

# Australian Standard®

## Methods of testing soils for engineering purposes

### Method 4.4.1: Soil chemical tests— Determination of the electrical resistivity of a soil—Method for sands and granular materials

**1 SCOPE** This Standard sets out a procedure for the measurement of electrical resistivity of sands and granular materials (see Note 1).

**2 REFERENCED DOCUMENTS** The following documents are referred to in this Standard:

AS

1289	Methods of testing soils for engineering purposes
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)
1289.2.1.2	Method 2.1.2: Soil moisture content tests—Determination of the moisture content of a soil—Sand bath method (subsidiary method)
1289.2.1.4	Method 2.1.4: Soil moisture content tests—Determination of the moisture content of a soil—Microwave-oven drying method (subsidiary method)
1289.2.1.5	Method 2.1.5: Soil moisture content tests—Determination of the moisture content of a soil—Infrared lights method (subsidiary method)
1289.2.1.6	Method 2.1.6: Soil moisture content tests—Determination of the moisture content of a soil—Hotplate drying method (subsidiary 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
1289.E5.1	Method E5.1: Soil compaction and density tests—Determination of minimum and maximum dry density of a cohesionless material
1289.E6.1	Method E6.1: Soil compaction and density tests—Density index method for a cohesionless material

**3 APPARATUS** The following apparatus shall be used:

- (a) A plastic soil box as shown in Figure 1. The box shall be approximately 220 mm long with internal dimensions of 40 mm × 30 mm. It shall be fitted with plate electrodes at each end and potential measurement pins on one side spaced so that

the distance between their axes in centimetres is numerically equal to the cross-sectional area of the box in square centimetres.

- (b) An instrument for measuring earth resistance\*.

**4 PROCEDURE** The procedure shall be as follows:

- (a) Determine the moisture content of the sand or granular material, as delivered to the laboratory, in accordance with AS 1289.2.1.1, or one of the subsidiary methods 2.1.2, 2.1.4, 2.1.5 and 2.1.6 (see Note 2).
- (b) Determine the maximum density in accordance with AS 1289.E5.1 or AS 1289.5.1.1 as appropriate and calculate the dry density required by the relevant specification (see Note 3).

Where density is not specified for the project, use a dry density ratio of 90 percent (see AS 1289.5.4.1) or dry density index of 90 percent (see AS 1289.E6.1), as appropriate.

- (c) Calculate the mass of sand, as delivered, to be compacted into the mould to produce the required dry density ratio. Calculate the volume of water required for complete saturation of the sample.
- (d) Obtain by quartering or riffing four subsamples of sand or granular material of about 600 g. From each subsample, take the mass of material sufficient to fill the soil box.
- (e) Place about 75 percent of the additional water required into the soil box (see Note 4). Carefully place the sand or granular material into the water in the soil box. Gently tap the soil box to obtain the required density condition. Add remaining water to the soil box ensuring that as much air as possible is expelled from the sand or granular material.
- (f) Connect the four terminals on the soil box to the appropriate terminals on the earth tester. Take resistance readings on the null indicator at a time of 1 min after connection, and record.
- (g) Repeat Steps (e) and (f) for remaining subsamples.
- (h) Take the mean of the four values obtained. If any value departs from the mean by more than 10 percent, obtain another subsample and repeat the procedure.

**5 CALCULATION** Divide the mean of the four values obtained by 100 to obtain the resistivity of the material, in ohm metres.

**6 TEST REPORT** The following test results and general information shall be reported:

- (a) *Test results* Report the following:
- (i) The mean resistivity value in ohm metres to the following accuracy:
- (A) Mean resistivity greater than 50  $\Omega$ .m—report to nearest 5  $\Omega$ .m.
- (B) Mean resistivity between 10  $\Omega$ .m and 50  $\Omega$ .m—report to nearest 2  $\Omega$ .m.
- (C) Mean resistivity less than 10  $\Omega$ .m—report to nearest 1.0  $\Omega$ .m.
- (ii) The density ratio  $R_D$  or density index  $I_D$  of the material under test, as appropriate, in percent.

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\* A 4-terminal null balance Megger earth tester or equivalent apparatus is suitable.

- (b) *General information* Report the following:
- (i) Sample identification.
  - (ii) Source of material.
  - (iii) Date of sampling.
  - (iv) Soil description.
  - (v) The number of this Standard, i.e. AS 1289.4.4.1.

NOTES ON TEST:

- 1 This test is normally used for the quality control of bedding and backfilling materials for cast iron and steel pipe, buried metallic structures and reinforcement. It does not indicate the corrosion hazards to buried metals since these are largely controlled by the nature of the groundwater.
- 2 For the purposes of this test, rapid methods of determining moisture content are acceptable.
- 3 For the purposes of this test, compaction parameters from previous compaction tests may be used if the materials are similar.
- 4 The resistivity of the water added to the sample shall be in excess of 200  $\Omega$ .m.