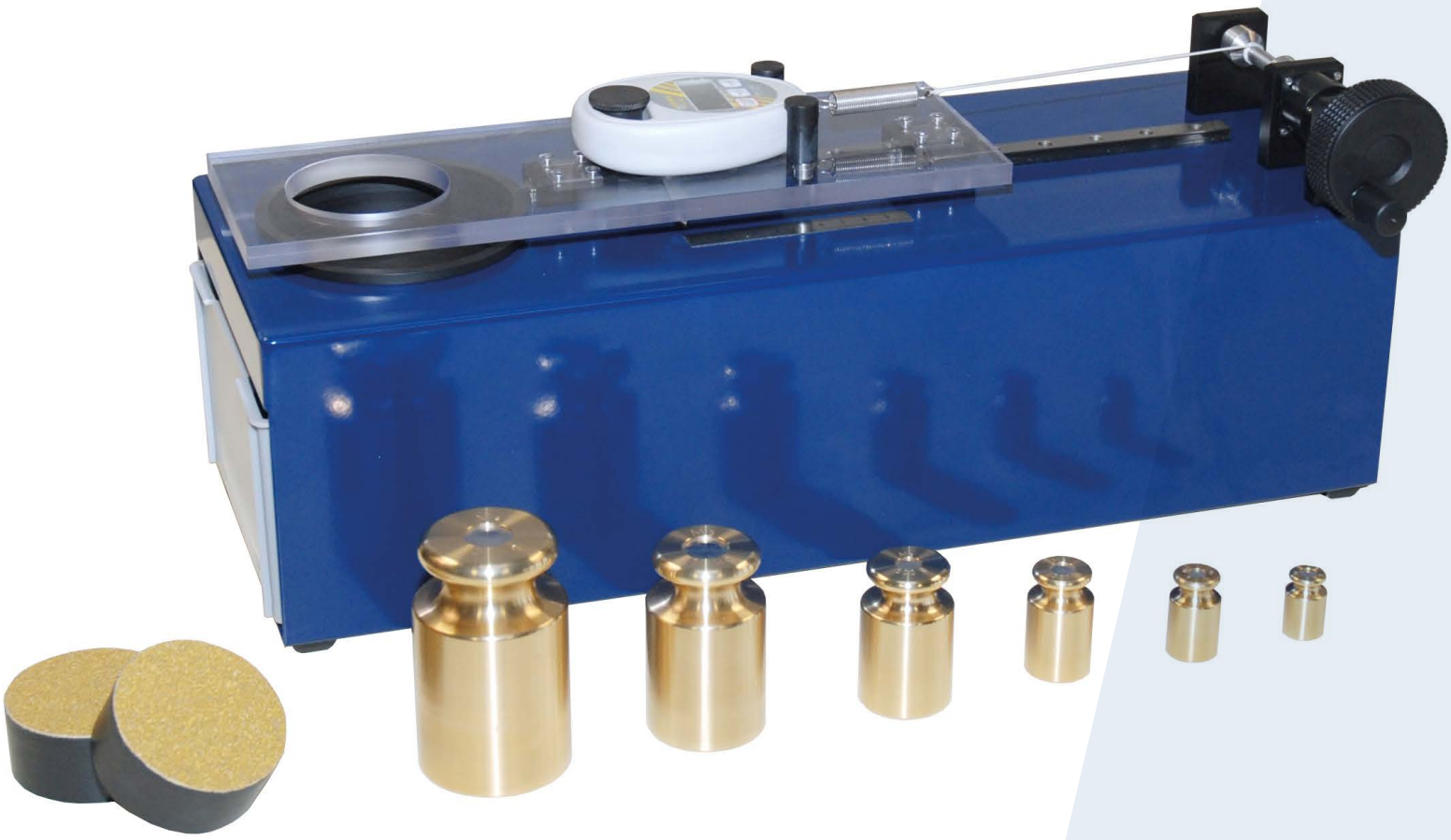
ROYAL Eijkelkamp

Meet the difference

Surface Shear Stress Apparatus



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Surface Shear Stress Apparatus

In many land use systems worldwide soil deformation is a major problem arising from increasing land use intensity. Altered soil functions, in particular reduced hydraulic conductivities and impeded aeration, influence the top soil layers. This has an important effect on vulnerability to erosion, in particular. Assessing very thin soil layers like soil crusts requires very sensitive and highly accurate equipment which should also allow very small vertical stress application during measurement. Many different shear test devices are available for measuring shear strength, including direct shear apparatus, shear vanes or cone penetrometers, but the construction of the frame shear test requires a thickness of the sample of at least 3 cm for example, which excludes such a test device for soil crust strength determination.

Soil stability is a decisive factor for erosion risk reduction. Soil stability is determined by shear resistance or the angle of internal friction, depending on or varying through soil-water pressure and humus content. Soil shear resistance will increase with increasing organic carbon content. Air-dry soil state samples will result in the smallest resistance to shearing in comparison with the range of water content applied. The effect of bulk density on soil shear strength depends on the water content and is distinct for a higher range of vertical loads.

Applications

- Erosion;
- Geotechnical engineering;
- Geo-Hydrologic research;
- Basic material research.

User groups

- Laboratories;
- Universities;
- Research institutes;
- Educational institutes.

Features

- Easy manual operation;
- Accurate measurement principle, digital read-out;
- Sample size Ø 103x100 h 30 mm;
- Excellent price-quality ratio;
- Developed in cooperation with Christian-Albrechts University, Kiel

Technical specifications

Soil sample	:	Ø =100 mm; h = 30 mm			
Soil sample rings	:	Ø =103x100 mm; h = 30 mm			
Shear container	:	diameter = 68 mm			
Roughness abrasive	:	P-40 (special proven quality!)			
Weight container	:	for about 40 g	->	1.08	hPa
Weight 1	:	50 g	->	1.35	hPa
Weight 2	:	100 g	->	2.70	hPa
Weight 3	:	200 g	->	5.40	hPa
Weight 4	:	500 g	->	13.51	hPa
Weight 5	:	1000 g	->	27.01	hPa
Weight 6	:	2000 g	->	54.02	hPa
Shear speed	:	manually			
Shear force	:	Range digital scale: 0 – 5000 g Resolution: 5 g Peak value and hold function			
Dimensions	:	WxDxH = 50.5 x 21 (24) x 21cm			
Weight	:	approx. 10 kg (total weight including additional parts e.g. different weights)			

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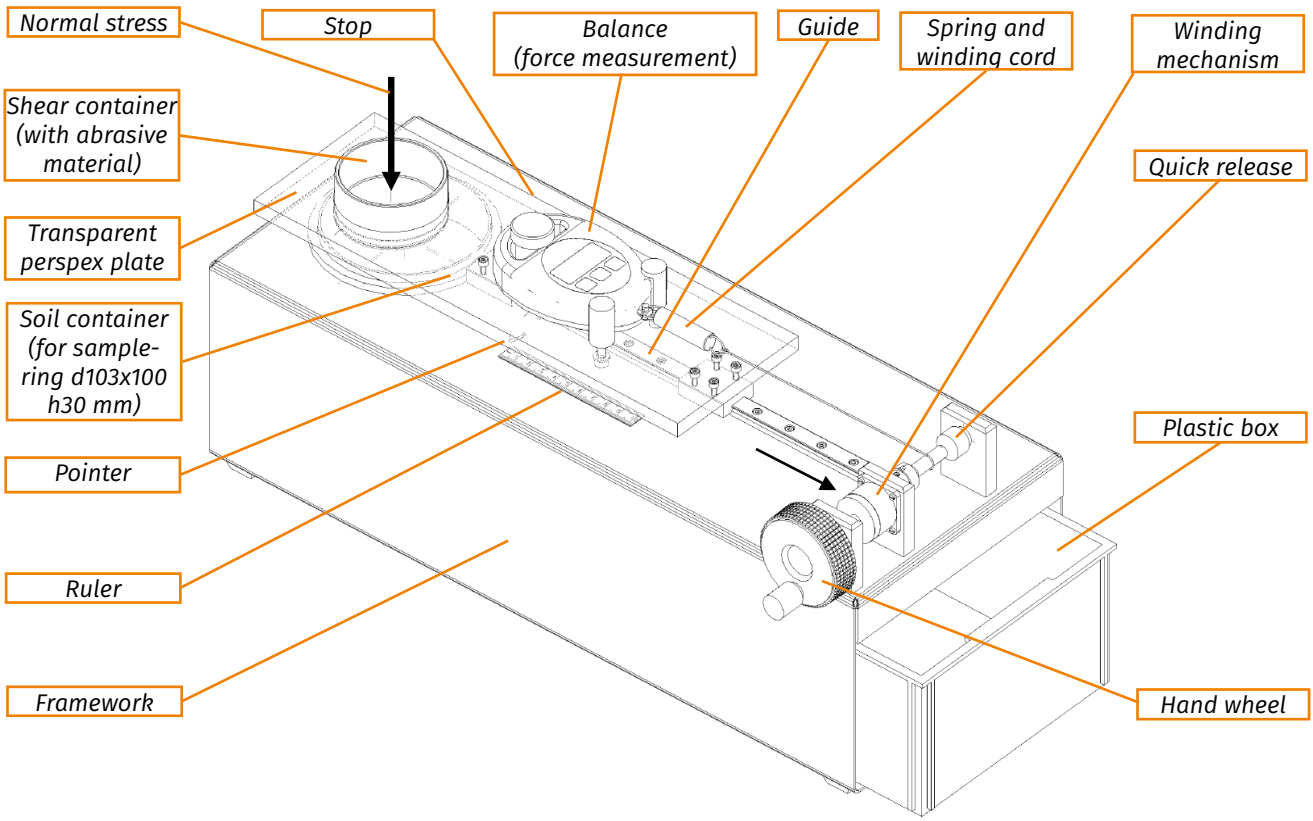
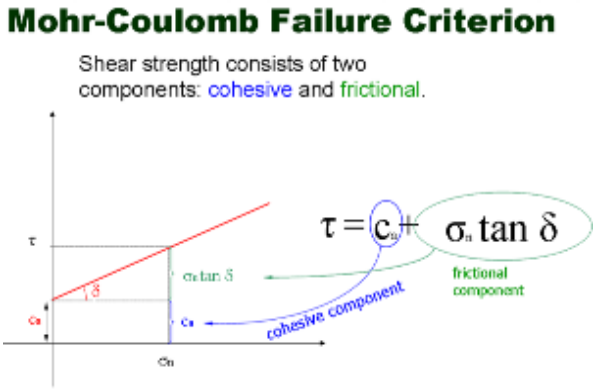
Instrument layout



Schematic representation of surface shear apparatus

Measurement evaluation



The available equipment allows the determination of the shear strength using a modified Mohr-Coulomb's equation:

$\tau = c_a + \sigma_n \tan\delta\varphi$

τ = soil shear strength (hPa),
c_a = adhesion between sandpaper and soil (hPa),
σ_n = normal stress applied on the soil surface (hPa),
δ = surface angle of internal friction (°).

Very small vertical stresses (between 1 and 30 hPa) are applied to a fixed round soil sample (diameter 100 mm/ height 30 mm) via a cylindrical shear container, covered with special high-quality abrasive at the bottom to create a rough shear-plane. The horizontal force is applied with a manual precision-winding mechanism. The spring construction transfers distance to force and damps for force increments. The 'Surface Shear Test' is a comparison test so it is important to use the same initial conditions to enable a reliable comparison between different measurements.

The shear container with established vertical load, placed on top of the sample, needs to be exposed to a horizontal force until it starts to move visually. The shear stress under applied vertical load is calculated by the weight divided by the area of the shear container. Three replicates for one vertical load are needed for each type of soil core (to determine the shear stress). Measurements can be performed on soils with different predetermined water tension values. The same sample cannot be used for measurement twice, because of irreversible damage to the surface structure, caused by shearing.

- The soil container with soil sample is placed into the instrument.
- A shear container (Ø = 68 mm) with high-quality abrasive (free from dirt; in good condition) material is placed on top of the soil sample.
- The soil sample is exposed to a vertical pressure/load (different weights are available) by placement of the weights into the shear container.
- To execute the surface shear test, a horizontal load is applied manually to the shear container with a vertical load by slowly turning (for about max. 1 turn/sec.) the hand wheel of a precision-winding mechanism.
- The surface shear load (= slowly applied max. load to create a movement of the shear container with vertical load) is measured by a digital balance. This balance logs the max. applied force until movement for 5 seconds.