Laboratory tests for determining the coefficient of permeability of soil

DIN 18130-1

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In keeping with current practice in standards published by the International Organization for Standardization (ISO), a comma has been used throughout as the decimal marker.

Contents

Continued on pages 2 to 24.

Translation by DIN-Sprachendienst.

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Foreword

This standard has been prepared by Technical Committee *Baugrund, Versuche und Versuchsgeräte* of the *Normenausschuß Bauwesen* (Building and Civil Engineering Standards Committee).

Amendments

In comparison with the November 1989 edition, the following amendments have been made.

a) A simple hydraulic cell test has been included (cf. subclause 7.4), while the triaxial cell test using saturated specimens and a low hydraulic gradient/pore pressure ratio (previously described in clause 9) is no longer specified.

b) The standard has been editorially revised.

Previous editions

DIN 18130-1: 1983-11, 1989-11.

1 Scope and field of application

This standard is intended for use in earthworks and foundation engineering. It specifies laboratory methods of determining the coefficient of permeability of unconsolidated soil ('permeability', for short). The results obtained are used in calculations of groundwater flow and serve to assess the permeability of man-made impervious layers and filter layers.

2 Normative references

This standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the titles of the publications are listed below. For dated references, subsequent amendments to or revisions of any of these publications apply to this standard only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

DIN 4021	Ground exploration by excavation, boring and sampling
DIN 4022-1	Classification and description of soil and rock – Borehole logging of soil and rock not involving continuous coring
DIN 18125-2	In-situ determination of soil density
DIN 18127	Determination of dry density/moisture content relationship – (Proctor test)
DIN 18137-2	Determination of the shear strength parameters of soil by the triaxial test
DIN 18196	Earthworks – Soil classification for civil engineering purposes and methods of soil identification

3 Concepts

3.1 Flow rate

For the purposes of this standard, the flow rate, Q, is the volume of water, V_w, passing through the cross-sectional area, A (including particles and voids), of a specimen per unit time, t:

$$Q = \frac{V_w}{t} \qquad (1)$$

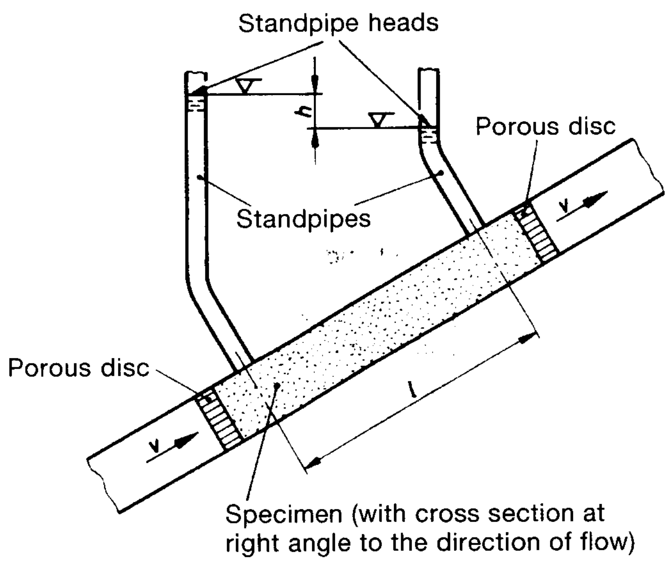

Figure 1: Water flow in a soil specimen

3.2 Discharge velocity

The discharge velocity, v, is the rate of flow of water through a cross-sectional area, A, at a right angle to the direction of flow:

$$v = \frac{Q}{A} \tag{2}$$

3.3 Standpipe head

The standpipe head (i.e. piezometric head) for a given soil specimen through which water flows is the head of water that results when a tube of sufficient length is connected to this specimen without significantly affecting the flow conditions (cf. figure 1).

3.4 Difference in head

The difference in head, h, is the difference between the heads of two standpipes (or piezometric tubes) located at different cross sections of a specimen (cf. figure 1).

3.5 Hydraulic gradient

The hydraulic gradient, i, is the ratio of the difference in total head of water (head loss), h, on either side of a specimen to the length of the flow path, l (distance between the corresponding gland points, measured in the direction of flow), i.e.

$$i = \frac{h}{l} \tag{3}$$

3.6 Coefficient of permeability

In accordance with Darcy's law of laminar flow, the coefficient of permeability of a saturated soil, k, is the ratio of the discharge velocity, v, to the hydraulic gradient, i, i.e.

$$k = \frac{v}{i} = \text{const.} \tag{4}$$

NOTE: The coefficient of permeability of a saturated soil is always greater than that of a partially saturated soil (cf. note 2 to subclause 5.5).

3.7 Permeability range

A permeability range covers a certain range of coefficients of permeability.

NOTE: For civil engineering purposes, soil is classified, according to the degree of permeability, into the five permeability ranges given in table 1.

Table 1: Permeability ranges

Coefficient of permeability, k, in m/s	Degree of permeability
Less than 10^{-8}	Very slightly permeable
10^{-8} to 10^{-6}	Slightly permeable
Over 10^{-6} up to 10^{-4}	Permeable
Over 10^{-4} up to 10^{-2}	Highly permeable
Over 10^{-2}	Extremely permeable

3.8 Test class

A test class covers the permeability tests carried out under the same conditions of saturation and water flow (cf. table 4).

NOTE: The classification system given in table 4 is based on the degree of accuracy to which the coefficient of permeability of a saturated soil can be determined.

4 Designation

Designation of a class 3 (3) laboratory test for determining the coefficient of permeability of fine-grained soil using a compression permeameter (KD), with measurement of hydraulic gradient and water volume by means of standpipes or piezometric tubes (ES, ST), and with the specimen under static load (SB):

Test DIN 18130 – KD – ES – ST – SB – 3