ROYAL Eijkelkamp
Meet the difference

Air Permeameter for soil

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The air permeameter apparatus measures the permeability or conductance of an (undisturbed) soil sample. Air permeability is the property of the soil pore system allowing air to flow through. Generally the pore sizes and their connectivity determine whether a soil has high or low permeability. Air will flow easily through soil with large pores and good connectivity between them. Small pores with the same degree of connectivity would have lower permeability, because air will flow through the soil more slowly. Air permeability is also a function of soil texture and macro-pore volume and connectivity, and a function of the matric potential and water content, because continuous macro-pores which would normally conduct air become increasingly filled with water with an increasing load, depending on the soil and initial water content. Determining the air permeability is required when considering quantified data and interpretation of the pore continuity and its dependency on the matric potential, as well as the effect of mechanical stress application on the anisotropy of pore structure for example.

In many land use systems worldwide, soil deformation is a major problem due to increasing land use intensity. Altered soil functions, in particular reduced hydraulic conductivities and impeded aeration, may decrease crop growth and productivity as well as the filtering and buffering capacity of soils. A commonly applied method for the influence of compaction on permeability is determining the air permeability before and after static loading in oedometer tests.

Applications

- Erosion, drainage, irrigation;
- Geo-Hydrologic research;
- Environmental research;
- Basic material research.

User groups

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

Features

- Easy manual operation;
- Proven accurate measurement principle;
- Multi sample sizes using the fast-exchange sample holder;
- Sample sizes: Ø 53x50 h 51 mm; Ø 60x56 h 40.5 mm and Ø 103x100 h 30 mm;
- Excellent price-quality ratio;
- Developed in cooperation with Christian-Albrechts University, Kiel.

Technical specifications

	Range	Accuracy	Remarks
Operating pressure max.	0.5 bar		external pressure regulator and dryer are required
Restricted air pressure scale	600 hPa	1.6%	
Sample pressure scale	15 hPa / cmH_2O	0.1 hPa / cmH_2O	scale zero mechanism
Temperature	0-60 °C	2%	restricted air temperature
Flowmeter 1 range	0.1- 0.6 l/min	1.25% FSD*	
Flowmeter 2 range	0.2- 2.0 l/min	1.25% FSD*	
Flowmeter 3 range	1.0- 10 l/min	1.25% FSD*	

Environmental conditions		
Temperature	15-35 °C	(stable room temperature is highly recommended)
Dimensions	53 x 28 x 51 cm	(width x depth x height)
Weight	approx. 18 kg	

(1 cmH_2O = 0.981 hPa = 0.981 mbar = 0.000981 bar)
(1 bar = 0.1 Mpa = 1000 hPa = 10.2 mH_2O)

**: FSD= Full Scale Deflection is equal to the max. value of the meter.*

Eijkelkamp states explicitly that these instructions are only indicative. Specifications may be changed without notice and no rights whatever may be claimed.

Schematic instrument layout

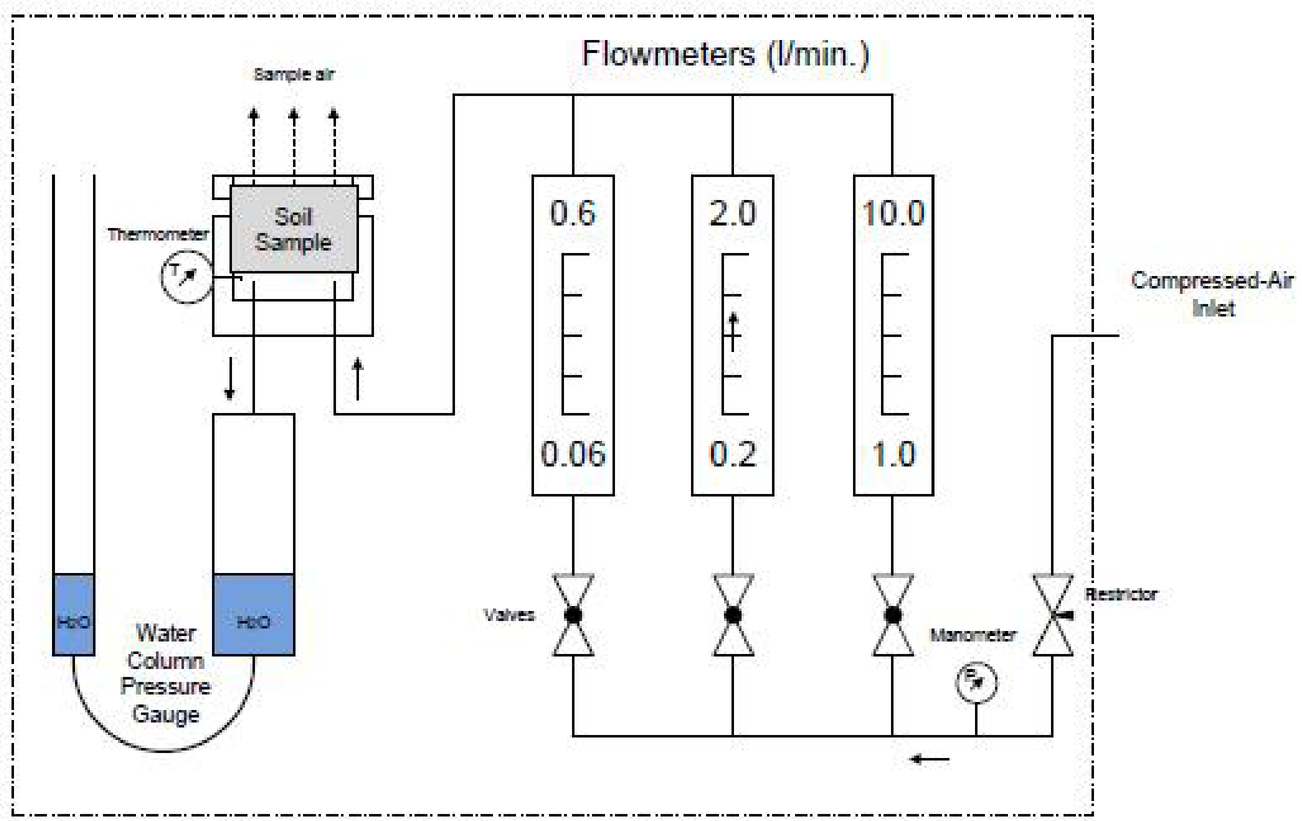

Fig. 1: Principle of apparatus to measure the dimensional air permeability of undisturbed soil samples.

Measurement evaluation

The air fluxes will be measured by flow meters at a defined air pressure difference of e.g. 1 hPa. Measurement of generally five replications is completed within max. 10 minutes (because of dry-out) and enables the quantification of pneumatic soil properties.

Air permeability will be calculated using:

$$K_l = \rho_l * g * \frac{\Delta V * l}{\Delta t * \Delta p * A}$$ with

ρ_l = air density [kg/m³];
g = gravitation = 9,81 [m/s²];
ΔV = amount of air [m³] passed through the sample during a specific time interval (Δt);
l = length of the soil sample [m];
Δp = applied pressure [hPa];
A = sample surface [m²].

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Fig. 2 provides an example of the change of the air permeability after compaction with different stresses, also causing changes in the three phases: solid, liquid, and gaseous. Classification of the obtained results, for example in accordance with the German soil mapping system, also allows a direct correlation with the soil strength properties and a direct measure for quantifying the soil degradation status.

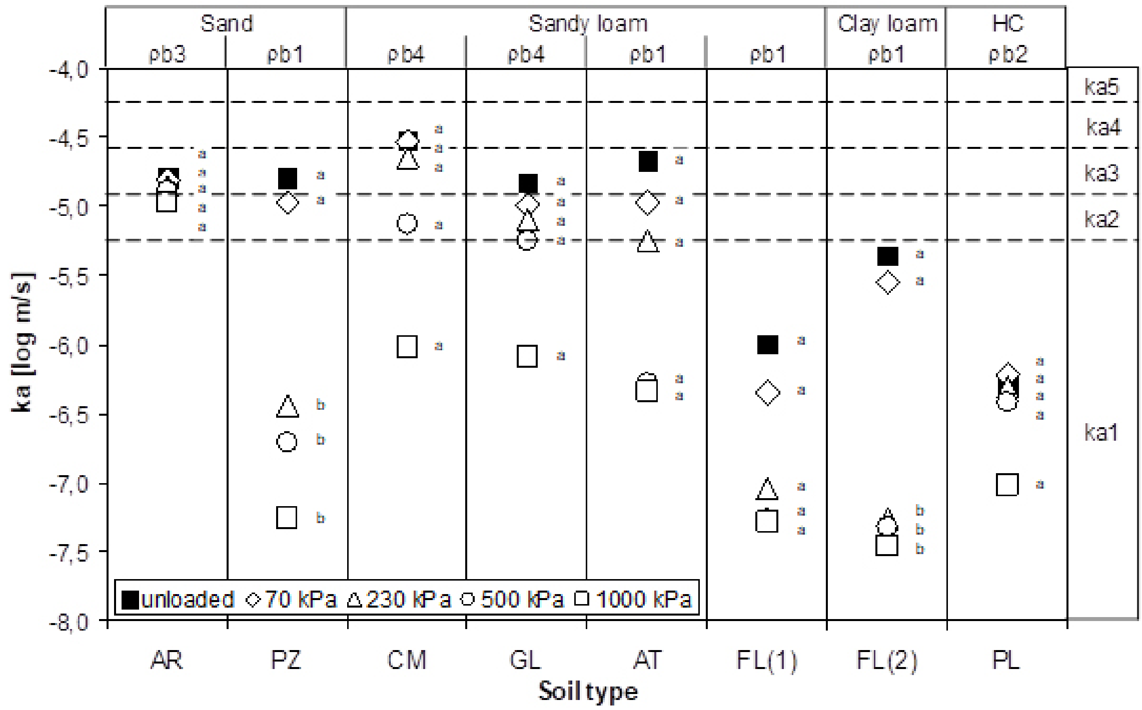

Fig. 2: Change in air permeability of the examined soil types / horizons due to different mechanical loads

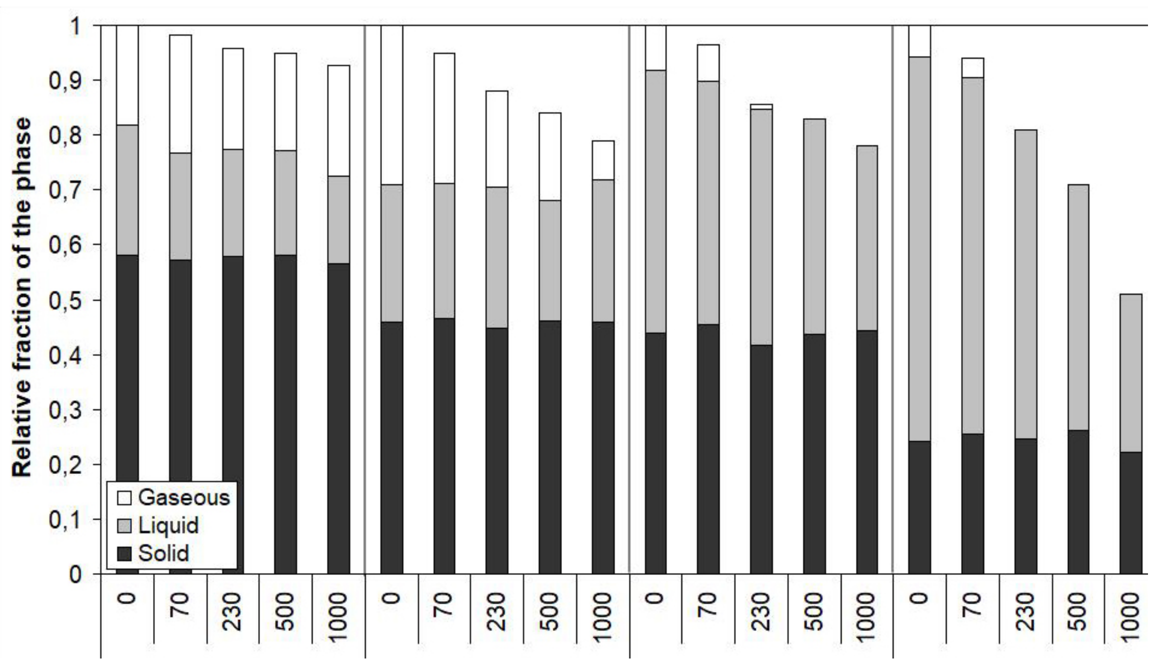

Fig. 3: Relative change in the three phases (solid, liquid and gaseous) after compaction with different loads for four of the investigated soils as exemplars.

Literature

Gebhardt, S.,Fleige, H., Horn, R. 2009; 'Effect of compaction on pore functions of different soils'. Journal of Plant Nutrition and Soil Science.

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