

English Version

## Soil improvers and growing media - Determination of electrical conductivity

Amendements du sol et supports de culture -  
Détermination de la conductivité électrique

Bodenverbesserungsmittel und Kultursubstrate -  
Bestimmung der elektrischen Leitfähigkeit

This European Standard was approved by CEN on 17 September 2011.

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## Foreword

This document (EN 13038:2011) has been prepared by Technical Committee CEN/TC 223 “Soil improvers and growing media”, the secretariat of which is held by ASI.

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of an identical text or by endorsement, at the latest by May 2012, and conflicting national standards shall be withdrawn at the latest by May 2012.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 13038:1999.

The main change to the previous is the change of the scope.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.



## 1 Scope

This European Standard specifies an instrumental method for the routine determination of electrical conductivity in a water extract of a soil improver or growing medium. The determination is carried out to obtain an indication of the content of water soluble electrolytes in either soil improvers or growing media.

This method is not applicable to liming materials and preformed materials such as mineral wool slabs and foam slabs.

**NOTE** The requirements of the standard may differ from the national legal requirements for the declaration of the products concerned.

## 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.

EN 13040:2007, *Soil improvers and growing media – Sample preparation for chemical and physical tests, determination of dry matter content, moisture content and laboratory compacted bulk density*

EN ISO 3696, *Water for analytical laboratory use – Specification and test methods (ISO 3696:1987)*

ISO 1770, *Solid-stem general purposes thermometers*

## 3 Terms and definitions

For the purposes of this document the terms and definitions given in EN 13040:2007 and the following apply.

### 3.1

#### **electrical conductivity**

ability of an aqueous extract of the sample to conduct electricity as a function of the ion concentration

## 4 Principle

A test portion is extracted with water at  $(22 \pm 3,0) ^\circ\text{C}$  in an extraction ratio of 1 : 5 (1 *V* sample + 5 *V* water) to dissolve the electrolytes. The specific electrical conductivity of the extract is measured and the result is adjusted to a measurement temperature of 25 °C.

## 5 Reagents

**5.1 Water** having an electrical conductivity not higher than 0,2 mS/m at 25 °C and a pH >5,6 (grade 2 water according to EN ISO 3696).

**5.2 Potassium chloride solution**,  $c(\text{KCl}) = 0,100 \text{ mol/l}$

Dissolve 7,456 g potassium chloride, (KCl), previously dried for 2 h at 105 °C, in water (see 5.1) and dilute to 1000 ml. The specific electrical conductivity of this solution at 25 °C is 1290 mS/m.



### 5.3 Potassium chloride solution, $c(\text{KCl}) = 0,0100 \text{ mol/l}$

Add 100,0 ml of potassium chloride solution (see 5.2) into a 1000 ml volumetric flask and dilute to the mark with water (see 5.1) at 20 °C. The specific electrical conductivity of this solution at 25 °C is 141 mS/m.

Commercially available solutions may also be used.

NOTE All potassium chloride solutions used for calibration should be stored in tightly sealed glass bottles which do not release alkali metal or alkali earth cations.

## 6 Apparatus

**6.1 Conductivity meter** fitted with a conductivity cell and equipped with adjustable measuring range setting and (automatic) temperature correction and having a resolution not greater than 1 mS/m at 25 °C. Preferably, the conductivity meter should also be equipped with a cell constant control.

**6.2 Analytical balance** with an accuracy of 0,001 g.

**6.3 Thermometer** capable of measuring to the nearest 0,1 °C complying with type C according to ISO 1770.

**6.4 Plastic or glass containers**, of sufficient capacity to accommodate the volume of the sample, extractant and 10 % air volume.

**6.5 Shaking or mixing machine**, capable of holding container (see 6.4) and maintaining the sample in suspension without damaging the structure of the sample.

**6.6 Filter paper**, with low ash content and high retentive properties.

## 7 Preparation

Prepare the sample in accordance with Clause 8 of EN 13040:2007 and determine the compacted laboratory bulk density of the sample in accordance with Annex A of EN 13040:2007.

## 8 Procedure

### 8.1 Test samples passing through a 20 mm sieve

Take a weight equivalent 60 ml of the sample volume to the nearest 1 g and transfer to the container (see 6.4). Add 300 ml of water (see 5.1) secure the cap and shake for 1 h on the shaking machine (see 6.5) at  $(22 \pm 3) ^\circ\text{C}$ .

### 8.2 Test samples passing through a 40 mm sieve

Take a weight equivalent 250 ml of the sample volume to the nearest 1 g and transfer to the container (see 6.4). Add 1250 ml of water (see 5.1), secure the cap and shake for 1 h on the shaking machine (see 6.5) at  $(22 \pm 3) ^\circ\text{C}$ .

### 8.3 Filtration

Filter through filter paper (see 6.6) discarding the first 10 ml. In some cases, paper filtration is too slow or even impossible. In such cases alternative procedures, (e.g. centrifugation, glass fibre filter papers) may be used to obtain a clear supernatant. The technique used shall be reported.



8.4 Blank

Repeat the procedures (see 8.1 to 8.2) but omitting the sample. Any modifications to the filtration procedure should also be repeated.

NOTE Measurement of a blank is introduced to determine the contribution of the water, glassware and filter paper used to the electrical conductivity of the extracts.

8.5 Measuring conductivity

8.5.1 Measure the conductance ( $G$ ) of the potassium chloride solutions (see 5.2 and 5.3) according to the instruction manual of the instrument.

8.5.2 Calculate for potassium chloride solution (see 5.3) the cell constant according to:

$$k = \frac{K_s}{G} \tag{1}$$

where

- $k$  is the cell constant, in reciprocal metres;
- $K_s$  is the specific electrical conductance of one of the potassium chloride solutions, in millisiemens per metre;
- $G$  is the measured electrical conductance of the same potassium chloride solution, in millisiemens per metre.

The calculated cell constant shall not differ by more than 5 % from the value given by the manufacturer.

8.5.3 Adjust the cell constant on the conductivity meter.

8.6 Measurement of the specific electrical conductivity of the filtrates

Measure within one hour of extraction the specific electrical conductivity of the filtrates in millisiemens per metre (mS/m) according to the instructions given by the manufacturer of the conductivity meter (see 6.1). Carry out the measurements with the temperature correction set at 25 °C. Note the results to one decimal place.

If the blank exceeds twice the detection limit of the conductivity meter, all the results from this batch are void. All the apparatus and equipment used in the extraction shall be checked and cleaned as required. No results shall be reported until the blank is less than twice the detection limit of the conductivity meter.

NOTE 1 The measured values of the electrical conductivity can be influenced by contamination of the electrodes.

This type of interference is very difficult to recognise. Pollution of the electrodes may change the cell constant, which can be perceived by measuring the electrical conductance of the standard potassium chloride solutions.

NOTE 2 Air bubbles on the electrodes, developed during warming up of solutions disturb the measurements.

9 Precision

The repeatability and reproducibility of the specific electrical conductivity in separately prepared samples should be in accordance with Table A.1.

A summary of the results of an interlaboratory trial to determine the precision of the method in accordance with ISO 5725 are given in Annex A.

The values derived from the interlaboratory trial may not be applicable to concentrations and matrices other than those given.

## 10 Test report

The test report shall contain the following information:

- a) a reference to this European Standard;
- b) all information necessary for complete identification of the sample;
- c) the results of the determination as whole numbers, expressed in millisiemens per metre;
- d) details of any operations not specified in the European Standard or regarded as optional, as well as any factor which may have affected the results;
- e) compacted laboratory bulk density.



Annex A  
(informative)

Results of an interlaboratory trial to determine specific electrical conductivity

An interlaboratory trial was organized in 1995 under the auspices of the European Committee for Standardization, to test the procedures specified in this European Standard.

In this trial the number of laboratories given in Table A.1 determined the specific electrical conductivity in three types of samples.

Table A.1 — Summary of the results of an interlaboratory trial for the determination of the specific electrical conductivity

Sample	Unfertilized peat perlite	Composted coarse bark	Sewage sludge composted with straw
Number of laboratories retained after eliminating outliers	16	16	16
Number of outliers (laboratories)	0	0	0
Mean Value (mS/m)	10,18	31,70	126,93
Repeatability standard deviation, $s_r$ (mS/m)	0,40	0,98	3,18
Repeatability relative standard deviation (%)	3,93	3,09	2,50
Repeatability limit, $r = 2,8 s_r$ (mS/m)	1,12	2,73	8,90
Reproducibility standard deviation, $s_R$ (mS/m)	2,02	5,39	11,96
Reproducibility relative standard deviation (%)	19,84	17,00	9,42
Reproducibility limit, $r = 2,8 s_R$ (mS/m)	5,71	15,11	33,50



## Bibliography

EN 27888, *Water quality – Determination of electrical conductivity (ISO 7888:1985)*

ISO 5725 (all parts), *Accuracy (trueness and precision) of measurement methods and results*