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Pre-shaped growing media — Determination of length, width, height, volume and bulk density

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National foreword

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A list of organizations represented on this committee can be obtained on request to its secretary.

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Supports de culture préformés - Détermination de la longueur, de la largeur, de la hauteur, du volume et de la masse volumique apparente

Vorgeformte Kultursubstrate - Bestimmung von Länge, Breite, Dicke, Volumen und Schüttdichte

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Foreword

This document (EN 15761:2009) has been prepared by Technical Committee CEN/TC 223 “Soil improvers and growing media”, the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2010, and conflicting national standards shall be withdrawn at the latest by June 2010.

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Introduction

This European Standard has been produced so that there is a standard method to measure and weigh pre-shaped growing media and to calculate the volume and bulk density.

The volume of growing media is a useful attribute for growers and is critical for ensuring plants have sufficient growing media for their root system.

The bulk density is crucial as the reporting of all chemical analyses is expressed in units of weight per volume, and the volume is determined from the weight of the sample used for the chemical analyses.

Pre-shaped growing media is generally at present made from Stonewool or Rockwool or mineral wool. They are known by various names, typically:

— "plugs" are small blocks used for seedlings, which are generally cylindrical in shape and with a diameter from 20 mm; once the seed has germinated the seedling in the plug may then be placed into "blocks";

— "blocks" may have holes to take plugs and can vary in size from 40 mm × 40 mm × 40 mm up to 100 mm × 200 mm × 65 mm; they are generally used for propagation purposes;

— "slabs" are used for growing vegetables and range in size from 370 mm × 240 mm × 100 mm to 2 000 mm × 200 mm × 75 mm.

It is anticipated that this standard will be developed to encompass other new pre-shaped growing media in due course, e.g. coir blocks.

1 Scope

This European Standard describes a method of determination of length, width, height, volume and bulk density of rectangular pre-shaped growing media.

In this standard "pre-shaped growing media":

— includes solid, regular shaped, stable growing media sold, which are ready for use as a growing media, where the dimensions and corners are stable, and the surfaces and edges are perpendicular to each other – including mineral wool and polyurethane products;

— does not include solid growing media that has to be hydrated for it to form, varies in dimension with varying water content – for example coir or peat slabs or growing bags.

The minimum linear dimension (length, width or height) for blocks to which this standard applies is 40 mm, and the maximum dimension is 2 000 mm.

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.

CR 13456:1999, *Soil improvers and growing media — Labelling, specifications and product schedules*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in CR 13456:1999 and the following apply.

3.1
length
l
longer linear dimension of the major surface of the test specimen

3.2
width
w
shorter linear dimension of the major surface of the test specimen measured at right angles to the length

3.3
height
h
linear dimension measured perpendicularly to the length and the width planes

3.4
depth
d
linear dimension measuring how deep recess intrude into the media

3.5
bulk density
indication of how much 1 l of the product weighs, with the volume being determined in a standardized way

NOTE The bulk density is expressed in grams per litre (g/L) or in kilograms per cubic metre (kg/m³).

4 Principle

The test specimen is placed on a flat surface and measurements for length, width and height are taken. The volume is calculated from these dimensions and, after the determination of the weight, the bulk density is calculated.

5 Apparatus

5.1 Flat surface, horizontal, flat stable surface, e.g. table top, which is large enough for the test specimen and the measuring devices.

5.2 Metal rule or metal tape, graduated in millimetres and permitting reading to 0,5 mm or less.

NOTE Measures conforming to the requirements of OIML R35-1:2007, *Material measures of length for general use. Part 1: Metrological and technical requirements* [1], Class II are appropriate. This can be obtained from http://www.oiml.org/publications/.

5.3 Height gauge, having an accuracy of at least 0,5 mm.

5.4 Pressure plate, square with a flat base and having sides of dimensions 100 mm x 100 mm, which weighs (50 ± 1) g.

NOTE Any other linear measuring device may be used if the results can be determined to within 0,5 mm.

5.5 Balance, having an accuracy of 0,1 g.

NOTE Any balance conforming to the requirements of OIML R76-1:2006, *Non-automatic weighing instruments. Part 1: Metrological and technical requirements – Tests* [2], Class II is appropriate. This can be obtained from http://www.oiml.org/publications/.

6 Procedure

6.1 Accuracy

Record all dimensional measurements to the nearest 0,5 mm or less.

Record weight to the nearest 0,1 g or less.

6.2 Number of measurements

For measurement of a nominal dimension of 150 mm or less, make one measurement using the pressure plate and the height gauge. Position the pressure plate centrally on the test specimen, covering the maximum area possible.

For measurement of a nominal dimension of more than 150 mm or less than 600 mm, make two measurements at one-third and two-third intervals laterally across the surface being measured, using an appropriate rule or tape.

For measurement of a nominal dimension of more than 600 mm, make three measurements at one-quarter, one-half and three-quarter intervals laterally across the surface being measured, using an appropriate rule or tape.

6.3 Test procedure

6.3.1 General

Lay the test specimen carefully on a flat surface. Determine the linear measurements by making the required number of measurements (6.2) between undamaged edges of the test specimen, keeping the tape or rule perpendicular to the edge.

6.3.2 Test specimens with holes or grooves

If the test specimen has holes or grooves, such as a mineral wool block for culturing, then determine the volume of these recesses for subtracting from the external volume. Using the metal rule or tape (5.2), determine the length, width and determine the depth of each rectangular recess at two points on each axis.

Determine the diameter and depth of each cylindrical recess at two points for each axis. Ensure the depth is measured to the major recessed plane, and not to the depth of any guide hole used to drill the recessed hole.

If the recess is neither rectangular nor cylindrical, then determine its volume in a mathematically correct manner by using the average of at least two measurements per axis.

6.4 Determining the weight

After determining length, width and height (6.2), determine the weight of the test specimen using the balance (5.5).

7 Calculations and expression of results

7.1 Length, width and height

Use the recorded values of the length, width and height of the test specimen, which are all expressed in millimetres, to calculate the mean values for *l, w* and *h*. Round each mean to the nearest millimetre.

7.2 Volume

7.2.1 Accuracy

Record all values for volume to the nearest cubic millimetre, and then divide by 10^6 to obtain the volume in litres. Record to four significant figures.

7.2.2 Test specimens with no recesses

Determine the volume by multiplying the values or, where more than one value has been determined, the mean values for the length, width and height measurements.

7.2.3 Test specimens with recesses

In the case of test specimens that have recesses, e.g. rock wool blocks, subtract the volume of plant holes and grooves from the externally measured volume. Calculate the volume of the recesses in the following way:

In the case of a rectangular recess, substitute the mean values for the length (l), width (w) and depth (d) into the following formula:

$$v = l \times w \times d \quad (1)$$

where

v is the volume, expressed in cubic millimetres (mm^3);

l is the length, expressed in millimetres (mm);

d is the depth, expressed in millimetres (mm);

w is the width, expressed in millimetres (mm).

In the case of a cylindrical recess, substitute the mean values for the diameter (D) and depth (*d*) into the following formula:

$$v = 0{,}25 \times \pi \times D^2 \times d \quad (2)$$

where

v is the volume, expressed in cubic millimetres (mm^3);

D is the diameter, expressed in millimetres (mm);

d is the depth, expressed in millimetres (mm).

7.3 Bulk density

Calculate the bulk density, ρ in grams of substrate per litre. Quote the mean results to three significant figures in grams per litre or kilograms per cubic metre, which are numerically the same.

$$\rho = \frac{m_d}{V} \quad (3)$$

where

m_d is the mass of the test specimen, expressed in grams (g);

V is the volume of the test specimen, expressed in litres (L).

8 Precision

Perform the analysis on the basis of a minimum of five replicates for mats and twenty replicates for blocks that have been taken randomly from each batch. Record the results for each replicate.

NOTE 1 Test specimens are randomly taken.

NOTE 2 Typical performance characteristics for precision and accuracy are shown in Table A.1.

9 Test report

Include the following information in the test report:

a) a reference to this Standard;

b) a complete identification of the test specimen(s);

c) the results of the determinations;

d) any deviations from the procedure specified, as well as any other factor that might have affected the results.

NOTE The test report may be prepared separately or in conjunction with the test report of the subsequent chemical and physical analyses.

Annex A
(informative)

Results of an inter-laboratory trial

A.1 Trials

An inter-laboratory trial was organized on 15 August 2007 to test the procedures specified in this standard. In this trial a number of laboratories, as given below, determined the length, width, height and, volume and from this data calculated the bulk density of an individual test specimen. This was carried out on five types of product, and the results are given in Table A.1 as follows.

Table A.1 — Summary of the results of an inter-laboratory trail for the determination of bulk density

Sample	**1**	**2**	**3**	**4**	**5**
Number of laboratories retained after eliminating outliers	5	5	5	5	5
Number of outliers (laboratories)	0	0	0	0	0
Mean value g/L	78,5	68,9	69,7	76,7	55,5
Repeatability[a] standard deviation, s_r g/L	0,22	0,48	0,42	0,34	0,24
Repeatability[a] relative standard deviation %	0,28	0,70	0,60	0,44	0,43
Repeatability[a] limit, r = 2,8 s_r g/L	0,62	1,35	1,16	0,95	0,67
Reproducibility[b] standard deviation, s_R g/L	0,23	0,48	0,51	0,52	0,62
Reproducibility[b] relative standard deviation %	0,29	0,70	0,73	0,67	1,12
Reproducibility[b] limit, R = 2,8 s_R g/L	0,64	1,35	1,42	1,45	1,74

1 Block, nominal 75 mm × 75 mm × 65 mm without holes or grooves.

2 Block, nominal 100 mm × 100 mm × 65 mm without holes or grooves.

3 Block, nominal 100 mm × 100 mm × 65 mm with one holes and three grooves.

4 Block, nominal 100 mm × 150 mm × 65 mm without holes or grooves.

5 Slab, nominal 1 000 mm × 150 mm × 75 mm without holes or grooves.

a Repeatability conditions (r) are conditions where independent test results are obtained with the same method on identical test specimens in the same laboratory by the same operator using the same equipment within short intervals of time.

b Reproducibility conditions (R) are conditions where test results are obtained with the same method on identical test specimens in different laboratories with different operators using different equipment.

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A.2 Results

A.2.1 The values of repeatability (*r*) and reproducibility (*R*) that were determined from an experiment organized and analysed in accordance with ISO 5725-2:1994 [3] in 2007 involving five laboratories and five levels. Data from no laboratories contained outliers. These results are valid only for tests carried out according to the standard measurement method.

A.2.2 The difference between two test results found on identical test specimens by one operator using the same apparatus within the shortest feasible time interval will exceed the repeatability limit (*r*) on average not more than once in 20 cases in the normal and correct operation of the method.

A.2.3 Test results on identical test specimens reported by two laboratories will differ by more than the reproducibility limit (*R*) on average not more than once in 20 cases in the normal and correct operation of the method.

Bibliography

[1] OIML R35-1:2007, *Material measures of length for general use. Part 1: Metrological and technical requirements*[1)]

[2] OIML R76-1:2006, *Non-automatic weighing instruments. Part 1: Metrological and technical requirements — Tests*[1)]

[3] ISO 5725-2:1994, *Accuracy (trueness and precision) of measurement methods and results — Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method*

1) This can be obtained from http://www.oiml.org/publications/.

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