Air permeameter

User manual

Meet the difference

Royal Eijkelkamp
Nijverheidsstraat 9, 6987 EN
Giesbeek, the Netherlands

T +31 313 880 200
E info@eijkelkamp.com
I royaleijkelkamp.com

M-0865E

Contents

On these operating instructions

☞ **If the text follows a mark (as shown on the left), this means that an important instruction follows.**

⚠ **If the text follows a mark (as shown on the left), this means that an important warning follows relating to danger to the user or damage to the apparatus.The user is always responsible for its own personal protection.**

Text **Italic indicated text indicates that the text concerned appears in writing on the display (or must be typed).**

General safety precautions

☞ **Read and understand these entire instructions before proceeding.**

⚠ **This apparatus is for research applications only and needs to be operated by qualified operators.**

⚠ **A qualified operator is well trained, mental and physical fit to operate multiple complex instruments.**

⚠ **Other use then intended purposes should be avoided.**

⚠ **Never make modifications with exceptions of spare parts (Chapter 4). Any changes made will void warranty and any liability of Eijkelkamp.**

⚠ **Take care for personal hygiene and environmental precautions in case of operating contaminated samples.**

⚠ **Do not operate with damaged hoses or any other damaged parts.**

⚠ **Disconnect apparatus from air pressure supply before installation, or servicing.**

⚠ **This apparatus is rated for indoor lab locations only.**

⚠ **Servicing should be performed by Eijkelkamp trained qualified personel only!**

⚠ **Only original spare parts supplied by Eijkelkamp are allowed to service.**

⚠ **In case of any doubt about functionality, always contact your supplier.**

1. Product description

1.1 Introduction

The air permeameter apparatus measures the permeability or conductance of an (undisturbed soil) sample. Air permeability is the property of the soil pore system that allows 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 with good connectivity between them. Small pores with the same degree of connectivity would have lower permeability, because air would flow through the soil more slowly. The air permeability is besides a function of soil texture and macro-pore volume and connectivity, also a function of the matric potential and water content, respectively, because continuous macro-pores which normally would conduct air become more and more water filled with increasing load, depending on the soil and initial water content. The determination of the air permeability is required if quantified data and interpretation about the pore continuity and its dependency on the matric potential as well as the effect of mechanical stress application on e.g. anisotropy of pore structure are considered.

In many land use systems all over the world 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 the determination of the air permeability before and after static loading in oedometer tests.

1.2 Applications

- Erosion, drainage, irrigation
- Agriculture research
- Geo-hydrologic research
- Environmental research
- Basic material research

1.3 User groups

- Laboratories
- Research institutes
- Educational institutes
- Universities

1.4 Features

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

C A U
Christian-Albrechts-Universität zu Kiel

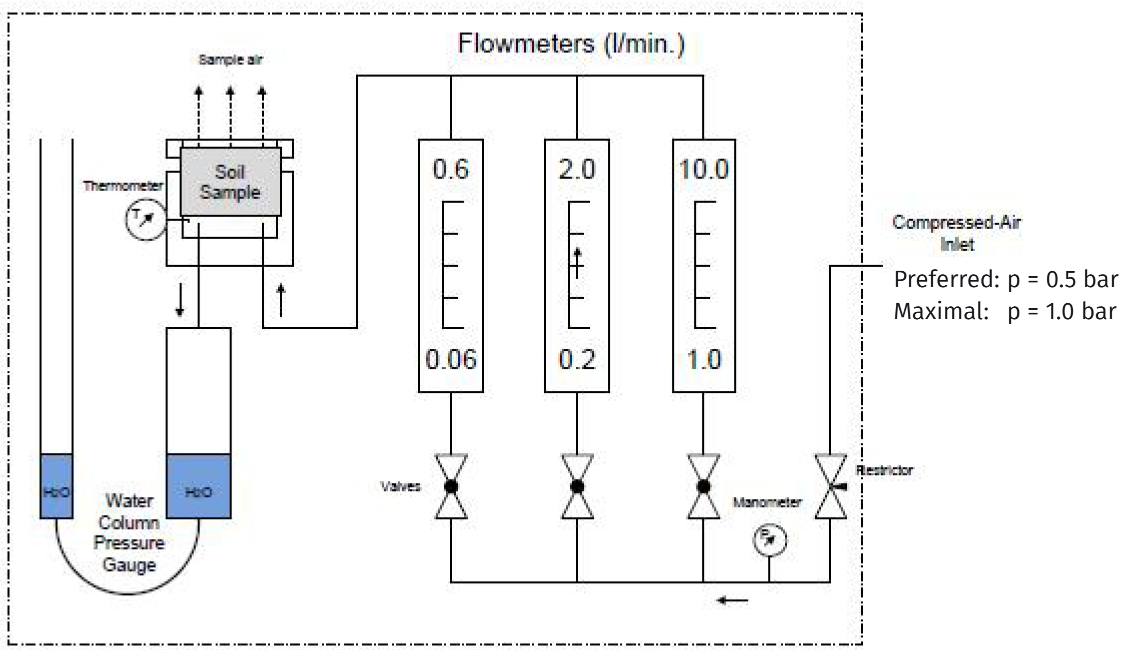
2. Technical specifications

Item	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		

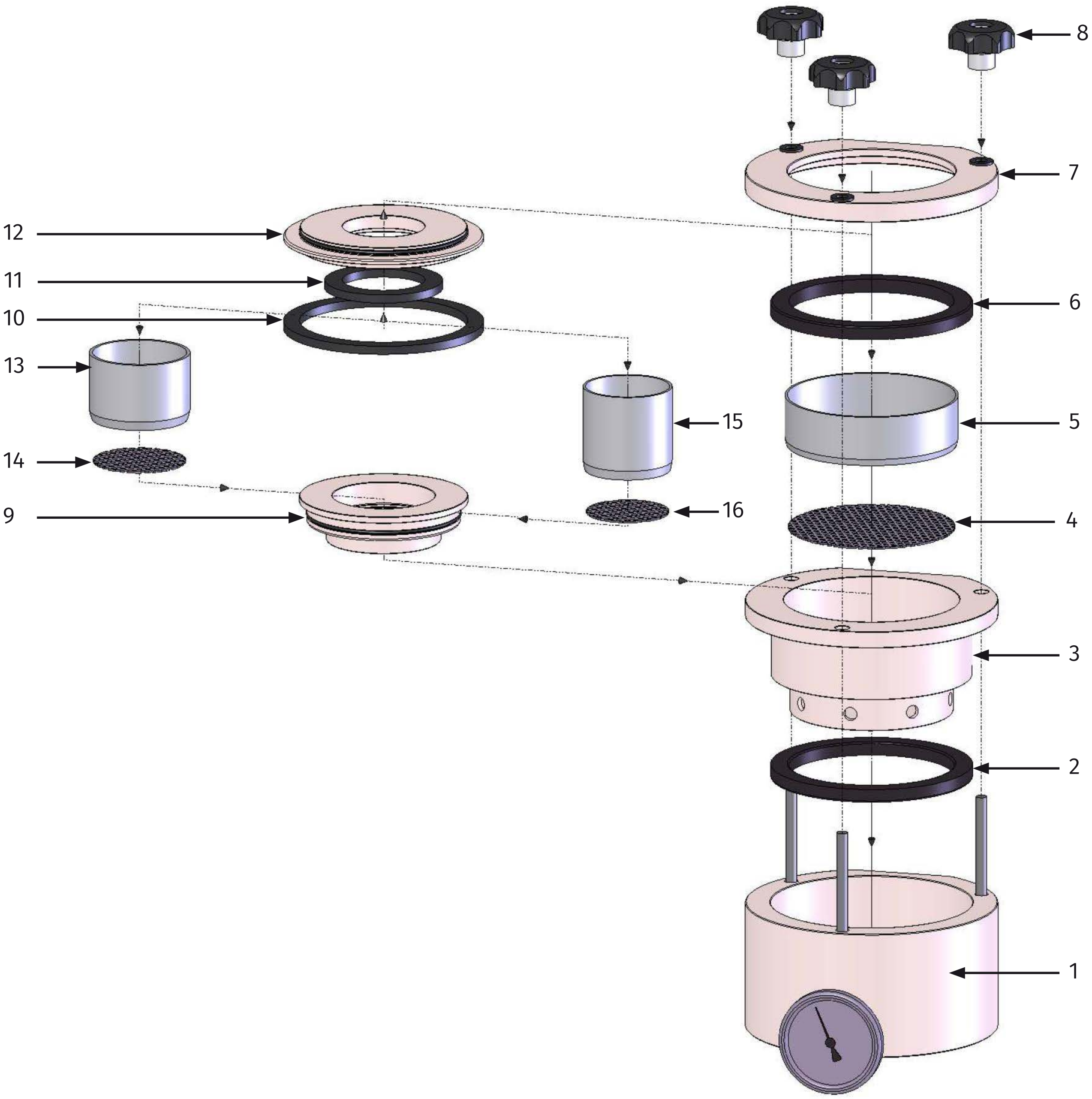
(1 cmH_2O = 0.981 hPa= 0.981 mbar= 0.000981 bar)
(1 bar = 0.1 MPa= 1000 hPa= 10.2 mH_2O)

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

3. Schematic construction



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



1. Sample holder chamber
2. Rubber seal sample holder
3. Sample holder insert
4. Perforated disc 103 mm
5. Sample ring Ø 103x100 height 30 mm
6. Rubber seal sample holder (see 2)
7. Clamp ring sample holder 103 mm
8. Clamp ring nuts (3x)
9. Sample holder 53/60 mm insert
10. Rubber seal (flat) sample holder clamp ring insert Ø 100 mm
11. Rubber seal (flat) sample holder clamp ring insert Ø 53 mm
12. Clamp ring sample holder 53/60 mm insert
13. Sample ring Ø 60x56 height 40.5 mm
14. Perforated disc 60 mm
15. Sample ring Ø 53x50 height 51 mm
16. Perforated disc 53 mm

4. Preparation (unpacking, etc.)

Remove all packaging materials, check for completeness and damages and report irregularities directly to your supplier.

Tabel 1 Part list air permeameter (art. no. 0865)

Quantity	Description	Art. no.	Remarks
1	Pressure hose 8x13 mm (max. 20 bar) length 10 m, with Euro quick connect coupling	H104510	
1	Plastic transparent bottle 1 litre	990804	
1	Sample holder insert 103 mm	H700597	
2	Rubber seal (flat) sample holder	H223558	
1	Perforated disc 103 mm	H274786	
1	Clamp ring sample holder 103 mm	H700598	
1	Sample holder 53/60 mm insert	H700617	
1	O-ring sample holder insert	H222983	(mounted)
1	Perforated disc 53 mm	H274790	
1	Perforated disc 60 mm	H274788	
1	Clamp ring sample holder 53/60 mm insert	H700618	
1	O-ring sample holder clamp ring insert	H222990	(mounted)
1	Rubber seal (flat) sample holder clamp ring insert Ø 100	H223560	
1	Rubber seal (flat) sample holder clamp ring insert Ø 53	H223440	
3	Clamp ring nut	H165885	
1	Calibration block (hole 0.6 mm) + identification sticker		(coupled with serial)

Use original Eijkelkamp spare parts only!

5. Installation

5.1 Placement of the apparatus

Make sure that you place the apparatus in a clean; dry; vibration free and non direct sunlight surrounding for best operational performance and measurement results. The apparatus should be well accessible from the operating front.
Adjust the table surface height and levelness for ergonomic purposes. There are four adjusting screws underneath the frame.

6. Checking the apparatus

Before measurements can be performed the instrument calibration and functionality must be checked. For detailed information see the appendix calibration, maintenance and service.

In case of any doubt about functionality, always contact your supplier.

7. Connecting the air pressure

Clean, dry air must be available in the operating range of 0.5 bar. Maximum inlet pressure to the apparatus is for about 1 bar; supplied by a pressure pre-regulator (fig. 1).

The precision regulator on the apparatus will restrict the pressure to the needed operating pressure general 0-0.2 bar *.

☞ **Usage of compressed air without fluctuations will make fine adjustment easier. To minimize the influence of pressure fluctuations a pressure pre-regulator is preferred for the supply pressure. It's not included with the apparatus.**

Make sure that the hoses are qualified for the pressure, fitted well and are undammaged.

*** Higher pressure than 0.5 bar will invoke the internal overpressure valve to operate. Prevent this (energy/air loss and annoying noise)**

Connect the supplied pressure hose fitted well to your pressure system and connect to the apparatus with the supplied Euro quick connect coupling (Fig. 2a and b).

Work pressure:	p = 0.5 bar
Max. pressure:	p = 1.0 bar

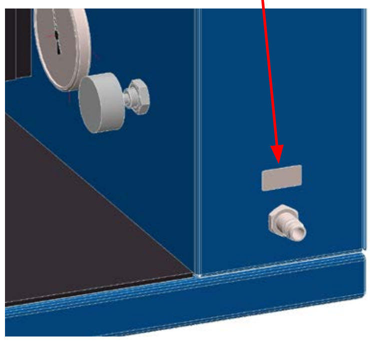


Fig. 1 Work and max. pressure

Fig. 2a To connect the air supply

Fig. 2b Firmly push the coupling onto the connection

Fig. 3a To release: pull back the black ring

Fig. 3b Pull further to disconnect

The release of the air supply coupling is done in 2 steps: pull back the black ring, the air pressure then will be released and than pull further to disconnect (Fig. 3a and b).

8. Filling the water column pressure gauge

The water column pressure gauge is used to measure the air pressure difference across the sample.

Fill the system using demineralised water preventing e.g. algae built up inside the system. An anti-bacterial addition can be added to the water e.g. Aqua-Stabil (supplied by Julabo labortechnik GMBH).

Fig. 4a Remove plastic bottle

Fig. 4b Bottle with nozzle

Fig. 4c Filling the U-tube

Fig. 4a Replace plastic bottle

- Remove the plastic overflow bottle from the hose at the backside of the apparatus (Fig. 4a).
- Fill the pressure gauge for about 0.2 litre using the plastic bottle with nozzle and other screw cap (Fig 4b/c). Make sure the water level is visible at the front side of the pressure gauge. Be sure the water level is just above zero level if the scale is shifted into bottom position (Fig. 5).
    - o The reservoir can be emptied by sucking using the plastic bottle with nozzle or an level hose.
    - o Make sure no air bubbles are enclosed into the pressure gauge circuit.
- Replace the bottle wit screw cap and hole. Replace the plastic overflow bottle into the cut out at the backside of the apparatus and replace the hose into the hole (Fig. 4d).

⚠ **The hose into the plastic overflow bottle has to breathe freely to the ambient air and not restricted i.e. underneath the water level in the bottle. Otherwise the measurement will be disturbed.**

⚠ **Regular (every 3 months) replace water filling or apply an addition, to prevent bacterial or other harmful contamination. Prevent inhalation or contact with the waste water.**

The water level indicating the air pressure applied to the soil sample can set to zero by shifting the scale up or down behind the indication tube.

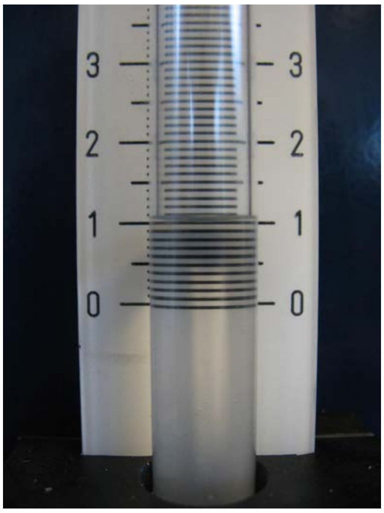


Fig. 5 Pressure gauge reading 1 cm water column

9. Operation of the apparatus

Prepare the soil sample to the desired state i.e. soil moisture tension. See appendix 1: Laboratory sample preparation.

The soil sample chamber can be used for 53, 60 and 103 mm (outer diameters) sample rings using the proper adaptors.

Using the soil sample chamber for 103 mm sample rings

6a. *6b.* *6c.* *6d.*

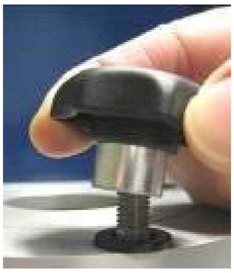
6e. *6f.* *6g.* *6h.* *6i.*

Fig. 6 Different steps for sample (∅103 height 30 mm) placement.

Make sure the sample rings and rubber rings are not damaged, otherwise leaks will be inevitable and the measurement will be disturbed.

Prevent mechanical damage or scratching of the sample chamber to avoid oxidation using e.g. silt/ salty/ contaminated samples (see Appendix 2: Calibration; maintenance and service).

a. Be sure the thick rubber seal is placed into sample holder chamber.
b. Removable sample holder insert. In case of a fragile sample, the sample holder can be taken out of the sample holder chamber to place the sample in vertical position, preventing the sample falling out of the sample ring (see also chapter 10; ‘Sample placement’ fig. 9a).
c. Placement of the sample holder insert into the sample holder chamber.
d. Sample holder chamber with sample holder insert.
e. Placement of the perforated plate into the sample holder insert.
f. Placement of the sample into the sample holder. The soil sample is placed with the sharp side of the sample ring downwards.
g. Installed sample.
h. Placement of clamp ring with thick rubber seal.

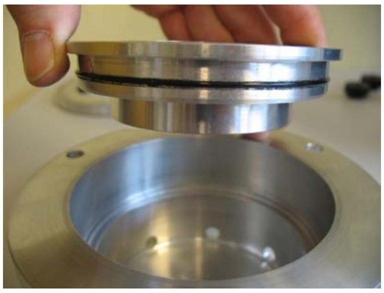


7a. *7b.* *7c.*

Fig. 7 Fixing the clamp ring using special 'fast screwing nuts'

a. Fixing the clamp ring using special 'fast screwing nuts'. The nuts can be shifted over the screw thread by tilting the nut. This is only possible while they are not fastened.
b. Fastening is done with the nut in horizontal position.
c. Fasten the nuts by turning them clockwise (CW), reasonable hand tight and all nuts equally tight to close the sealing gastight.
   (Release the nuts by turning them a few turns counter clockwise (CCW) and tilt the nuts to enable fast removal).

10. The soil sample chamber for 53 and 60 mm samples




8a. *8b.*


8c. *8d.*

Fig. 8 Placement/ assembling of different inserts for Ø53 or Ø60 mm samples.

a. Place the 50/63 mm sample holder insert into the sample holder.
b. Depending on the 50 or 63 mm sample, place the appropriate perforated disc (smallest diameter is used for the 53 mm sample ring.)
c. Remove the thick rubber seal from the clamping ring and place the 50/63 mm sample holder insert into the clamp ring.
d. Press the outer thin rubber seal into the clamp ring by hand force.

Sample placement:

9a. *9b.* *9c.*

Fig. 9 Sample placement of Ø53 or Ø60 mm sample rings.

a. Place the sample into the removable sample holder insert. In case of a fragile sample, the sample holder can be taken out of the sample holder chamber to place the sample in vertical position, preventing the sample falling out of the sample ring.
   The soil sample is placed with the sharp side of the sample ring downwards.
b. Installed sample holder insert with sample into sample holder.
c. Mount the clamp ring using the special 'fast screwing nuts' according to the steps; described in Fig. 7.

11. Starting the measurement

After (proper) placement of the soil sample the real measurement can be started.

Fig. 10a Open the left flow meter.

Fig. 10b Regulate the air pressure

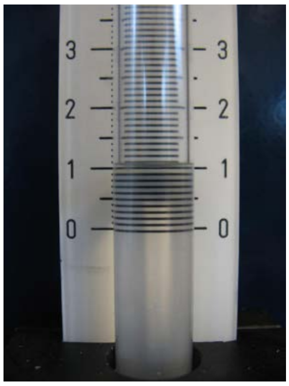


Fig. 10c Water column 1 cm

a. Start the measurement by opening the left flow meter by turning the 'ball valve'-lever CCW in vertical position.
b. Regulate the air pressure, using the needle regulator, at the proper pressure e.g. 1 cm water column on the air pressure gauge (depending on the kind of soil sample and related air permeability).
   As the pressure is very low the regulator should be used secure and with care in the small operation range up to 15 hPa (1cm$H_2$0 = 0.981 hPa or mbar = 0.000981 bar). The round scale manometer is used for indication only, pressure measurements are performed by the water column air pressure gauge.
c. Depending on the air permeability of the soil, start the measurement with a small pressure difference across the sample. E.g. 1 cm water column on the air pressure gauge.

☞ **Be sure the float of the flow meter is always turning during the measurement. If the float is not turning, this may indicate stick probably caused by condensation. This situation can lead to an inaccurate measurement.**

First read the left flow meter 60- 600 cm^3/min (=0.06...0.6 l/min).
Try to regulate the pressure in combination with an air flow in the range of 300...600 cm^3/min.
If the reading is higher then 0.6 l/min, open the middle valve and close the left one.

Read the middle flow meter range 0.2...2.0 l/min.
If the reading is higher then 2.0 l/min, open the right valve and close the middle one

Read the right flow meter range 1.0...10 l/min.

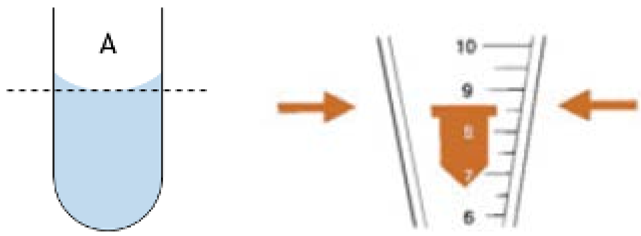
Check the thermometer to be sure that the transported air temperature trough the sample is (nearly) equal to the surrounding climate.

d. Note the measured values; ... l/min @ ... mmH_2O @ ... °C.

☞ **Keep measurement time as short as possible (max. 2 minutes) as the airflow will dry out the soil sample.**

Temperature from a compressed air source can differ significantly from ambient temperature and will influence the result.

Always read the pressure gauge and flow meters the same way so you can make a reliable comparison between different samples and measured values.



Flow rate is then measured against the flat top edge of the float.

If for some unexpected reason the pressure exceed the maximum range of pressure gauge, then the water will be drained into the plastic bottle at the backside of the apparatus.

⚠ **Prevent exposure of your face above the sample during pressure build-up.**

⚠ **Prevent applying pressure with all valves closed. Serious pressure build-up can destroy the samples or cause a dangerous situation during opening one or more flow meters afterwards.**

⚠ **Never block openings like tube to bottle. This leads to disfunction or dangerous situations.**

12. Theory of operation

The determination of the air permeability is required if quantified data and interpretation about the pore continuity and its dependency on the matric potential as well as the effect of mechanical stress application on e.g. anisotropy of pore structure are considered. The theory as well as the analysis of the obtained results are described in Hartge and Horn (2009).
The air permeability (kl) will be determined with an air permeameter apparatus.

The undisturbed soil samples will be placed in the sample holder. The air fluxes will be controlled by flow meters with varying sensitivity at a defined air pressure difference of e.g. 1 cm water head equivalent to 1 hPa. The measurement of mostly 5 replications is finished within max. 10 minutes and enables the quantification of pneumatic soil properties.

The air permeability will be calculated after

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

with

ρ_l = air density (kg/m^{3})
g = gravitation (9.81 (m/s^{2}))
Δ V = amount of air [m^3] passed through the sample during a specific time interval (Δ t)
l = length of the soil sample (m)
Δ p = applied pressure (hPa)

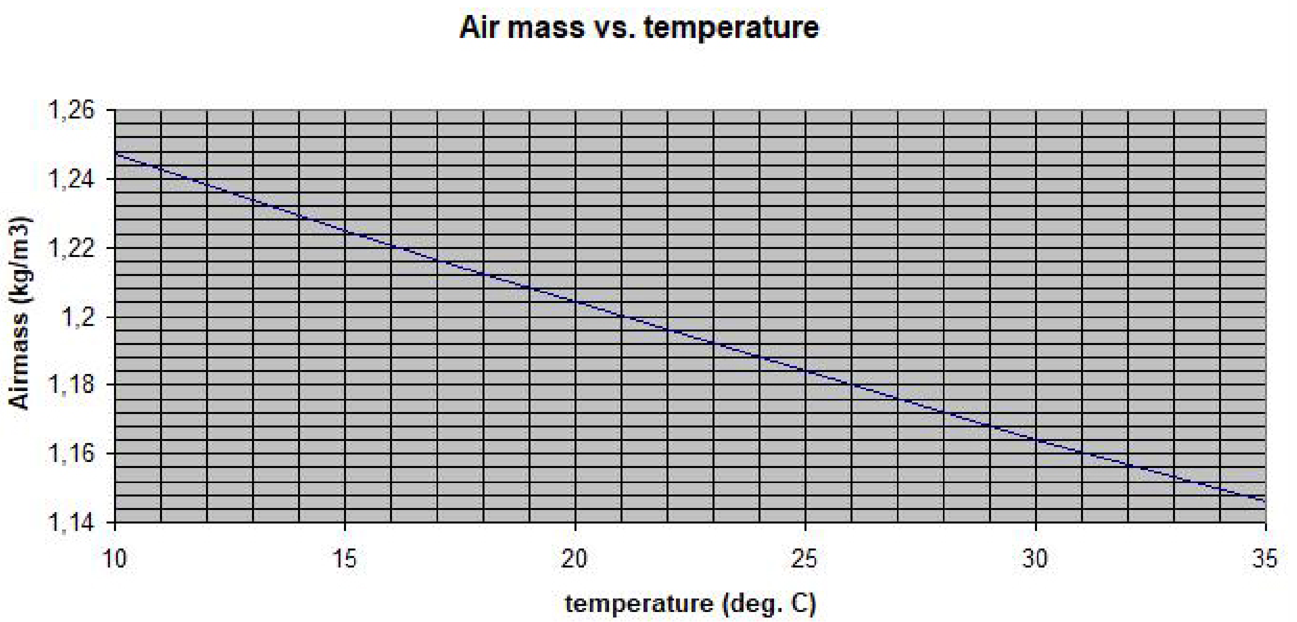


Fig. 11 Air mass correction graph for temperature influence

A = sample surface (m^2)
Possible results:
Unlike the hydraulic conductivity, the air permeability is not only a function of soil texture and macro-pore volume and connectivity, but also a function of the matric potential and water content, respectively, because continuous macro-pores which normally would conduct air become more and more water filled with increasing load, depending on the soil and initial water content. In Fig. 12 an example is given about the change of the air permeability after compaction with different stresses, which causes also changes of the three phases:

solid, liquid, and gaseous. A classification of the obtained results e.q. according to the German soil mapping system allow also a direct correlation with the soil strength properties and a direct measure to quantify the soil degradation status.

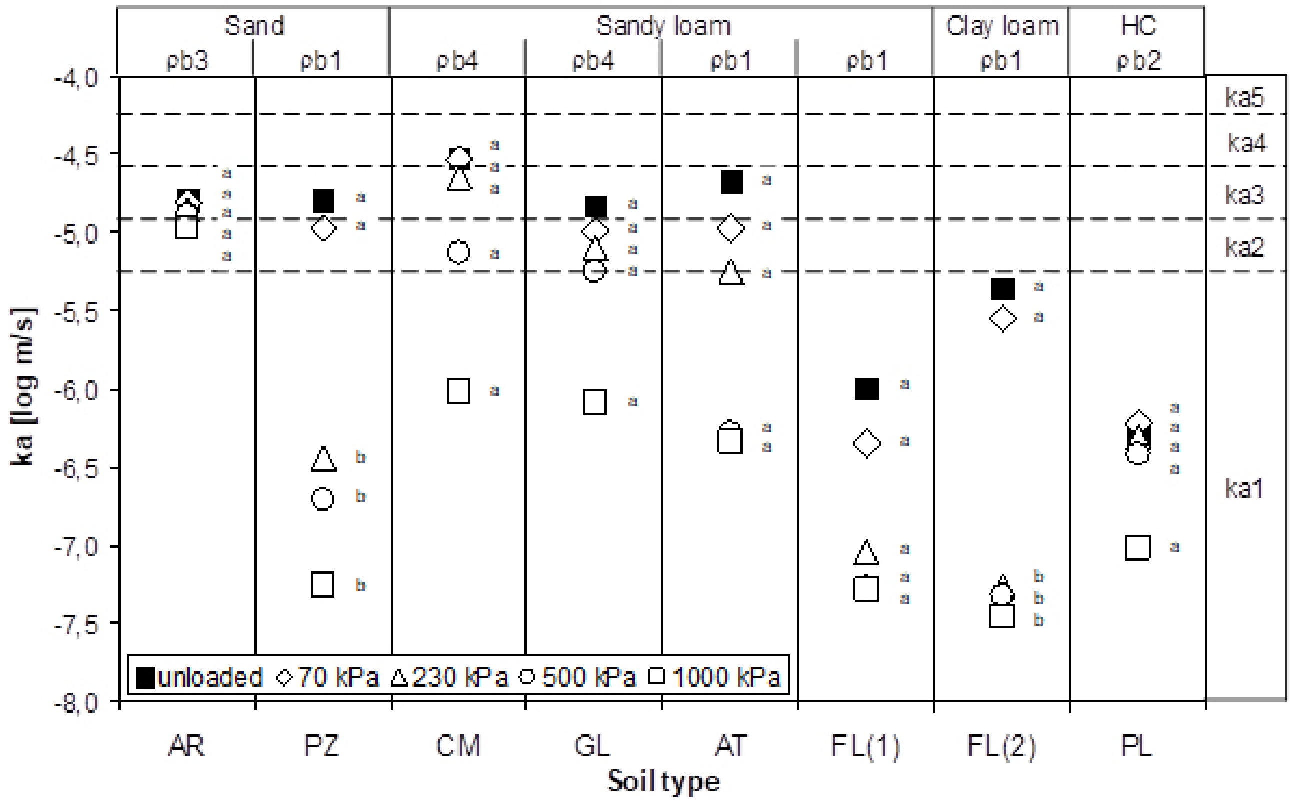


Fig. 12 Change in air permeability of the examined soil types/ horizons due to different mechanical loads (unloaded, 70 kPa and 230 kPa: n = 8, 500 kPa and 1000 kPa: n = 3); classification of bulk density (ρb, [g/cm³]) according to the German soil classification system (AG Boden, 2005) and air permeability (ka, [10^{-6} m/s]) according to DVWK-Merkblätter, 1997: ρb1: very low (< 1.2), ρb2: low (1.2 to < 1.4), ρb3: medium (1.4 to < 1.6), ρb4: high (1.6 to < 1.8), ρb5: very high (≥ 1.8); ka1: very low (< 5.5), ka2: low (5.5 to < 12), ka3: medium (12 to < 25), ka4: high (25 to < 55), ka5: very high (≥ 55) (taken from Gebhardt et al. 2009).

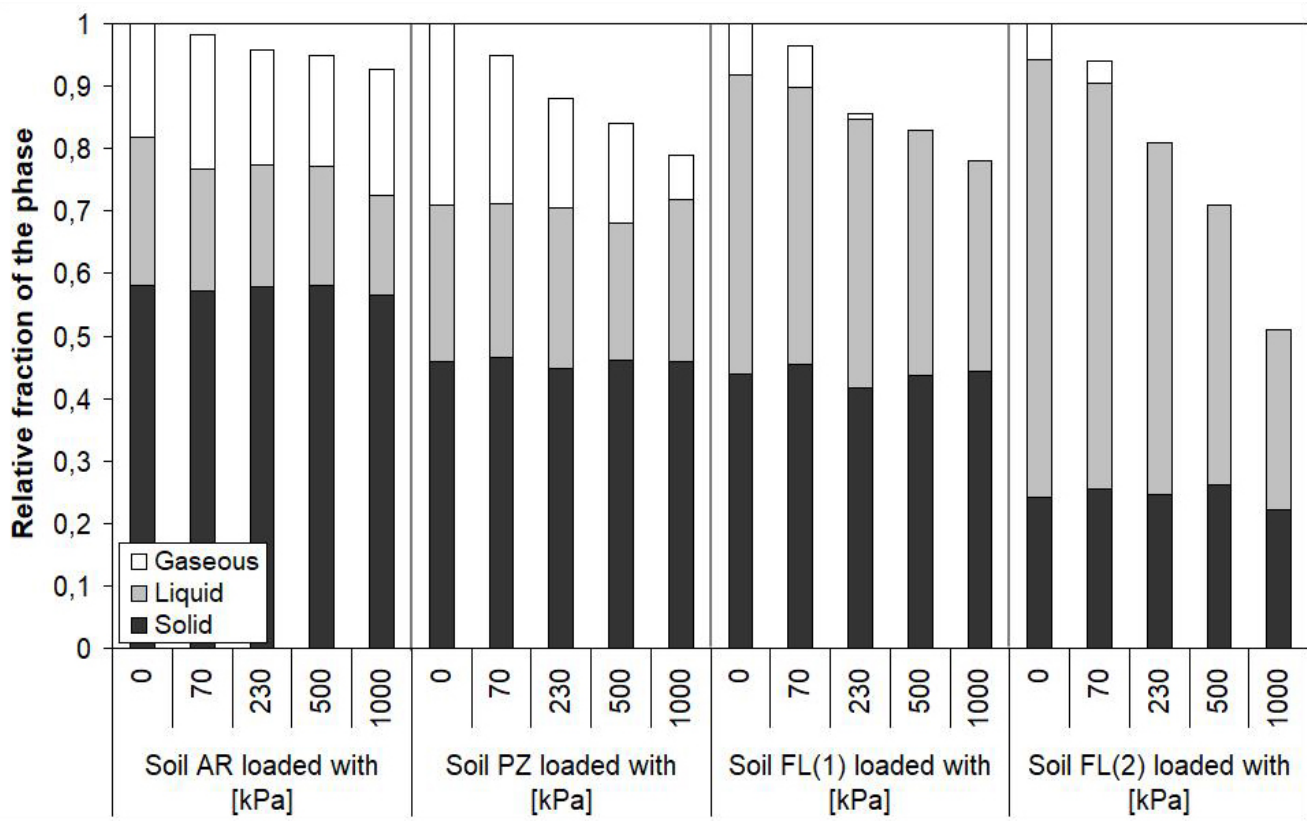


Fig. 13 Relative change of the three phases solid, liquid and gaseous after compaction with different loads for four of the investigated soils exemplarily (mean values from three replications for each load; a small part of the changes is caused by the fact that for each pressure used to compact the samples a new set of samples had to be used with small differences in physical properties like pore volume or pore size distribution) (taken from Gebhardt et al. 2009).

Literature:

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

Eijkelkamp expresses her thanks to the scientific contributions of R.Horn, S.Gebhardt, H. Fleige and J.Rostek.

Appendix 1: Taking soil samples

To determine the characteristic of a specific soil, undisturbed core samples must be collected. This is because of the major influences of both pore size distribution and soil structure on moisture retention, especially at the high matrix potentials of the operating range of suction tables.
There is no explicit prescription in literature for recommended sample sizes. Optimal sizes for core rings are determined by the size of structural elements in the soil. To obtain representative data, sample sizes should be large with respect to the size of soil aggregates, cracks, root channels or animal holes. From a practical point of view, sample diameters should not be too large as not to reduce the amount of simultaneously analysable samples, and sample height should be constrained to several centimetres; so that equilibrium conditions are reached in a reasonable period of time.

According to the Dutch NEN 5787 standard, samples with a volume between 100 and 300 cm^3 are usually used for the suction tables, while samples with a height of more than 5 cm are discouraged, because the time needed to establish equilibrium will be long, and the accuracy of determination of pF-values near saturation will be low. In the procedures for soil analyses of the International Soil Reference and Information Centre (ISRIC), sample rings with a diameter of 5 cm and a volume of 100 cm^3 are recommended, while in other publications heights of 2 or 3 cm are preferred.

When pressing the core rings into the soil, care should be taken not to disturb the original setting of the soil and to completely fill the ring. Sampling conditions are best when the soil is approximately at field capacity. Ring holders may be used to facilitate insertion, especially in the subsoil. After insertion to the desired depth, the rings are carefully dug out (e.g. using the spatula provided with the Eijkelkamp sample ring set), at some centimetres below the ring itself. The surplus of soil is reduced to a few millimetres, trimming it carefully with a fine iron saw, and the caps are placed on the ring for protection and to minimise evaporation losses. The remaining surplus of soil will protect the sample during transport and will be removed in the laboratory, prior to analysis. Transport the core rings in a protective case.
Since soil structure and pore size distribution have significant influence on air permeability, several replicate samples are needed to obtain a representative value. Depending on natural variability of the study area, three to six replicate samples per unit are advised.
In case the samples cannot be analysed on short notice, store the samples in a non freezing refrigerator to reduce microbial activity which might cause non-representative changes in soil structure.

Soil samples

The soil sample should be undisturbed and as the measurement quality depends on the soil sample quality care should be taken during sampling. A practical way of sampling is using the hammering method (equipment see fig. 14); the most precise but costly method is using hydraulic sampling equipment; this is not further discussed here.

Fig. 14 Various tools for field sampling

Field sampling (Fig. 15)

Fig. 15 Various steps for field sampling.

- Clear and prepare the soil surface to make sure representative samples can be taken.
- Place 5 sample rings on the soil surface.
- Place the sample tool over the sample ring.
- Drive the ring fully into the soil by hammering the sample tool.
- Excavate the sample by spade or trowel.
- Remove the surplus soil to ca 2-5 mm of the sample ring both sides.
- Cover the ring with transport caps preventing to dry out and compressing the soil sample.
- Register the ring number and sample details.

Lab sample preparation

- Carefully remove the surplus soil on both sides of the sample ring by stepwise vertical cuttings breaking horizontal parts soil away. In this way the pore structure will kept in original condition.
- Optional weigh the sample for volumetric soil moisture content of the field capacity.
- Bring the soil moisture matrix to a predetermined value (Eijkelkamp can supply the proper equipment for this (see Fig. 16).
- Weigh the sample for volumetric soil moisture content.

Fig. 16 Equipment for sampling and sample preparation (Set art. no. 0827SA)

Appendix 2: Calibration; maintenance and service

Specifications check
Calibration of the flow meters can be checked using a calibration block i.e. sample blocks with a specified permeability.

A reference pressure source can be used to check the reading of the pressure gauge.

Calibration
Ex factory the apparatus is completely checked for leakage and a calibration measurement is done with the delivered calibration block.
The specific calibration block is related to the specific instrument.

☞ **We advise to check the apparatus periodical at least before first use and at least once a year (depending on the usage interval; check the apparatus more frequently).**

Calibration procedure:
- Be sure that the calibration block is clean and undamaged. Check the flow channel (Ø=0.6 mm) is completely open and free of dirt by holding it against the light.
  In case of an obstruction; use only compressed-air to blow dirt away.

Store your calibration block into a clean protected place.
Never use a sharp object to puncture the hole. Damage of the hole will change the specific calibration values.

- Place the calibration block into the sample holder (procedure see chapter 10).
- Open the left flow meter (60...600 cm³/min).
- Apply pressure carefully and adjust a flow of 300 cm³/min. Some experience/feeling is needed for fine adjustment (this is also dependent on pressure fluctuations into the compressed air system). It could be helpful to tighten the nut of the needle regulator slightly by using a wrench (Fig. 17) just before the setting value 300 cm³/min is reached.

Fig. 17 Tightening the nut of the needle regulator slightly

- Read out the water level of the pressure gauge and compare this value/pressure with the reference value of the calibration block.
- Lower pressure in comparison with reference value will probably denoting leakage.

Functionality check

The apparatus can be tested against any air leakage applying a small overpressure at the system input reading at the water manometer/air pressure gauge. The sample should be completely air blocked (e.g. the calibration block blocked using insulation tape) and the left valve and flow meter needs to be fully opened. After system air filling, the flow meter needs to measure zero cm^3/min at a nearly constant pressure.
Sometimes the pressure fluctuates a little because of fluctuations into the main compressed-air supply

Maintenance

- Remove condensate from air filters and compressor timely to prevent moisture is entering the system.
- Replace water filling regularly to prevent pollution.
- Clean the instrument regularly with non abrasive materials. A vacuum cleaner (only at dry soil); a soft brush and clean (distilled) water can be used e.g.. Always be sure the sample holder is cleaned well after use of silt/ salty/ contaminated samples.

Prevent redundant usage of water or usage of compressed-air into the sample holder. This will lead to obstruction of the vents.

- Check on wear out of the rubber rings of the sample chamber.

Indication of maintenance interval schema *

Maintenance	Interval
Remove condensate from air filters and compressor	1 month
Replace water filling, cleaning and functional testing	3 months
Calibration check	1 year
General maintenance** - Specifications check - Functionality check - Repair	3 year

* The intervals are only as indication and can be adapted based on local conditions and use.
** Please consult Royal Eijkelkamp for service contract proposals.

Spare and maintenance parts

Normally there are no spare parts needed, in case of questions please contact Royal Eijkelkamp.

Appendix 3: Problem solving, tips and tricks

Q The water manometer level reading is too high or to low.
A Adjust the manometer scale by shifting it to the desired zero level. If out of range adjust the water level in the container using the plastic bottle with nozzle.

Q Faulty or unexpected readings.
A Check for air leaks, i.e. damaged probe rings or rubber rings. Check the calibration (Appendix 2).

Q Faulty or unexpected readings.
A Check for air leaks, probably between the soil sample wall and the sample ring.

Q Temperature air-flow lower or higher then ambient temperature.
A Use temperature compensation in calculations.

Appendix 4: EC Declaration of Conformity

The undersigned, representing the manufacturer

Eijkelkamp Agrisearch Equipment BV
(Royal Eijkelkamp)
Nijverheidsstraat 9
6987 EN Giesbeek
The Netherlands

Herewith declare that the product:

Type : Air permeameter
Art.nr. : 0865
Function : apparatus for measuring the permeability or conductance of an undisturbed soil sample.

is in conformity with the essential requirements of the following EC Directive(s) when installed in accordance with the installation instructions contained in the product documentation:

2006/42/EC Machinery Directive

and that the relevant standards and/or technical specifications have been applied.

Giesbeek, 2010

Manufacturer

Signature

Name: Jos van Zuilen
Position: General Manager