



**Transport**  
Roads & Maritime  
Services

# Test method T169

Measurement of soil moisture suction  
using the filter paper method

OCTOBER 2012



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## Revision Summary

Ed/Rev Number	Clause Number	Description of Revision	Authorisation	Date
		Reformatted and Revision Summary Added	D.Dash	May 1999
		Date on Test Method Revised to Agree with Date on Revision	D.Dash	Feb 2001
Ed 2/ Rev 0	All	Reformatted RMS template	J Friedrich	October 2012

Note that Roads and Maritime Services is hereafter referred to as 'RMS'.

The most recent revision to Test method T169 (other than minor editorial changes) are indicated by a vertical line in the margin as shown here.

# Test method T169

## Measurement of soil moisture suction using the filter paper method

### 1. Scope

This test method describes the procedure for the determination of the soil moisture suction of a soil using calibrated filter papers. It is applicable to soil having soil suction in the range  $p^F$  1.5 to  $p^F$  4.2.

### 2. Apparatus

- (a) Treated filter papers, Whatman No 540 or similar, calibrated by the procedure described in Clause 5 - Techniques. (Supplied by the Materials and Research Laboratory). The papers are treated by soaking in a 0.005% Mercuric Chloride solution and then oven dried. This treatment helps prevent fungus growth on the filter papers
- (b) Treated filter papers 80mm diameter, Whatman No 524 or similar
- (c) Sample tins approximately 80mm in diameter and 35mm high with airtight lids
- (d) Dolly, 75mm diameter
- (e) Plastic bags, sufficiently large to hold about 12 sample tins
- (f) Routine soil sampling tools, e.g. scoops, chisel, mallet etc
- (g) Balance readable and accurate to .01g within the operating range

### 3. Procedure

The following sampling procedure is to be carried out as quickly as possible to minimise any change in moisture conditions of the samples.

- (a) Excavate about 1,000 g of the soil, whose suction is to be measured, from its natural environment. Place the material in a metal dish and cover to minimise evaporation losses
- (b) Place about 100 g of the soil in a sample tin, roughly level and compact with the fingers by a kneading action
- (c) Place one 80 mm diameter filter paper placed on top of the soil and then place the dolly on the filter paper. Level the soil by applying uniform pressure to the dolly just sufficient to level the soil without squeezing any water from it
- (d) Saturate one of the calibrated numbered filter papers and place symmetrically on the other 80 mm diameter filter paper and place another 80mm diameter filter paper on top of the calibrated filter paper
- (e) Place another 100 g of the soil sampled on top of the three filter papers and compact using a uniform pressure on the dolly as in *Procedure (c)*
- (f) Place the lid firmly on the sample tin and inside a plastic bag, and seal
- (g) Repeat the above procedure with a further three portions, ensuring that sample tin is filled completely
- (h) Leave the tins until equilibrium is reached. Invert the tins each three days to ensure a uniform distribution of soil moisture throughout the sample
- (i) Equilibrium is usually reached within seven days but may take longer, especially at higher suction values. Carefully remove the central calibrated filter paper from each sample tin and quickly weigh it. Dry the filter papers to a constant mass in an oven at a temperature with the range of 105°C to 110°C, and weigh quickly again

#### 4. Reporting

- (a) Calculate the moisture content of each calibrated filter paper as follows:-

Mass of moist filter paper = A (g)

Mass of dry filter paper = B (g)

$$\text{Moisture content} = \frac{A - B}{B} \times 100(\%)$$

Using the filter paper calibration chart supplied with the filter papers read off the individual suction values for each of the filter paper used. At least four filter papers should be used for each determination

- (b) Report the average soil suction for the four (or more) filter papers to the nearest 0.1 pF unit

#### 5. Techniques

- (a) Care should be exercised when handling the calibrated numbered filter papers as these can be reused. After each test thoroughly wash the filter papers in water to remove any traces of salts and then oven dry and store for re-use
- (b) This test is best performed on a moisture susceptible soil, i.e. soil which experiences relatively large changes in moisture content throughout the range of suction that is likely to occur in situ. These materials are usually characterised by high percentages of materials passing the 75  $\mu\text{m}$  sieve
- (c) When weighing filter papers it must be emphasised that they should be weighed as quickly as possible especially when they have been oven dried as they gain moisture from the atmosphere very quickly
- (d) The filter papers are calibrated over the range pF 1.0 to pF 4.2 using suction plates (for pFs 1.0 and 1.8) and pressure plate extractors (for pFs 2.5, 3.3 and 4.2)