
**Clay geosynthetic barriers —
Determination of water absorption of
bentonite**

*Géosynthétiques bentonitiques — Détermination de l'absorption d'eau
par la bentonite*



Reference number
ISO 10769:2011(E)

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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.

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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.

ISO 10769 was prepared by Technical Committee ISO/TC 221, *Geosynthetics*.

Clay geosynthetic barriers — Determination of water absorption of bentonite

1 Scope

This International Standard specifies a method for determining the water absorption of bentonite. The bentonite component is a part of clay geosynthetic barriers (GBR-C). Water absorption depends on the specific surface of the fine particles and the surface activity of the bentonite. The test provides an index value for production control testing of GBR-C.

2 Normative references

The following referenced documents are indispensable for the application 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 3310-1, *Test sieves — Technical requirements and testing — Part 1: Test sieves of metal wire cloth*

ISO 4793:1980, *Laboratory sintered (fritted) filters — Porosity grading, classification and designation*

ISO 11465, *Soil quality — Determination of dry matter and water content on a mass basis — Gravimetric method*

DIN 18132, *Soil, testing procedures and testing equipment — Determination of water absorption*

3 Terms and definitions

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

3.1

water absorption

w_A

ratio of the mass of water, m_{wg} , absorbed by the dry bentonite specimen in the test apparatus to the dry mass, m_d , of the bentonite specimen

NOTE 1
$$w_A = \frac{m_{wg}}{m_d}$$

where m_{wg} is the limiting value of the absorbed water absorbed over the test period.

NOTE 2 The result may also be expressed as the proportion by mass, in %.

4 Principles

The amount of water absorbed in relation to the dry mass of the bentonite sample is determined over time by an automatic electronic balance system. The water absorption value, w_A , is determined during a test period of 24 hours. Different bentonite samples can be compared using water content diagrams (see Annex A).

5 Apparatus

The following apparatus shall be used.

5.1 Drying oven.

5.2 Water absorption device (based on DIN 18132, for details see Figure 1), consisting of a glass top tube with glass filter plate to support the specimen; a glass connection tube and glass measurement tube with a 2 ml nominal volume; the glass measurement tube is positioned horizontally such that the measurement tube axis is 50 mm lower than the surface of the glass filter plate; the filter plate shall be clean and without contamination; the glass top tube shall be cleaned after 50 test uses (e.g. in an ultrasonic bath) or replaced.

5.3 Mortar and pestle or ball mill.

5.4 Desiccator jar.

5.5 Filling funnel with short stem [see Figure 1 c)], inserted into the glass top tube. The outlet of the glass funnel shall be 20 mm above the glass filter plate.

5.6 Glass stopper (see Figure 2).

5.7 Weighing paper (smooth laboratory paper), for use when filling the specimen.

5.8 Electronic balances, with computer interface. The resolution shall be 0,001 g.

5.9 Metal test sieves, with 250 μm mesh size in accordance with ISO 3310-1.

5.10 Computer.

6 Preparation and size of specimens

Sieve the sample of bentonite through a 250 μm mesh size sieve to remove particles greater than 250 μm . Grind all removed particles over 250 μm to a particle size less than 250 μm and resieve them. Dry the passed material in the oven at a temperature of $(60 \pm 3) ^\circ\text{C}$ until it has reached a constant mass in accordance with ISO 11465. Cool the sample to room temperature in a desiccator.

The dry mass of the specimen shall be approximately 0,25 g with no particles greater than 250 μm .

Determine the mass of the specimen with a resolution of 0,001 g.

7 Procedures

7.1 Preparation of the equipment

The inside surfaces of the individual items of glass equipment shall be clean. In order to avoid wetting errors, the glass measurement tube shall be cleaned before the start of the test and flushed several times with demineralised water.

The glass measurement tube (3), glass connection tube (2) and glass top tube (4) including the part above the glass filter plate are all fitted together as shown in Figure 1 in such a way that the ground conical joints are sealed, and filled with demineralised, deaired water, free of entrapped air and bubbles.

The glass measurement tube shall be horizontal. The water level in the glass top tube is now set to the height of the glass filter plate surface. Any droplet attached to the point of the glass measurement tube shall be swabbed off. The inside wall of the glass top tube shall be dried above the glass filter plate by swabbing off the water.

For the calibration, the equipment shall be weighed without specimen for a period of 24 h. Repeat the preparation if the mass is not constant after 24 h with a resolution of $\pm 0,03$ g.

7.2 Test procedure

Connect the interface of the electronic balance with the computer to establish a mass variation over time.

The specimen is placed on the glass filter plate using the glass funnel. The glass funnel outlet shall be placed centrally over the glass filter plate in the glass top tube in order to obtain a reproducible, conical test specimen on the glass filter plate. The test specimen shall be passed into the glass funnel using a smooth laboratory paper folded in the middle. The glass top tube shall be plugged with a glass stopper (see Figure 2).

The test period begins when the first particles of bentonite fall on the filter plate. The mass of the absorbed water is measured by the electronic balance and recorded by the computer. The duration of the test is 24 h.

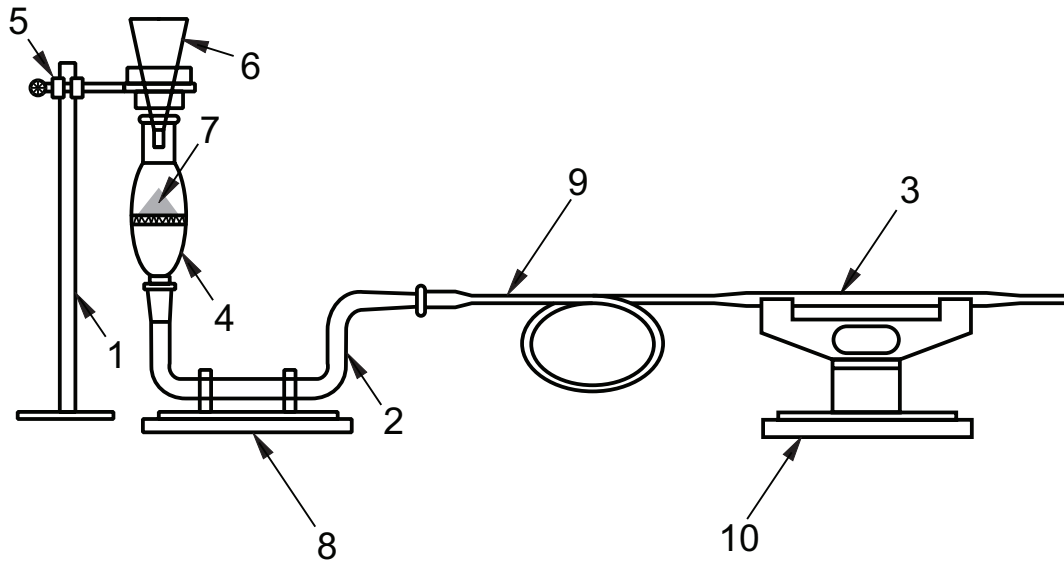
A second electronic balance may be utilized to control and calibrate the first electronic balance.

8 Test report

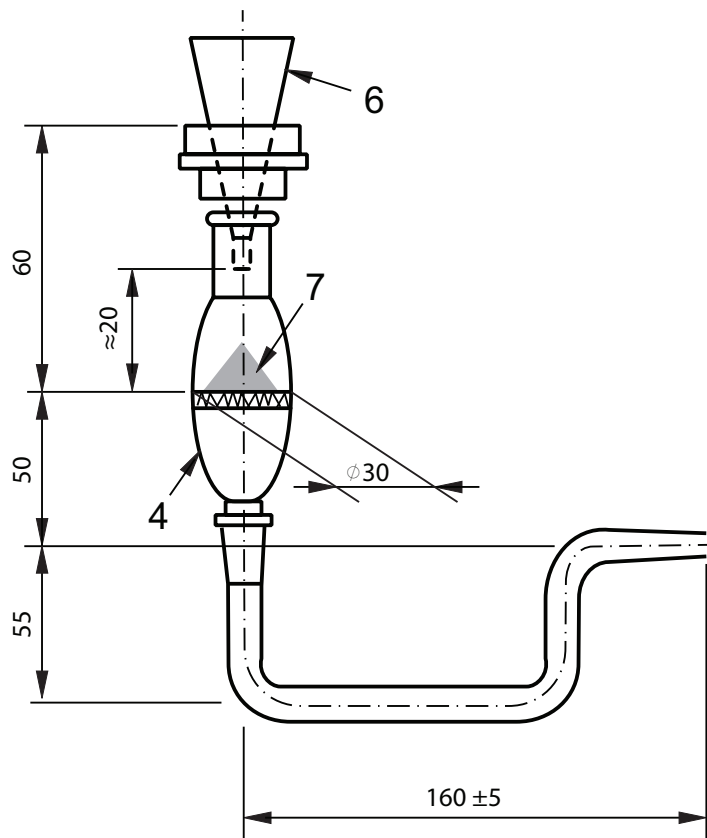
The test report shall include the following information:

- a) the reference number and year of publication of this International Standard (i.e. ISO 10769:2011);
- b) the identification of the sample, date of receipt and date of testing;
- c) the mass of the fraction particle size lower than 250 μm ;
- d) the room temperature;
- e) the water absorption, w_A ;
- f) a water content diagram, the water contents of bentonite shall be shown in a diagram in relation to the test time, where
 - abscissa – time to a logarithmic scale,
 - ordinate – water content to a linear scale;
- g) any deviation from this procedure.

Dimensions in millimetres

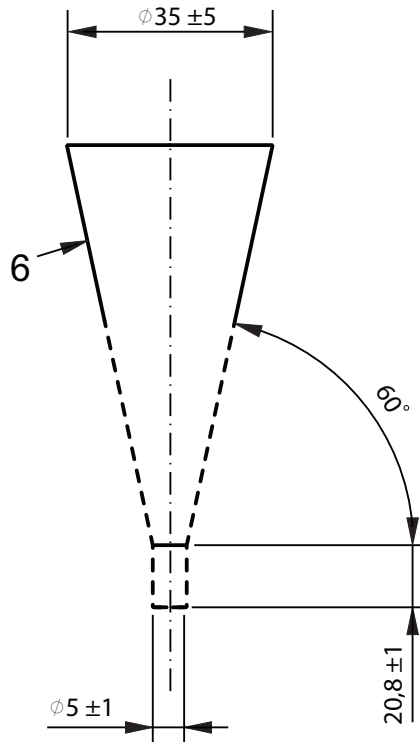


a) Test fixture



b) Details of glass top tube, glass connection tube and funnel

Figure 1 (continued)



c) Details of funnel

Key

- 1 stand
- 2 glass connection tube with ground female joint and ground male joint, axis of the ground conical joints arranged at right angles to one another
- 3 glass measurement tube
- 4 glass top tube with ground female joint and ground conical joint and glass filter plate, (porosity P 100, thickness 3 mm) in accordance with ISO 4793:1980, sealed in at right angles to the top tube pipe axis and at a distance of 50 mm from the measurement tube axis
- 5 stand clamp for glass funnel (6)
- 6 funnel with short stem and smooth inside surface
- 7 specimen cone
- 8 balance
- 9 hose
- 10 inspection balance

Figure 1 — Modified water absorption device based on Enslin/Neff method

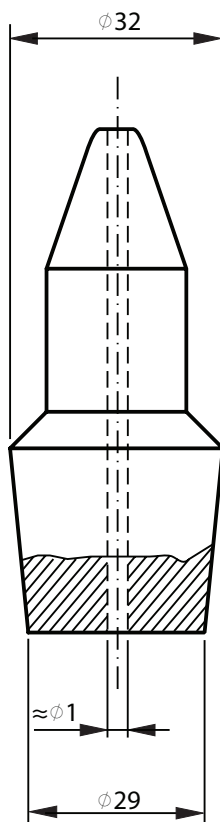
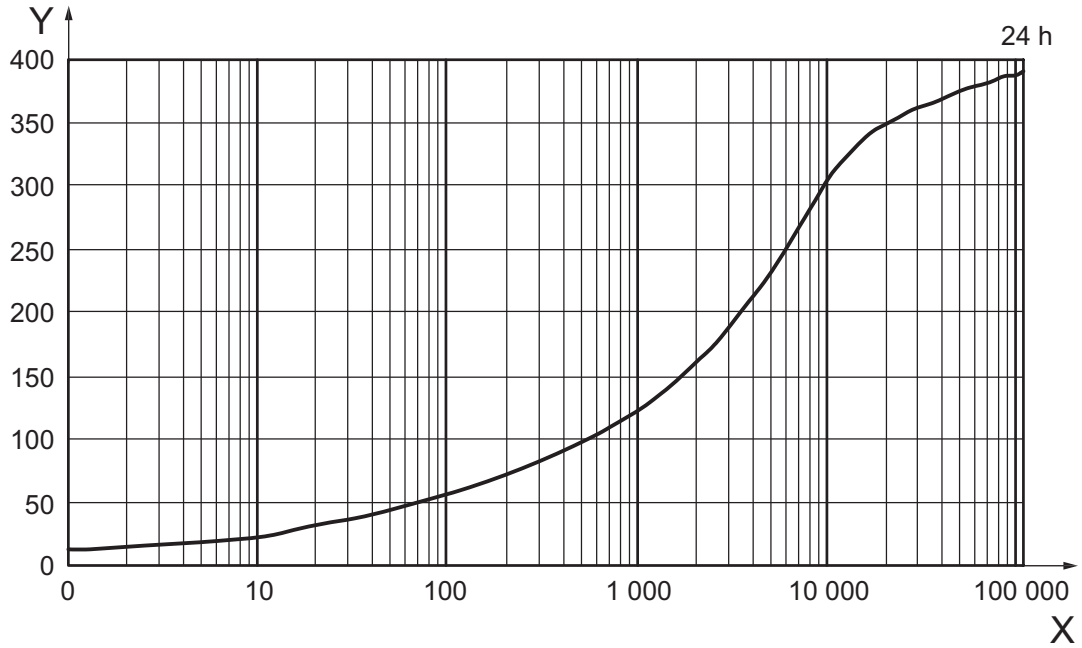


Figure 2 — Glass stopper with ground conical joint and capillary opening

Annex A
(informative)

Water content diagram



Key

X time (s)

Y water content (%)

Figure A.1A. — Sample for a water content diagram

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