

STANDARDS AUSTRALIA

RECONFIRMATION

OF

AS 1289.2.2.1—1998

Methods of testing soils for engineering purposes

Method 2.2.1: Soil moisture content tests—Determination of the total suction of a
soil—Standard method

RECONFIRMATION NOTICE

Technical Committee CE-009 has reviewed the content of this publication and in accordance with Standards Australia procedures for reconfirmation, it has been determined that the publication is still valid and does not require change.

Certain documents referenced in the publication may have been amended since the original date of publication. Users are advised to ensure that they are using the latest versions of such documents as appropriate, unless advised otherwise in this Reconfirmation Notice.

Approved for reconfirmation in accordance with Standards Australia procedures for reconfirmation on 13 June 2013.

The following are represented on Technical Committee CE-009:

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NOTES

Australian Standard®

Methods of testing soils for engineering purposes

Method 2.2.1: Soil moisture content tests— Determination of the total suction of a soil—Standard method

1 SCOPE This Standard sets out a method for the laboratory determination of the total suction of a soil (see AS 2870) by measurement of the dewpoint temperature of a thermocouple in a small air space in equilibrium with the soil. The method is applicable for suctions ranging from pF 3.2 to approximately pF 5.

2 REFERENCED DOCUMENT The following document is referred to in this Standard:
AS
2870 Residential slabs and footings — Construction

3 APPARATUS The following apparatus is required:

- (a) Thin-walled sampler consisting of a tube with a bevelled cutting edge machined directly on the sample tube. The bevelled cutting edge shall make an angle not exceeding 15° to the axis of the tube with a permitted land width at the cutting edge not exceeding 0.5 mm. The ratio of net projected area of sampler to projected area of sample core shall not exceed 10%, and any internal clearance shall not exceed 1% of the diameter at the cutting edge.
- (b) Dewpoint microvoltmeter and psychrometric sample chamber (see Note 1) with manufacturer's instruction manual.
- (c) Flat glass plate approximately 10 mm thick and at least 400 mm square.
- (d) Palette knife having a blade approximately 100 mm long and 20 mm wide and a scalpel for cutting.
- (e) Clock or watch with a sweep second hand or a digital stopwatch for determining equilibrium times and cooling and heating times.
- (f) Drying room with temperature controlled at $23 \pm 2^\circ\text{C}$ and with a relative humidity maintained between 40% and 60%. In areas of Australia where maintenance of these temperature and humidity limits is impractical, the equipment shall be calibrated and operated in a similarly stable climatic environment.

4 SAMPLES An intact sample shall be obtained from a thin-walled sampler pushed into the soil. The sample shall be at least 30 mm in length and a practical minimum of 30 mm in diameter (see Note 2). A visual description of the soil shall be recorded. After the sample is obtained, it shall be sealed quickly and thoroughly, taking care to exclude air. Samples shall be stored in the temperature controlled drying room for a minimum period of six hours prior to testing.

5 PROCEDURE The procedure shall be as follows:

- (a) Inspect the terminals on the microvoltmeter and check that the chamber wire connections are tight and correct. Record the chamber number.
- (b) Check the temperature in the chamber using the temperature switch on the microvoltmeter. Record the chamber temperature.
- (c) Set the cooling coefficient (π_v) of the chamber as described in the manufacturer's instruction manual, or adjust π_v for the chamber temperature based on past recorded variation of π_v with temperature. Record the value of π_v . Switch off the microvoltmeter.
- (d) From the soil sample, obtain a soil subsample of minimum diameter 7 mm and cut a 3 to 4 mm thick slice of soil to fit the standard sample cup, 9.5 mm diameter and 4.5 mm deep. Avoid contact of the subsample with hands.
- (e) Quickly transfer the subsample to the sample cup and trim the soil surface to ensure that the soil will not contact the thermocouple junction when placed inside the sample chamber. Clean the surface of the sample cup with a soft dry brush or dry tissue. Place the cup in the sample chamber and seal the sample chamber. Record the time.
- (f) Wait for the required equilibrium time (see Note 3) and then read the soil suction in microvolts as follows:
 - (i) Turn the microvoltmeter ON with the FUNCTION switch on SHORT, adjust the reading to zero, then wait approximately 30 s.
 - (ii) Turn the FUNCTION switch to READ. If the difference between SHORT and READ readings is greater than $2 \mu\text{V}$, temperature equilibration is not satisfactory and further equilibrium time is required. Repeat procedure until equilibrium is apparent.
 - (iii) Check the temperature in the chamber and record it. Adjust π_v accordingly.
 - (iv) Select an appropriate output voltage range and set the voltmeter to zero.
 - (v) Set the FUNCTION switch to COOL for the required cooling time as given in Table 1.
 - (vi) Set the FUNCTION switch to DEW POINT and record the voltage output in microvolts to the nearest 0.1 at the observed stable plateau point.
 - (vii) Calculate the soil suction using the calibration equation for the sample chamber (see Note 4). If the equilibrium time for the calculated suction is not satisfactory (see Note 3) turn the FUNCTION switch to HEAT for 3 s, then to SHORT. Switch the microvoltmeter off. Wait a minimum of 10 min and repeat Step (f).

 If the reading seems unusually low, or if the output of the thermocouple junction takes longer than normal to return to zero after heating, the thermocouple may be contaminated. Clean and dry the thermocouple in accordance with the manufacturer's instructions and check the calibration of the equipment. The test may then be continued using a new subsample.
- (g) Repeat Steps (d) to (f) on a second subsample.
- (h) If the two readings provide suctions which differ by either more than 0.2 pF for suctions less than or equal to 3.6 pF, or more than 0.1 pF for suctions greater than 3.6 pF, an additional subsample shall be tested.