

Australian Standard®

Methods of testing soils for engineering purposes**Method 3.8.3: Soil classification tests—
Dispersion—Determination of pinhole dispersion
classification of a soil**

AS 1289.3.8.3:2014

PREFACE

This Standard was prepared by the Standards Australia Committee CE-009, Testing of Soils for Engineering Purposes, to supersede AS 1289.3.8.3—1997.

This Standard incorporates Amendment No. 1 (March 2015). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.

METHOD

1 SCOPE

This Standard sets out the method for the determination of pinhole dispersion classification of a compacted fine-grained soil. The test is carried out on the portion of soil passing the 2.36 mm aperture sieve.

2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS	
1152	Specification for test sieves
1289	Methods of testing soils for engineering purposes
1289.0	Part 0: General requirements and list of methods
1289.2.1.1	Method 2.1.1: Soil moisture content tests—Determination of the moisture content of a soil—Oven drying method (standard method)
1289.3.2.1	Method 3.2.1: Soil classification tests—Determination of the plastic limit of a soil—Standard method
1289.5.1.1	Method 5.1.1: Soil compaction and density tests—Determination of the dry density/moisture content relation of a soil using standard compactive effort
1289.5.4.1	Method 5.4.1: Soil compaction and density tests—Compaction control test—Dry density ratio, moisture variation and moisture ratio

3 APPARATUS

The following apparatus shall be used:

- (a) Airtight sample bags or other suitable airtight containers.
- (b) Sieve, 2.36 mm aperture as specified in AS 1152.
- (c) Potable water, distilled water or water supplied by client.
NOTE: If client supplied water is used, the colour of the water may restrict the ability to identify visibility of colour and have an influence on the classification.
- (d) Clear plastic soil specimen cylinder 30.0 ±0.5 mm internal diameter and 100 mm long (see Figure 1).
- (e) Apparatus to hold the soil specimen cylinder during assembly and extrusion of the specimen.
- (f) Non-corrodible metal compaction pedestal close-fitting when assembled with the clear plastic soil specimen cylinder (see Figure 2).
- (g) Vernier caliper capable of measuring to the nearest 0.1 mm.
- (h) Plastic or brass nipple (see Figure 1).
- (i) 1.0 ±0.1 mm diameter drill bit, rigid metal rod or other suitable alternative.
- (j) Wire screens, 1 mm to 2 mm aperture.
- (k) Pea gravel passing 9.5 mm sieve and retained on the 6.7 mm sieve, washed, rounded and non-porous.
- (l) Constant head tank (see Figure 3) or other appropriate constant head assembly.
- (m) Graduated measuring cylinders.
NOTE: Measuring cylinders of 25 mL and 100 mL capacity will generally be satisfactory, but other capacities may be used.
- (n) Stop-clock readable and accurate to 2 s over a period of 10 min.
- (o) A matt black piece of A4 size card or equivalent.

4 SPECIMEN PREPARATION

The specimen preparation shall be as follows:

- (a) Ensure that soil samples are kept at natural moisture content by shipping and storing in airtight bags or containers before testing.
NOTE: Certain clays exhibit an irreversible change of dispersion-erosion properties if permitted to dry out. It is essential that the natural moisture content of the soil sample be maintained until the time of testing.
- (b) Sieve soil through 2.36 mm sieve to remove the gravel particles in order to produce a test sample.
- (c) Determine the natural moisture content of the test sample obtained in Step (b) in accordance with AS 1289.2.1.1.
- (d) If required, the following tests shall also be performed:
 - (i) Determine the plastic limit of the test sample in accordance with AS 1289.3.2.1.
 - (ii) Determine the maximum dry density and optimum moisture content (OMC) of the test sample in accordance with AS 1289.5.1.1.

- (e) Adjust the moisture content of the test sample to the plastic limit or OMC or to a value as otherwise specified. When adding water, use potable water, distilled water or other water specified. When drying to remove water, the temperature shall not exceed 50°C. Thoroughly and uniformly mix the test sample. Cure the sample in accordance with Table 1 below.

TABLE 1
MINIMUM CURING TIME

Sample condition prior to addition or removal of water	
Within 2% of OMC	Greater than 2% from OMC
24 h	48 h

- (f) Calculate the mass of wet soil required to produce a layer of one-fifth of the final height of the specimen compacted to a density ratio equal to 95% of the maximum dry density (see AS 1289.5.4.1), or to a density or density ratio as otherwise specified. Prepare five portions of the calculated mass from the test sample prepared in accordance with Clause 4(e).
- (g) Assemble the plastic cylinder over the metal pedestal. Place the first portion in the plastic cylinder and compact to achieve the required height using an appropriate tamping tool, lightly scarify the top of each compacted layer, except for the top layer to ensure the bonding between layers.
- NOTE: It is suggested that the heights for each layer be marked on the external surface of the clear plastic cylinder, or each layer should be measured using a vernier caliper.
- (h) Repeat Step (g) for the subsequent four layers to achieve a specimen height of 40 ± 0.5 mm. Cure the compacted specimen for not less than 24 hours in an airtight container.
- (i) Insert the top cap into the specimen by hand to create the conical indentation for the insertion of the brass nipple. Insert the brass nipple into the top of the specimen until the end is flush with the compacted soil face.
- NOTE: If the sample is too stiff to achieve full penetration by hand, use a conical reaming tool to create a pilot hole smaller than the diameter of the nipple.
- (j) Form a 1 mm diameter hole through the soil specimen from the opening in the nipple using the drill bit or rigid metal rod. Inspect to ensure that the hole created is clear.
- (k) Place the wire mesh and pea gravel at either end of the sample and carefully assemble the apparatus as shown in Figure 3. Connect the assembled apparatus to the constant head tank filled with test water.

5 PROCEDURE

The procedure shall be as follows:

- (a) Set the head to 50 mm and allow the water to flow through the specimen. Measure the flow through the soil for $5 \text{ min} \pm 2 \text{ s}$ in 10 mL increments in accordance with the following provisos:
- (i) If the flow ceases during this stage of the test, reform the 1 mm hole and continue the test. Record that the hole has been reformed.
 - (ii) If the flow is visibly cloudy, continue the test for an additional 5 min. If the flow does not become clearer with time, the test is complete and record the designation as D1; if the flow becomes clear, proceed to Step (b).

- (iii) If the flow has a slight but easily visible colour when viewed from the side of the cylinder, continue the test for an additional 5 min. If the flow does not become clearer with time the test is complete and record the designation as D2; if the flow becomes clear, proceed to Step (b).
- (iv) If the water is clear (or has only a trace of colour) after 5 min, proceed to Step (b).

NOTES:

- 1 To assist in the determination of changes in water clarity, place the matt black A4 card behind and beneath the measuring cylinder.
 - 2 Where falling particles are observed in the measuring cylinders at any stage, this should be recorded.
- (b) Raise the head to 175 mm and allow the water to flow through the specimen. Measure the flow through the soil for 5 min $\pm$ 2 s in 25 mL increments in accordance with the following provisos:
 - (i) If the water has colour and the rate of flow increases rapidly, stop the test and record the designation as PD1.
 - (ii) If the water continues to flow clear, or has only a trace of colour as seen from the side of the cylinder, proceed to Step (c) [see Step (a) Notes 1 and 2].
 - (c) Raise the head to 350 mm and allow the water to flow through the specimen. Measure the flow through the soil for 5 min $\pm$ 2 s in 50 mL increments in accordance with the following provisos:
 - (i) If the flow has a slight colour or exceeds 3.5 mL/s, stop the test and record the designation as PD2.
 - (ii) If the flow is completely clear as seen from the top of the measuring cylinder, proceed to Step (d) (see Step (a) Notes 1 and 2).
 - (d) Raise the head to 1000 mm and allow the water to flow through the specimen for 5 min $\pm$ 2 s in 50 mL increments and record the flow through the soil and whether the flow has a trace of colour and record the designation as ND1 or is completely clear, record the designation as ND2 (see Step (a) Notes 1 and 2).
 - (e) At the end of the test, extrude the specimen from the cylinder, split radially about halfway along the specimen and examine the hole for erosion. Record the size of the hole in terms of the number of diameters of the original 1.0 mm diameter.
- NOTE: When breaking the soil specimen at the end of the test for inspection, care must be taken that the hole is not damaged or smeared. If necessary, break the specimen in a second place.

6 CLASSIFICATION

The soil shall be classified according to the visibility of colour of flow at end of test criteria shown in Table 2.

7 TEST REPORT

The following shall be reported:

- (a) The pinhole dispersion classification (designation and description).
- (b) The rate of flow, in millimetres per second, through the specimen at the end of the test.
- (c) Source of material.
- (d) Soil description.