

# SVENSK STANDARD

## SS-EN ISO 11260:2018

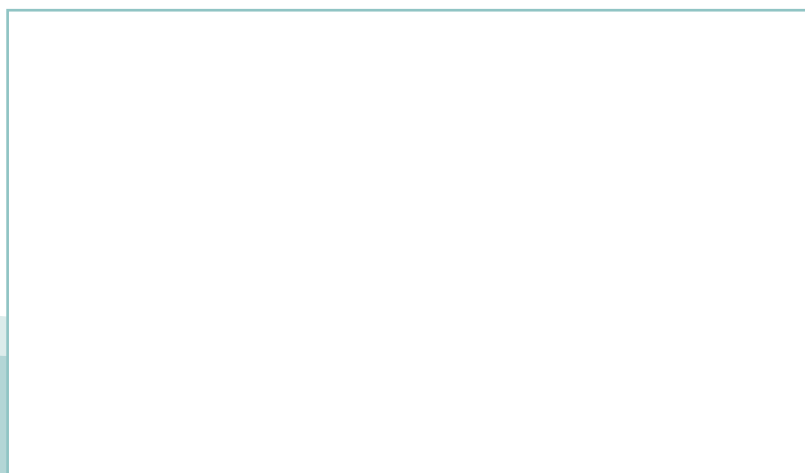


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**Markundersökningar – Bestämning av effektiva katjonbyteskapaciteten och basmättnadsgraden med användning av bariumkloridlösning (ISO 11260:2018)**

**Soil quality – Determination of effective cation exchange capacity and base saturation level using barium chloride solution (ISO 11260:2018)**



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Europastandarden EN ISO 11260:2018 gäller som svensk standard. Detta dokument innehåller den officiella engelska versionen av EN ISO 11260:2018.

Denna standard ersätter SS-EN ISO 11260:2011, utgåva 1

The European Standard EN ISO 11260:2018 has the status of a Swedish Standard. This document contains the official version of EN ISO 11260:2018.

This standard supersedes the SS-EN ISO 11260:2011, edition 1

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EUROPEAN STANDARD

EN ISO 11260

NORME EUROPÉENNE

EUROPÄISCHE NORM

May 2018

ICS 13.080.10

Supersedes EN ISO 11260:2011

English Version

## Soil quality - Determination of effective cation exchange capacity and base saturation level using barium chloride solution (ISO 11260:2018)

Qualité du sol - Détermination de la capacité d'échange cationique effective et du taux de saturation en bases échangeables à l'aide d'une solution de chlorure de baryum (ISO 11260:2018)

Bodenbeschaffenheit - Bestimmung der effektiven Kationenaustauschkapazität und der Basensättigung unter Verwendung von Bariumchloridlösung (ISO 11260:2018)

This European Standard was approved by CEN on 19 March 2018.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

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## European foreword

This document (EN ISO 11260:2018) has been prepared by Technical Committee ISO/TC 109 " Oil and gas burners" in collaboration with Technical Committee CEN/TC 444 "Test methods for environmental characterization of solid matrices" the secretariat of which is held by NEN.

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 November 2018, and conflicting national standards shall be withdrawn at the latest by November 2018.

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

This document supersedes EN ISO 11260:2011.

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, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

### Endorsement notice

The text of ISO 11260:2018 has been approved by CEN as EN ISO 11260:2018 without any modification.





# Soil quality — Determination of effective cation exchange capacity and base saturation level using barium chloride solution

**WARNING** — Persons using this document should be familiar with normal laboratory practice. This document does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices.

**IMPORTANT** — It is absolutely essential that tests conducted in accordance with this document be carried out by suitably qualified staff.

## 1 Scope

This document specifies a method for the determination of the cation exchange capacity (CEC) at the pH of the soil and for the determination of the content of exchangeable sodium, potassium, calcium and magnesium in soil.

This document is applicable to all types of air-dried soil samples. ISO 11464 can be used for pre-treatment.

## 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 3696, *Water for analytical laboratory use — Specification and test methods*

ISO 11265, *Soil quality — Determination of the specific electrical conductivity*

## 3 Terms and definitions

No terms and definitions are listed in this document.

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/>

## 4 Principle

The determination of CEC as specified in this document is a modification of the method proposed by Gillman (see Reference [6]). The CEC of soil samples is determined at the pH of the soil and at a low total ionic strength.

The soil is first saturated with respect to barium by treating the soil three times with a 0,1 mol/l barium chloride solution. Thereafter, the soil is equilibrated with a 0,01 mol/l barium chloride solution. Subsequently a known excess of 0,02 mol/l magnesium sulfate is added. All the barium present, in solution as well as adsorbed, is precipitated in the form of highly insoluble barium sulfate and, consequently, the sites with exchangeable ions are readily occupied by magnesium. The excess magnesium is determined by inductively coupled plasma atomic emission spectrometry ICP-AES. Alternative methods with a comparable precision and detection limit may also be used.

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It is also possible to determine the concentrations of sodium, potassium, calcium and magnesium (and other elements such as iron, manganese and aluminium) in the 0,1 mol/l barium chloride extract of the soil.

If the barium chloride extract has a yellowish-brown colour, this indicates that some organic matter has been dissolved. If this occurs, record it in the test report.

NOTE 1 Since organic matter contributes to the CEC, its presence will result in a measured CEC value which is an underestimation of the actual CEC.

NOTE 2 The sum of exchangeable cations can give a result that is greater than the actual CEC due to the dissolution of salts present in the soil. However, preliminary washing of the soil with water to remove these salts can change the relative proportions of cations in the CEC.

## 5 Interferences

The method described suffers from interference from calcium which may be present as calcite or gypsum in the sample. Also, the presence of any soluble salts gives values for the exchangeable cations that are higher than the actual exchangeable amounts (see References [4] and [5]).

Measurement of the specific electrical conductivity of the soil samples in accordance with ISO 11265 will indicate if the soil samples are affected by salt.

## 6 Procedures

### 6.1 Sample pretreatment

Pretreat and air-dry the sample, e.g. in accordance with ISO 11464.

### 6.2 Leaching

#### 6.2.1 Reagents

Use only reagents of recognized analytical grade and water in accordance with grade 2 of ISO 3696.

##### 6.2.1.1 Barium chloride solution, $c(\text{BaCl}_2) = 0,1 \text{ mol/l}$ .

Dissolve 24,43 g of barium chloride dihydrate ( $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$ ) in water and make up to 1 000 ml with water at 20 °C.

##### 6.2.1.2 Barium chloride solution, $c(\text{BaCl}_2) = 0,002 5 \text{ mol/l}$ .

Dilute 25 ml of the 0,1 mol/l barium chloride solution to 1 000 ml at 20 °C.

##### 6.2.1.3 Magnesium sulfate solution, $c(\text{MgSO}_4) = 0,020 0 \text{ mol/l}$ .

Dissolve  $(4,93 \pm 0,01)$  g of magnesium sulfate heptahydrate ( $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ ) (see Note) in water and make up to 1 000 ml at 20 °C.

$\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$  may lose water of crystallization on standing. The reagent should be standardized by titration with EDTA at pH 10 using Eriochrome Black T indicator or be kept in a bottle in a sealed polyethylene bag placed in a refrigerator.

#### 6.2.2 Leaching procedure

Transfer 2,50 g of air-dried soil (sieved to a particle size  $< 2 \text{ mm}$ ) to a tightly stoppered polyethylene centrifuge tube of about 50 ml capacity. Note the combined mass of tube and soil ( $m_1$ ). Add

30 ml  $\pm$  0,1 ml of barium chloride solution ([6.2.1.1](#)) to the soil and shake for 1 h. Centrifuge the tubes at 3 000g for 10 min.

Transfer the supernatant liquid to a 100 ml volumetric flask. Repeat the addition of 30 ml of the barium chloride solution, the shaking and centrifugation twice more, adding the supernatant liquid to the 100 ml volumetric flask each time. Make up to the volume of the volumetric flask with barium chloride solution ([6.2.1.1](#)).

Mix, filter and store the extract for the determination of the concentration of sodium, potassium, calcium and magnesium in accordance with [6.4](#) and [6.5](#). Add 30 ml of barium chloride solution ([6.2.1.2](#)) to the soil cake and shake overnight. (The barium concentration in the equilibrium solution will be about 0,01 mol/l when 2,5 ml of solution is left in the soil cake.) Balance the tubes and centrifuge at about 3 000g for 10 min. Decant the supernatant liquid.

Weigh the tube with its contents and cover ( $m_2$ ). Add 30 ml  $\pm$  0,1 ml of magnesium sulfate solution ([6.2.1.3](#)) to the soil cake and shake overnight. Centrifuge at 3 000g for 10 min. Decant the supernatant solution through a coarse filter paper into a conical flask and store for the determination of the concentration of excess of magnesium in accordance with [6.3.4](#).

Prepare a blank by following the above described procedure completely without the addition of soil.

## 6.3 Determination of CEC

### 6.3.1 Principle

The cations are determined by ICP-AES.

### 6.3.2 Reagents

Use only reagents of recognized analytical grade and distilled or deionized water for all solutions.

**6.3.2.1 Hydrochloric acid**,  $c(\text{HCl}) = 12 \text{ mol/l}$  ( $\rho = 1,19 \text{ g/ml}$ ).

**6.3.2.2 Magnesium standard solution**,  $c(\text{Mg}) = 0,001 0 \text{ mol/l}$ .

Pipette 50,0 ml of the 0,020 0 mol/l magnesium sulfate solution ([6.2.1.3](#)) into a volumetric flask of 1 000 ml and make up to the mark with water.

### 6.3.2.3 Calibration check solution.

Prepare the calibration check solution by using an independent standard of the same chemical matrix as the calibration solutions. The concentration of the standard shall be in the centre of the calibration curve.

### 6.3.3 Calibration series

Pipette 0 ml, 1 ml, 2 ml, 3 ml, 4 ml and 5 ml of magnesium standard solution ([6.3.2.2](#)) into a series of 100 ml volumetric flasks. Make each flask up to the mark with water and mix. These calibration solutions have magnesium concentrations of 0 mmol/l, 0,01 mmol/l, 0,02 mmol/l, 0,03 mmol/l, 0,04 mmol/l and 0,05 mmol/l, respectively.

### 6.3.4 Spectrometric procedure

Pipette 0,200 ml of each of the final filtrates of the soil samples (see [6.2.2](#)) and of the blanks (see [6.2.2](#)) into individual 100 ml volumetric flasks. Make up to the mark with water and mix.