INTERNATIONAL STANDARD

ISO 17892-11

First edition
2019-01

Geotechnical investigation and testing — Laboratory testing of soil —

Part 11: Permeability tests

Reconnaissance et essais géotechniques — Essais de laboratoire sur les sols —

Partie 11: Essais de perméabilité

Reference number
ISO 17892-11:2019(E)

© ISO 2019



COPYRIGHT PROTECTED DOCUMENT

© ISO 2019

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword ... **iv**
Introduction ... **v**
1 Scope ... **1**
2 Normative references ... **1**
3 Terms and definitions ... **1**
4 Symbols ... **2**
5 Apparatus ... **3**
5.1 General ... 3
5.2 Permeameters ... 3
5.2.1 General ... 3
5.2.2 Rigid wall permeameters ... 3
5.2.3 Flexible wall permeameter ... 5
5.3 Porous discs ... 7
5.4 Permeant water properties ... 7
5.5 Measurement and control devices ... 7
5.5.1 Elevation head ... 7
5.5.2 Displacement and volume measuring devices ... 7
5.5.3 Flow volume measurement device ... 7
5.6 Ancillary apparatus ... 8
6 Test procedure ... **8**
6.1 General requirements ... 8
6.1.1 Saturation ... 8
6.1.2 Hydraulic gradient ... 8
6.1.3 Water temperature ... 9
6.2 Specimen preparation ... 9
6.2.1 General ... 9
6.2.2 Rigid wall permeameter ... 9
6.2.3 Flexible wall permeameter ... 10
6.3 Test preparation ... 10
6.3.1 Cylindrical permeameter ... 10
6.3.2 Oedometer ring ... 10
6.3.3 Flexible wall permeameter ... 11
6.4 Permeability measurement ... 12
6.5 Dismounting ... 14
7 Test results ... **14**
7.1 Bulk density, dry density, water content and degree of saturation ... 14
7.2 Coefficient of permeability and hydraulic gradient ... 14
7.3 Correction for test temperature ... 15
8 Test report ... **16**
8.1 Mandatory reporting ... 16
8.2 Optional reporting ... 16
Annex A (normative) **Calibration, maintenance and checks** ... **17**
Bibliography ... **20**

© ISO 2019 – All rights reserved

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 341, *Geotechnical Investigation and Testing*, in collaboration with ISO Technical Committee ISO/TC 182, *Geotechnics*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This first edition cancels and replaces ISO/TS 17892-11:2004, which has been technically revised. It also incorporates the Technical Corrigendum ISO/TS 17892-11:2004/Cor 1:2006.

The main changes compared to the previous edition are as follows:

— the document has been restructured with general revision of text and figures and addition of specimen preparation procedures;

— types of apparatus have been included for rigid wall permeameters, both cylindrical and oedometer ring equipment, and flexible wall permeameters;

— permeability measurement by constant head, falling head and constant flow conditions has been included;

— normative Annex A on calibration, maintenance and checks has been added.

A list of all the parts in the ISO 17892 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

© ISO 2019 – All rights reserved

Introduction

This document provides laboratory test methods for the determination of the coefficient of permeability of soils within the international field of geotechnical engineering.

The tests have not previously been standardized internationally. It is intended that this document presents broad good practice and significant differences with national documents is not anticipated. It is based on international practice (see Reference [1]).

The permeability test is carried out on a cylindrical test specimen that is either confined laterally by a rigid container or by a flexible membrane. The specimen is subjected to differential hydraulic head and the water flow is measured under either a constant or falling head. The results are used to determine the coefficient of permeability of the soil specimen. Tests can be carried out on undisturbed, remoulded, compacted or reconstituted specimens.

The calculation of the coefficient of permeability assumes the application of Darcy's law for laminar flow of water under saturated conditions.

It is possible that the size of the specimen does not adequately represent the fabric features present in field conditions.

© ISO 2019 – All rights reserved

Geotechnical investigation and testing — Laboratory testing of soil —

Part 11: Permeability tests

1 Scope

This document specifies methods for the laboratory determination of the water flow characteristics in soil.

This document is applicable to the laboratory determination of the coefficient of permeability of soil within the scope of geotechnical investigations.

NOTE This document fulfils the requirements of the determination of the coefficient of permeability of soils in the laboratory for geotechnical investigation and testing in accordance with EN 1997-1 and EN 1997-2.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 386, *Liquid-in-glass laboratory thermometers — Principles of design, construction and use*

ISO 14688-1, *Geotechnical investigation and testing — Identification and classification of soil — Part 1: Identification and description*

ISO 17892-1, *Geotechnical investigation and testing — Laboratory testing of soil — Part 1: Determination of water content*

ISO 17892-2, *Geotechnical investigation and testing — Laboratory testing of soil — Part 2: Determination of bulk density*

ISO 17892-3, *Geotechnical investigation and testing — Laboratory testing of soil — Part 3: Determination of particle density*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
permeameter
apparatus (cell) containing the test specimen in a permeability test

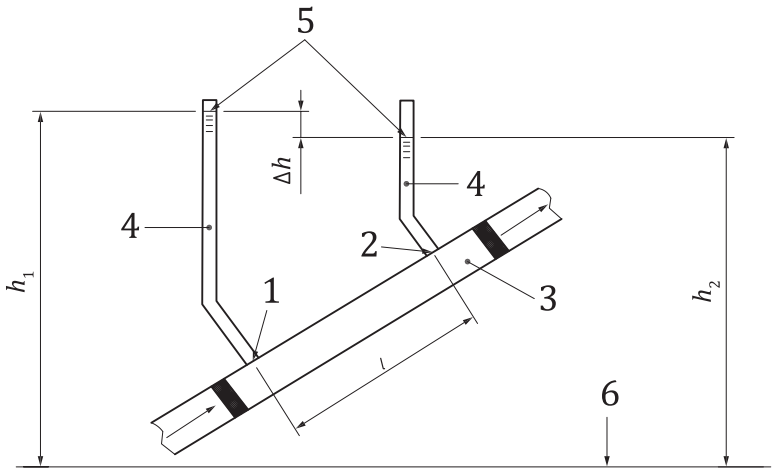
3.2
flow rate
volume of water passing through a specimen per unit time

© ISO 2019 – All rights reserved

3.3
discharge velocity
rate of flow of water per unit cross-sectional area of specimen in the direction of flow

3.4
hydraulic gradient
ratio of the difference in elevation head of water (head loss) between two points, to the length of the flow path (distance between the points measured in the direction of flow)

Note 1 to entry: In Figure 1 the hydraulic gradient is $i = \Delta h/l$.



Key
1 measurement point 1
2 measurement point 2
3 specimen
4 standpipe
5 standpipe head
6 datum

Figure 1 — Water flow in a soil specimen

3.5
coefficient of permeability
ratio of the *discharge velocity* (3.3) to the *hydraulic gradient* (3.4)

Note 1 to entry: The coefficient of permeability is in accordance with Darcy's law for laminar flow.

3.6
degree of saturation
ratio of the volume of water to the volume of voids

4 Symbols

A	cross-sectional area of specimen in the direction of flow
a	cross-sectional area of standpipe
a_{in}	cross-sectional area of inlet pipe
a_{out}	cross-sectional area of outlet pipe
B	pore pressure coefficient
D	diameter of the specimen

© ISO 2019 – All rights reserved