ROYAL Eijkelkamp
Meet the difference

Nijverheidsstraat 9, 6987 EN Giesbeek, The Netherlands
T +31 313 88 02 00
E info@eijkelkamp.com
I royaleijkelkamp.com

06.01 HAND PENETROMETER EIJKELKAMP

Using the penetrometer

Before starting the measurements, check whether the black pointer of the manometer (2) is at zero. Because of internal friction the pointer may sometimes not return to zero. By turning the plunger and pulling it out a little the pointer must return to zero. If the black pointer is not at zero, no soundings can be made (the apparatus must be returned to the factory for control).

The red maximum pointer can be turned to zero with the help of the adjusting screw (1). If both pointers are at zero, select a cone (9) appropriate for the expected density of the soil that is to be sounded. The hand pentrometer is an instrument for indicative measurement of maximal resistance to penetration. The apparatus has a mean deviation of + and - 8%. For a long term and accurate use a measuring range of 200 - 700 N is advised (green zone on manometer). Measurements in the range of 0 to 100 N are not possible. In the range 100 to 200 N the deviation is +/- 15%.
The large deviation can be avoided by choosing another cone.
Measurements in the range 700 to 1000 N must be avoided because they shorten the life cycle of the manometer. When temperature is below 5 °C, deviation will be larger as a result of thickening of the oil.
Fit the cone to the rod (8) and connect the rod, via an extension rod (7) and the plunger (6), to the measuring instrument (5). Next apply uniform pressure to the hand grips (4), push the cone into the ground at a constant rate of 2 cm/sec.
During the measurement, the resistance can be read under the black pointer of the manometer. The maximum resistance, while measuring that section, is indicated by the red maximum pointer. Before starting the following section, turn the maximum pointer once again to zero.
The apparatus is withdrawn by pulling with one hand on the measuring instrument (5) and one hand on the rod (8). When applying the nylon quick-coupler use the push/pull handle to withdraw the rods from the soil. With cones 1 and 2, the maximum sounding depth, without augering, for a single sounding is 50 cm. The resistance is read in N (Newton) and noted for the appropriate depth. The base area of the cone should also be noted because the cone resistance is expressed in N/cm^2.

$$\text{Cone resistance} = \frac{\text{manometer reading}}{\text{base area of cone}}$$

Example:
A manometer reading of 300 N and a cone base area of 5 cm^2 means a cone resistance of: 300/5 = 60 N/cm^2. Or: 60 N/cm^2 = 600 kN/m^2 = 0.6 MPa (mega pascal = 10^6 pascal).

Cone surface/ Manometer value in N	1 cm^2	2 cm^2	$3^1/_3$ cm^2	5 cm^2
100	100	50	30	20
150	150	75	45	30
200	200	100	60	40
250	250	125	75	50
300	300	150	90	60
350	350	175	105	70
400	400	200	120	80
450	450	225	135	90
500	500	250	150	100
600	600	300	180	120
700	700	350	210	140
800	800	400	240	160
900	900	450	270	180
1000	1000	500	300	200

Table in N/cm^2 (100 N/cm^2 = 1000 kN/m^2 = 1 MPa) (N x 1.45 = PSI and N x 0.01 = MPa)

Maintenance and control

Apparatus
- Keep the apparatus dry and clean. Apply a drop of oil to the screw threads to prevent them from rusting.

Check if:
- The measuring needle is straight and the pointer (above 100 N) increases without shocks.
- The red maximum pointer is straight and works well.
- Wether the black pointer returns to zero after a measurement, within the black marking. By turning the plunger and pulling it out a little the pointer must return to zero.
- The apparatus leaks oil.
- The displacement of the plunger is not too big. If so it needs to be refilled with oil.
  To do this: Open the plug of the oil filler (3) with a socket-head screw wrench. Remove the ball of the oil filler by shortly turning the apparatus (use a cloth). Holding the filler at the highest possible point, pour in the spare oil (included in the bag of tools). Be sure the plunger is in the lowest position. Replace the ball (preferably a new one) and screw the plug in, remove overplus of oil with a cloth.

If the apparatus is still not functioning it must be returned to the producer/supplier for repair.

Sounding cones
- Keep the cones dry and clean. Apply a drop of oil to the screw threads to prevent them from rusting.
- Check the wear of the cones by using the cone check (06.01.26). If you are measuring the diameter with a caliper gauge: If their base area is 5% less than the prescribed base area they should be replaced. If the conical surface is damaged, the cone must be replaced.

Cone	Base area	Diameter	Rejection diameter
No.1	1 cm^2	11.28 mm	11.00 mm
No.2	2 cm^2	15.96 mm	15.55 mm
No.3	$3^1/_3$ cm^2	20.60 mm	20.08 mm
No.4	5 cm^2	25.23 mm	24.59 mm

Sounding- and extension rods
- Keep the rods clean and dry. To prevent rusting, apply a drop of oil to the screw threads. Check the rods on straightness and on easy turning of the screw threads.

Note: we advise to return the apparatus every year for calibration.