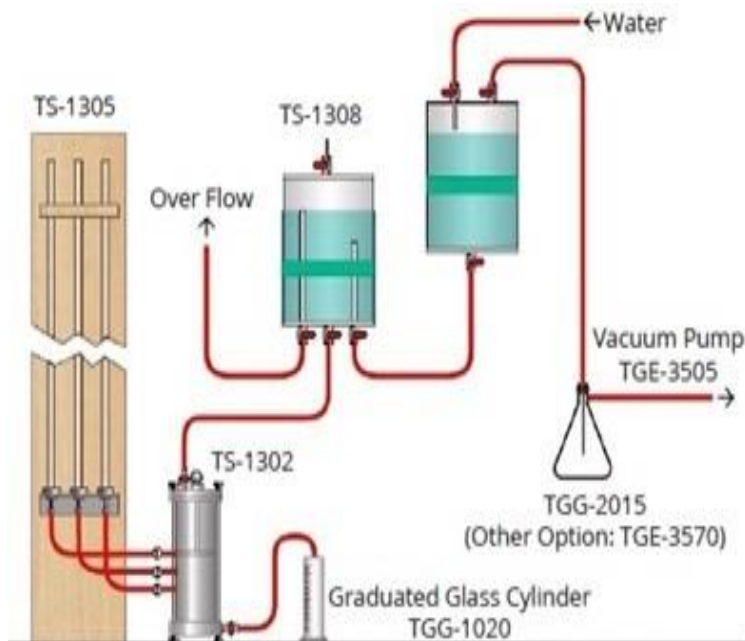


# PERMEABILITY TEST BY CONSTANT HEAD METHOD

**1. Objective:** The constant head permeability test is a laboratory experiment conducted to determine the permeability of soil. The soils that are suitable for this tests are sand and gravels. Soils with silt content cannot be tested with this method. The test can be employed to test granular soils either reconstituted or disturbed.

## 2. Apparatus Required



- (a) Permeameter mould of capacity of 1000 ml, with an internal diameter of  $100 \pm 0.1$  mm and internal effective height of  $127.3 \pm 0.1$  mm,
- (b) Compacting equipment of 50 mm diameter circular face, weight 2.76 kg and height of fall 310 mm and
- (c) a bade with a porous disc, 12 mm thick which has the permeability 10 times the expected permeability of soil.

**Fig. 1: Arrangement for Constant Head permeability**

**3. Reference:** IS 2720(Part 36):1987 Methods of test for soils: Laboratory determination of permeability of granular soils (constant head) (first revision). Reaffirmed- Dec 2016.

## 4. Procedure:

### 1. Preparation of specimen for testing:

#### o Undisturbed Soil Sample:

- a. Note down the sample number, bore hole number and its depth at which the sample was taken.
- b. Remove the protective cover (paraffin wax) from the sampling tube & place it in the sample extraction frame, and push the plunger to

get a cylindrical form sample not longer than 35 mm in diameter and having height equal to that of mould.

- c. The specimen shall be placed centrally over the porous disc to the drainage base.
  - d. The angular space shall be filled with an impervious material such as cement slurry or wax, to provide sealing between the soil specimen and the mould against leakage from the sides.
  - e. The drainage cap shall then be fixed over the top of the mould.
  - f. Now the specimen is ready for the test.
- **Disturbed Soil Sample:**
    - a. A 2.5 kg sample shall be taken from a thoroughly mixed air dried or oven dried material.
    - b. The initial moisture content of the 2.5 kg sample shall be determined. Then the soil shall be placed in the air tight container.
    - c. Add required quantity of water to get the desired moisture content & mix the soil throughly.
    - d. Weigh the empty Permeameter mould and place the assembly on a solid base and fill it with sample and compact it.
    - e. After completion of a compaction the collar and excess soil are removed, find the weight of mould with sample.
    - f. Place the mould with sample in the Permeameter, with drainage base and cap having discs that are properly saturated.

## 2. **Test Procedure:**

- a. For the constant head arrangement, the specimen shall be connected through the top inlet to the constant head reservoir.
- b. Open the bottom outlet.
- c. Establish steady flow of water.
- d. The quantity of flow for a convenient time interval may be collected.
- e. Repeat three times for the same interval.

**5. Observation and Recording:** The flow is very low at the beginning, gradually increases and then stands constant. Constant head permeability test is suitable for cohesionless soils. For cohesive soils falling head method is suitable.

<b>Experiment No.</b>	<b>1</b>	<b>2</b>	<b>3</b>
Length of specimen, L(cm)			
Area of specimen, A(cm <sup>2</sup> )			
Time, t(sec)			
Discharge, Q (cm <sup>3</sup> )			
Height of water, h (cm)			
Temperature (°C)			

**Table 1:** Recordings during Constant Head Permeability Test

**6. Calculation:**

1. Permeability  $K_T$  at temperature T is calculated by:

$$K_T = (Q * L) / (A * h * t)$$

where,

$K_T$  = co-efficient of permeability in cm/sec.

Q = Discharge, cm<sup>3</sup>/ sec

L = Length of specimen in cm,

A = Cross sectional area of specimen in cm<sup>2</sup>

h = Constant Head causing flow in cm.

t = Time in secs

2. The coefficient of permeability is reported in cm/sec at 27° C. The dry density, the void ratio and the degree of saturation shall also be reported.