

CONSTRUCTION MATERIALS TESTING SOLUTIONS

Soil Permeability Test on Granular and Compacted Material

Constant and Falling Head Apparatus

Standards ASTM D2434-06 | BS 1377:5 | BS EN ISO 17892-11 | AASHTO T215

Soil Permeability

Constant and Falling Head Apparatus

A soil’s permeability reflects its ability to let fluids flow through. The main fluid geotechnical engineers are usually concerned with, is water.

For many construction projects (from excavations, earth dams to piping and erosion and highway drainage schemes), good drainage is essential so it is crucial to know the soil’s permeability characteristics.

Controls’ permeability apparatus is used for testing the permeability of granular soils (gravel and sand) and fine soils. It can perform two different types of tests:

CONSTANT HEAD TEST

For this test procedure, water flows through the soil specimen under the application of a constant pressure difference in order to reach a laminar flow condition.

The hydraulic gradient readings are obtained from manometer tubes levels connected to the take-off points of the permeability cell.

Water passing through the specimen is collected and measured over a period of time and the coefficient of permeability calculated.

FALLING HEAD TEST

When soils are of intermediate or low permeability, it is best to follow the falling head procedure.

The soil specimen is connected to a manometer tube, which provides both water and the tools to measure the water volume flowing through the sample.

Our manometer tubes come in different diameter sizes allowing you to select the most suitable one for the type of soil material being tested.

Benefits

Controls offers Permeability Apparatus that are:

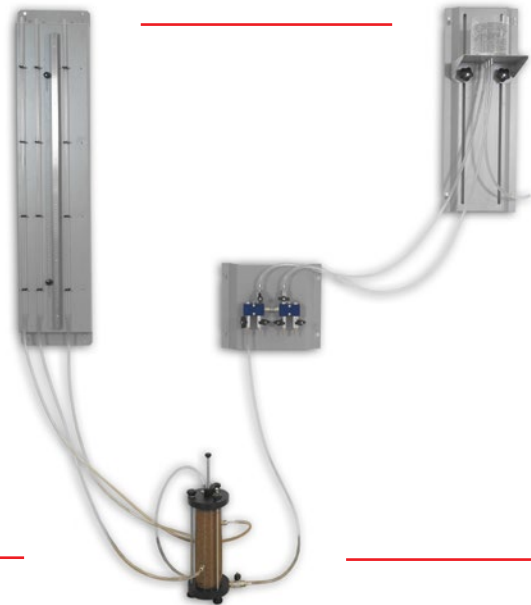
- ✓ **Modular and expandable, suitable for different types of soil testing**
- ✓ **Easy and fast to install**
- ✓ **Easy to use**
- ✓ **Flexible with the ability to test undisturbed, remolded and compacted soils.**

k = m/s	k = 1	10 ⁻¹	10 ⁻²	10 ⁻³	10 ⁻⁴	10 ⁻⁵	10 ⁻⁶	10 ⁻⁷	10 ⁻⁸	10 ⁻⁹	10 ⁻¹⁰	10 ⁻¹¹	10 ⁻¹²
Drainage Characteristics	Good			Poor			Practically Impervious						
Permeability Classification	High		Medium		Low		Very Low		Practically Impermeable				
General Soil Type	Gravels	Clean Sands		Fissured and Weathered Very Fine or Silty Sands				Intact Clays					
Test Method	CH Cell 114 mm dia.	CH Cell 75 mm dia.		FH Cell				FH in Oedometer					
Standards	ASTM D2434-06 / BS 1377:5 BS EN ISO 17892-11 / AASHTO T215.				BS EN ISO 17892-11 ASTM D5856				BS EN ISO 17892-11				

Permeability test methods reference table

Constant Head Apparatus

- ✓ This apparatus is used for the determination of permeability of granular (cohesionless) soils in a steady-state condition.
- ✓ Determination of 'k' developed under the assumptions of the validity of Darcy's Law stipulating that the coefficient of permeability is equal to the ratio of the flow rate to the hydraulic gradient.
- ✓ Test procedure helps determine the representative values of the coefficient of permeability 'k' of granular soils that may either occur in natural deposits in embankments, or when used as base courses under pavements.
- ✓ Procedure is limited to disturbed granular soils with permeability ranging from 1 to 1×10^{-5} m/s, in order to avoid consolidation influences during testing.



Ordering Information

Kit 1

38-T0184/KIT1

- Constant Head permeability cell, 75 mm dia. (38-T0184/C1).
- Manometer stand (38-T0183/MS) with three 6 mm dia. manometer tubes (38-T0183/6)
- Ruler 1152 x 250 x 34 mm (38-T0183/R)
- Constant level tank (38-T0184/T), complete with inlet, outlet, overflow, connecting tubing for the cell.



Constant Head permeability cell



Manometer stand with ruler



Constant level tank

Optional Items

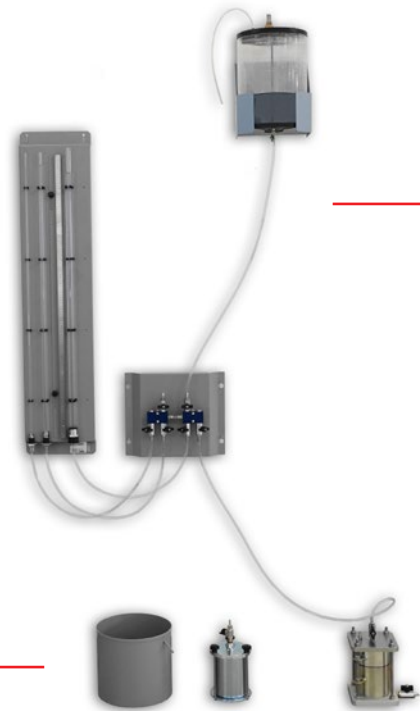
38-T0183/P

Control panel used for saturating samples.



Falling Head Apparatus

- ✓ The Falling Head Apparatus is used to determine the permeability of fine-grained soils such as silts and clays with intermediate to low permeability (ranging from 1×10^{-5} to 1×10^{-9} m/s).
- ✓ This test method covers laboratory measurement of hydraulic conductivity of laboratory-compacted materials with a rigid-wall and compaction-mold permeameter.
- ✓ This testing method can be applied to an undisturbed sample.
- ✓ May be used with compacted specimens with coefficient of permeability 'k' less than or equal to 1×10^{-5} m/s.



Ordering Information

Kit 1



Falling Head Apparatus



Manometer stand



Soaking reservoir

38-T0185/KIT1 | Falling Head Apparatus Kit

- Falling Head cell, 100 mm internal dia. (38-T0185/C1)
- Manometer stand* (38-T0183/MS) with three tubes available in 6 mm dia. (38-T0183/6), 8 mm dia. (38-T0183/8) and 14 mm dia. (38-T0183/14) with quick couplings and anchoring system (38-T0183/A).
- Soaking reservoir (38-T0185/T), complete with overflow tube.

* **Note:** Connecting valve (38-T0183/6C, 38-T0183/8C, 38-T0183/14C) should be ordered separately.

Kit 2

38-T0185/KIT2 | Falling Head Apparatus Kit for compacted soil

- Compaction mold permeameter, 4" (101.6mm) dia. conforming to ASTM D5856 (38-T0185/C2)
- Manometer stand (38-T0183/MS) with 3 tubes 6 mm (38-T0183/6), 8 mm (38-T0183/8), 14 mm (38-T0183/14) dia. with quick couplings and anchoring system (38-T0183/A)

Note: Connecting valve (38-T0183/6C, 38-T0183/8C, 38-T0183/14C) should be ordered separately.



Falling Head Apparatus with compaction mold permeameter



Manometer stand

Optional Items (both kits)

38-T0183/P
Control panel

38-T0183/R
Ruler 1152x250x34 mm

Note: Both kits require de-airing water apparatus to be ordered separately.

Single Components

In addition to the standard kits for constant head and falling head, all the components can be ordered separately, in order to configure the apparatus according to your request.

	Constant Head		Falling Head	
Permeability Cell	38-T0184/C1 ¹	Constant Head permeability cell, 75 mm internal dia., 3 take-off points.	38-T0185/C1 ^{2A}	Falling Head permeability cell, 100 mm internal dia. complete with 75-micron gauze and 2 m of tubing conforming to BS EN ISO 17892-11.
	38-T0184/C2	Constant Head permeability cell, 114 mm internal dia., 6+6 (blanked) take-off points.	38-T0185/C2 ^{2B}	Compaction mold permeameter, 4" (101.6 mm) dia. conforming to ASTM D5856
			38-T0185/C3	Compaction mold permeameter, 6" (152.4 mm) dia. conforming to ASTM D5856
Tank	38-T0184/T ¹	Constant level tank. Complete with inlet, outlet, overflow, connecting tubing for the cell.	38-T0185/T ^{2A}	Soaking reservoir, complete with overflow tube.
Manometer Stand	38-T0183/MS ¹	Manometer stand with 4 tubes positioning. Dimensions: 1152 x 250 x 34 mm Tubes, ruler and anchoring system need to be ordered separately.	38-T0183/MS ^{2A/2B}	Manometer stand with 4 tubes positioning. Dimensions: 1152 x 250 x 34 mm Tubes, ruler and anchoring system need to be ordered separately.
Ruler	38-T0183/R ¹	Ruler for T0183/MS	38-T0183/R	Ruler for T0183/MS
Manometer Tubes	38-T0183/6 ¹	Manometer tube 6 mm dia. Connecting valve need to be ordered separately (T0183/6C).	38-T0183/6 ^{2A/2B}	Manometer tube 6 mm dia. Connecting valve need to be ordered separately (T0183/6C).
	38-T0183/8	Manometer tube 8 mm dia. Connecting valve need to be ordered separately (T0183/8C).	38-T0183/8 ^{2A/2B}	Manometer tube 8 mm dia. Connecting valve need to be ordered separately (T0183/8C).
	38-T0183/14	Manometer tube 14 mm dia. Connecting valve need to be ordered separately (T0183/14C).	38-T0183/14 ^{2A/2B}	Manometer tube 14 mm dia. Connecting valve need to be ordered separately (T0183/14C).
	38-T0183/22	Manometer tube 22 mm dia. Connecting valve need to be ordered separately (T0183/22C).	38-T0183/22	Manometer tube 22 mm dia. Connecting valve need to be ordered separately (T0183/22C).
Anchoring System	38-T0183/A	Anchoring system to connect manometer tubes with valves on T0183/MS.	38-T0183/A ^{2A/2B}	Anchoring system to connect manometer tubes with valves on T0183/MS.
Control Panel	38-T0183/P	Control panel used for saturating samples.	38-T0183/P	Control panel used for saturating samples.

NOTES:

¹ Standard configuration for constant head apparatus included in 38-T0184/KIT1

^{2A} Standard configuration for falling head apparatus included in 38-T0185/KIT1

^{2B} Standard configuration for falling head apparatus for compacted soil included in 38-T0185/KIT2

Single Components at a Glance

Manometer stand (38-T0183/MS) with tubes 6 mm (38-T0183/6), 8 mm (38-T0183/8), 14 mm (38-T0183/14) dia., connecting valves, ruler (38-T0183/R) and anchoring system (38-T0183/A)

Note: Connecting valves (38-T0183/6C, 38-T0183/8C, 38-T0183/14C) should be ordered separately.



38-T0184/T

Constant level tank. Complete with inlet, outlet and overflow, connecting tubing for the cell.



Manometer stand (38-T0183/MS) with 3 manometer tubes 6 mm dia. (38-T0183/6) and Ruler (38-T0183/R)

Note: See Accessories List for other Manometer tubes dimensions.



38-T0183/A

Anchoring system to help connect the manometer tubes with valves on 38-T0183/MS.



38-T0184/C1

Constant Head permeability cell, 75 mm internal dia., 3 take-off points.

Note: Constant Head permeability cell (38-T0184/C2), 114 mm internal dia. A 6+6 (blanked) take-off points is also available.



38-T0185/C1

Falling Head permeability cell, 100 mm internal dia.



38-T0185/C2

Compaction mold permeameter, 4" (101.6mm) dia. conforming to ASTM D5856.

Note: Compaction mold (38-T0185/C3) 6" (152.4 mm) is also available.



Entry-level Apparatus

We also offer two simpler apparatus that can either be used for educational purposes or for evaluating less complex natural phenomena such as erosion.

Combined Constant or Falling Head Apparatus



38-T0186/A

Used for both Constant or Falling Head methods for determining soil permeability. The apparatus consists of:

- two section plastic chambers
- a plated steel top with gaskets
- a plastic funnel reservoir (with a maximum head of 550 mm when upright)
- a 100 cc pipette
- two porous stones 63.5 mm dia. x 12.7 mm thick with 300-micron average pore size.

ACCESSORIES AND SPARES

38-T0186/1

Spare porous stone 63.5 mm dia. x 12.7 mm thick. Available in a pack of five.

38-T0186/A1

Support base for T0186/A (in case of not supporting on the wall).

Pinhole Test Apparatus

38-T0189/A

Certain fine-grained soils with high sodium content are very much prone to erosion from water. During the test, the water is set to flow at a high hydraulic gradient through a cavity in the soil.

The apparatus consists of:

- cylindrical metal container fit one end with water inlet and the other end with an outlet connection
- standpipe tube with scale
- stand to support the pinhole apparatus.



ACCESSORIES AND SPARES

38-T0184/T

Constant level tank. Complete with inlet, outlet, overflow.

38-T0184/A5

PVC tubing dia. 10 mm (o.d.) x 8 mm (e.d.), 10 m coil

Wykeham Farrance also offers permeability testing equipment for low permeability material using consolidation and triaxial cells or a permeability cell for contaminated soils. Discover our range at www.controls-group.com/wf.



Triaxial cell



Toxic interface chamber



Permeability cell for contaminated soil

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