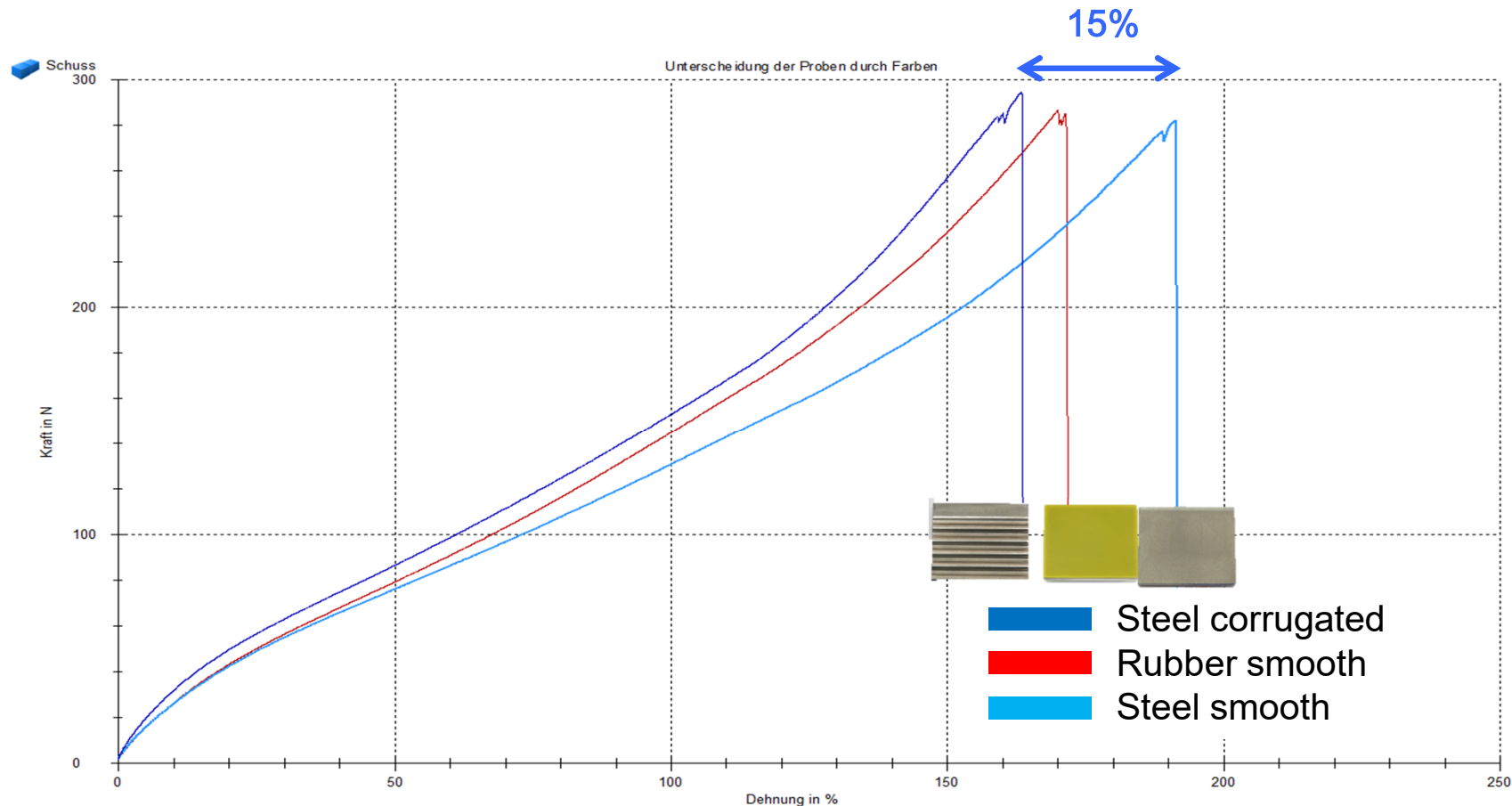


Jaw inserts: Steel corrugated

Correct specimen gripping is essential to obtain reliable test results

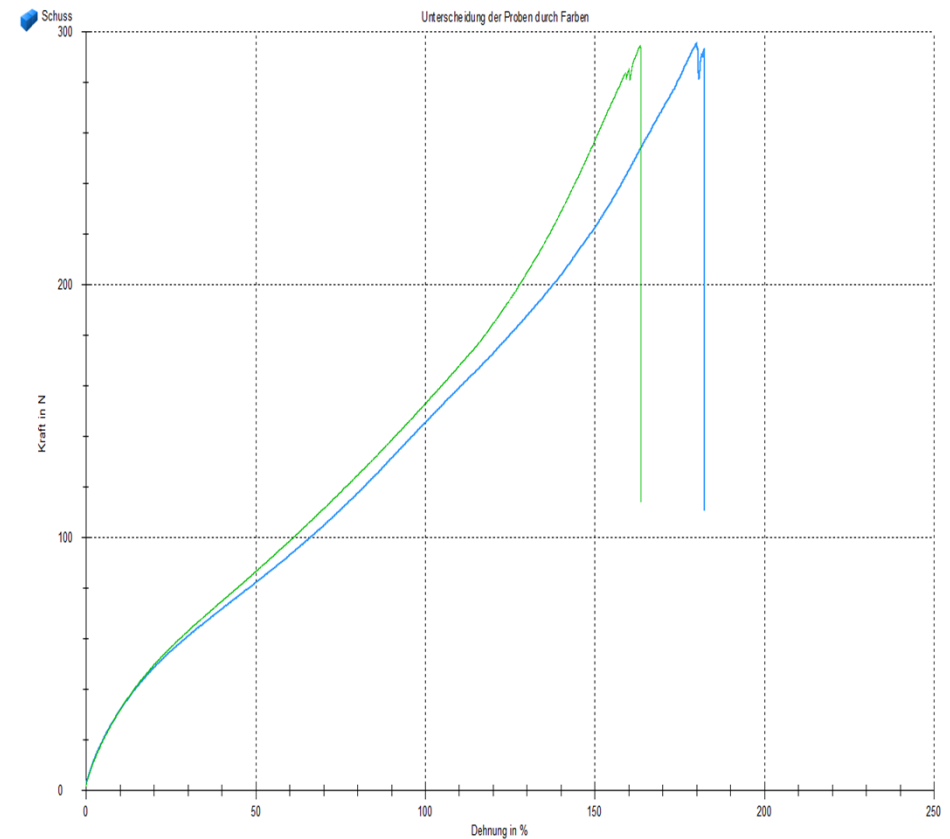
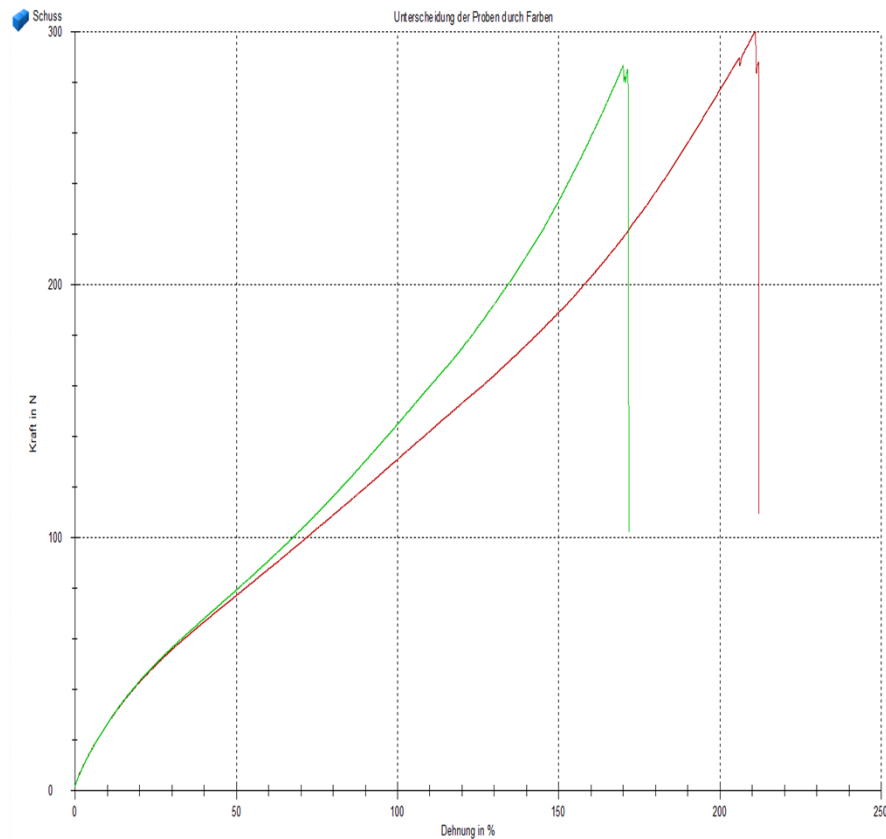
- Correct specimen gripping is essential
 - for accurate, repeatable and reproducible test results
 - for specimen throughput, because wrong measurement will be avoided
 - to reduce the risk of slippage
 - to avoid specimen break in the jaws (lower F_{max})
 - to reduce influence on strain measurement and ensure accurate determination
 - to minimize wear of inserts and grips
- The force control function of the test system avoids unwanted loading of the specimen during the gripping process

Using different jaw inserts can lead to considerable strain measurement deviations (up to 15%), using the same 5 kN pneumatic grip, air pressure and the same material



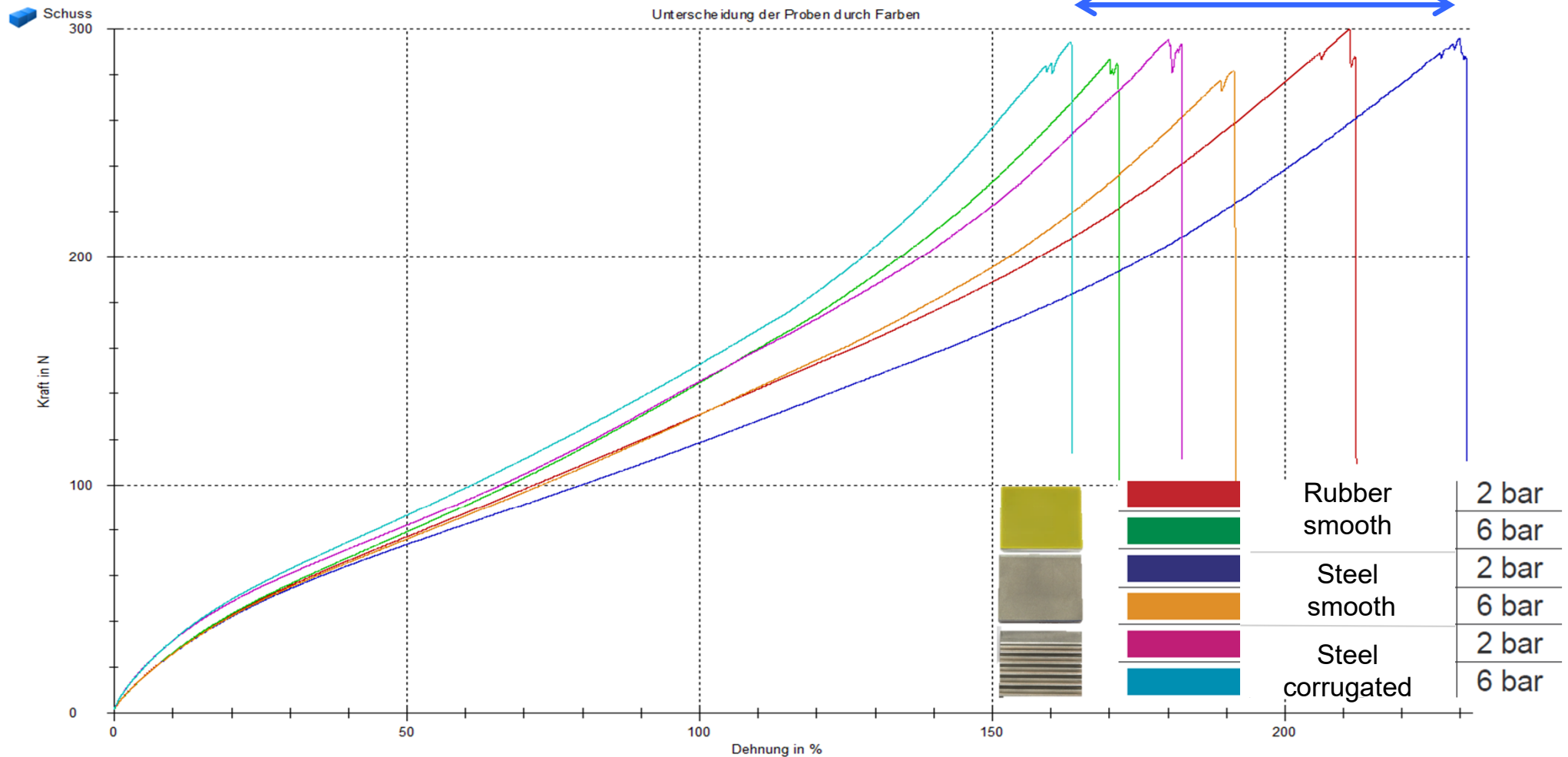
Influence of gripping pressure

Identical jaw inserts but different gripping pressure leads to considerable strain measurement deviations (up to 25%), using the same 5 kN pneumatic grip and the same material



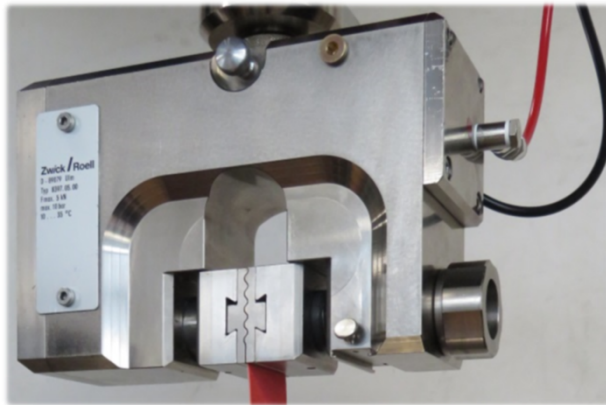
Influence of jaw inserts and grip pressure

Different jaw inserts and different gripping pressure give strain measurement deviations of up to 45% by using the same 5 kN pneumatic grip and the same material



Influence of different gripping pressure

To ensure reproducible test results it is important to define an identical gripping force. The required air pressure can be different, depending on the type of pneumatic grip ...



Pneumatic grip 5kN
Gripping force at 6 bar → 9kN !



Pneumatic grip 10kN
Gripping force at 6 bar → 18kN !

Caution:
Air pressure ≠ Gripping pressure

Several important factors have to be considered to ensure reliable tensile test results and correct gripping of testing automotive textiles is essential

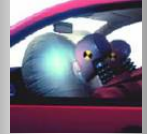
- For correct gripping the following is important:
 - Choice of right grip type and jaw inserts
 - Right gripping pressure
 - Specimen clamping to be symmetrical in tensile axis

- Also important:
 - Accurate sample preparation
 - Identical conditioning of specimens
 - Correct measurement of gage length (grip to grip separation)
 - Testing according to requirements of testing standard

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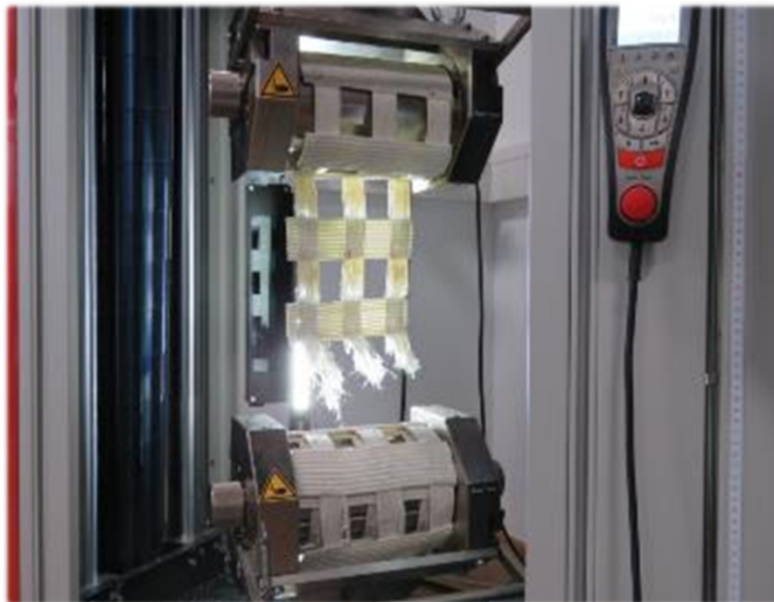
Tensile test on ropes

- We must prepare the surface from the rolls with a thin film of oil, because during tensile the material will melt on the surface about the high friction.
- We must also cool around 1/3 of the rolls, to reduce the temperature from the friction from the rope.
- With this preparation we received higher results (2-3kN more), no breaks on the rolls and a break in the free grip to grip separation.



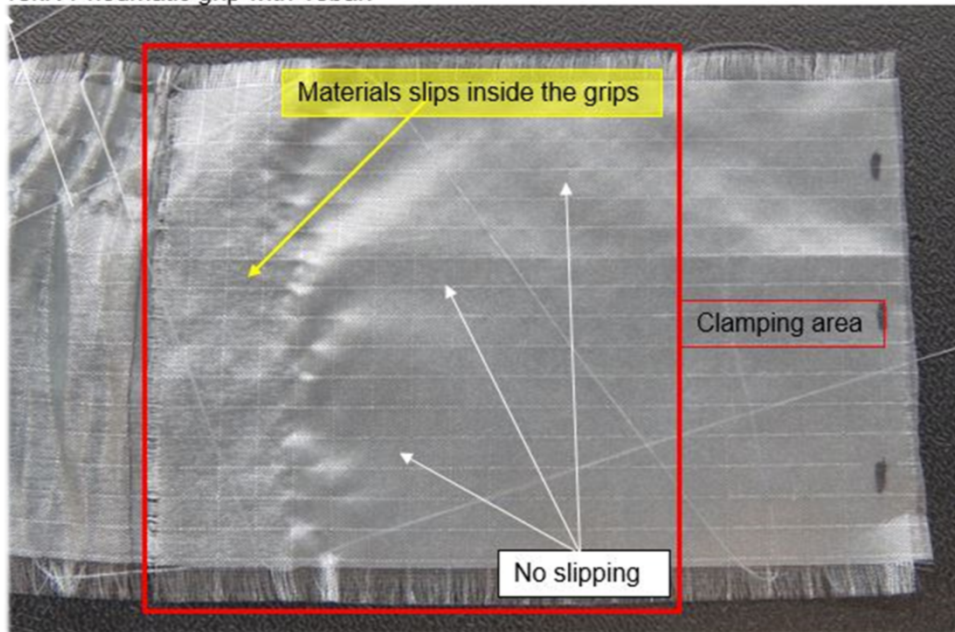
Roller-grips 250kN Typ 8566

- Customer have special geogrids with a high proportion of parafinoil PVC coating.
- Through the coating and the structure of the material the hydraulic grips for Geotextile type VAS 400kN can not test this material according to the standard.
- The samples slips out or breaks in the clamping during the test, because lots of oil comes out from them.
- With the roller grips and 1 time wrapping we can reduced this behavior and received higher forces.
- The customer performed the test based to the ASTM D 6637 and used special distance (800mm) to received higher forces and a break in the free grip to grip separation. We must used also a rubber strip to reduced the slipping effects on the rolls (between sample and roller)

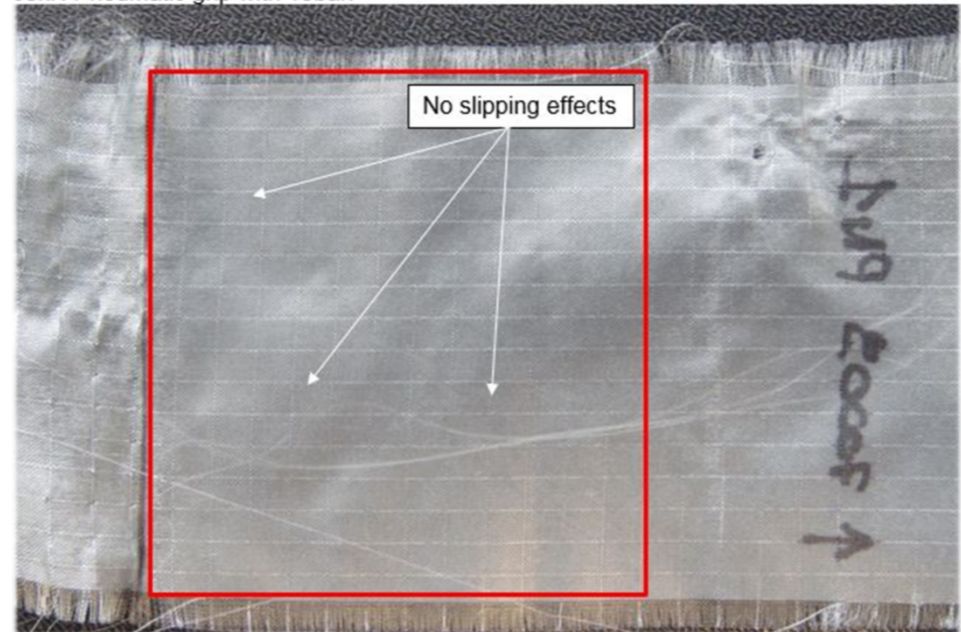


- The materials (airbag fabrics) are very smooth and extremely slippery.
- We must use a 30kN pneumatic grip with 10bar clamping pressure and vulkollan smooth inserts to hold the specimen according to the standard. The maximum forces were only between 500 – 4900N, but with a smaller gripping system we didn't receive the needed clamping pressure to reduce the slipping effects.

10kN Pneumatic grip with 10bar:

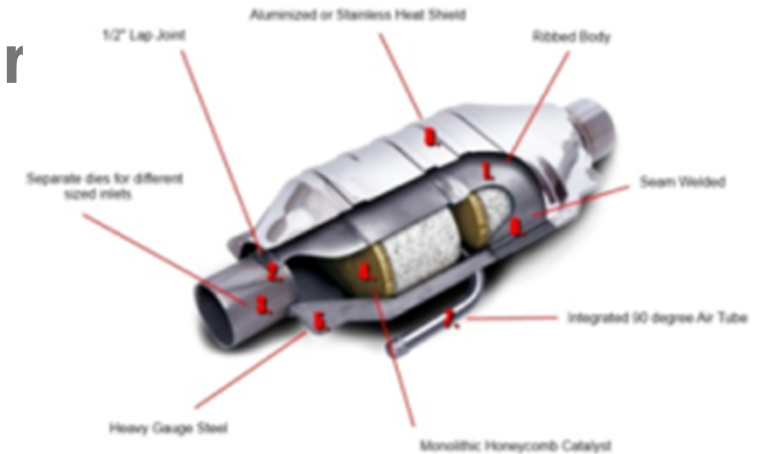
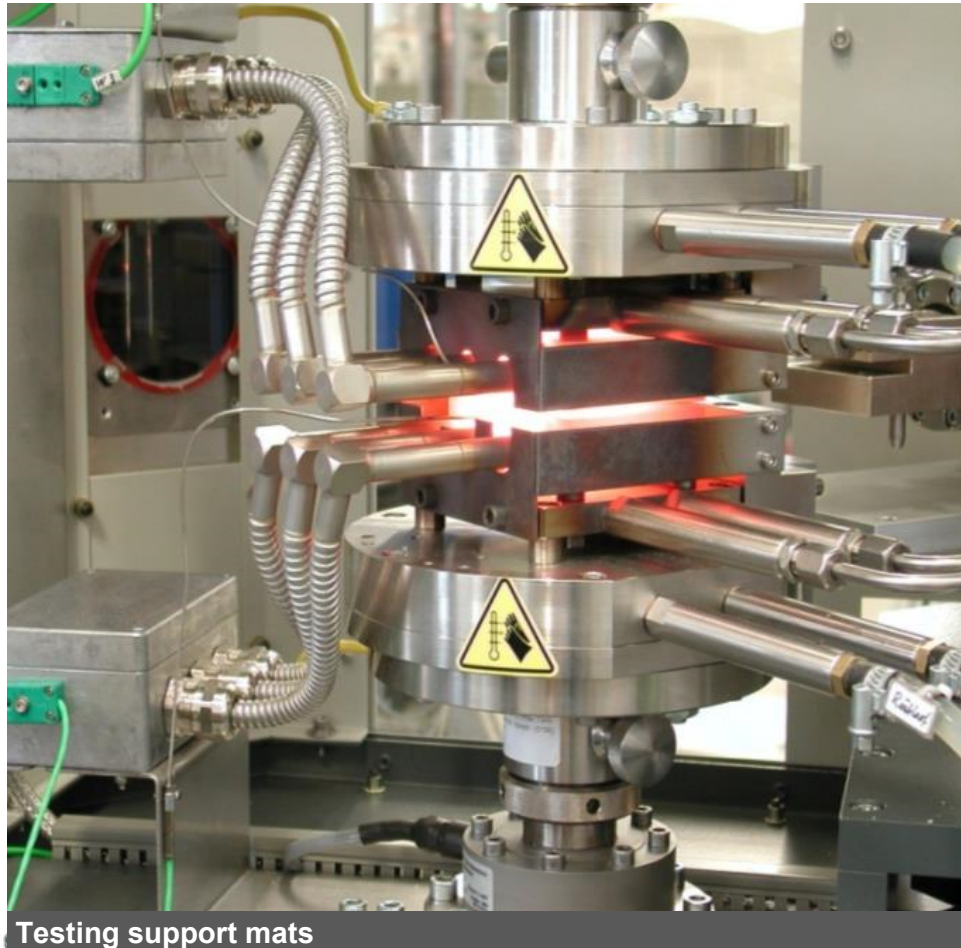


30kN Pneumatic grip with 10bar:



Special solution for insulation mats

Testing support mats for catalytic converters during loading and under high temperature influences



Testing requirements:

- testing support mats during loading/temperature influences
- RCTF: Real Condition Test Fixture
- TMA: Thermo-Mechanical Analysis
- determination of friction coefficient under temperature and compression influence

Standards:

customer's standard - no general standards

Zwick Solution:

- heated 10 kN compression platens
- temperatures up to 1050°C
- Laser extensometer



Interesting applications
Any questions regarding textiles?

...Thank you for your interest