



# SLOVENSKI STANDARD SIST EN 17685-1:2023

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## Zemeljska dela - Kemijski preskusi - 1. del: Določanje deleža žaroizgube

Earthworks - Chemical tests - Part 1: Determination of loss on ignition

Erdarbeiten - Chemische Prüfverfahren - Teil 1: Bestimmung des Glühverlusts

Terrassements - Essais chimiques - Partie 1 : Détermination de la perte au feu

**Ta slovenski standard je istoveten z: EN 17685-1:2023**

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### ICS:

13.080.99	Drugi standardi v zvezi s kakovostjo tal	Other standards related to soil quality
93.020	Zemeljska dela. Izkopavanja. Gradnja temeljev. Dela pod zemljo	Earthworks. Excavations. Foundation construction. Underground works

**SIST EN 17685-1:2023**

**en,fr,de**



EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN 17685-1**

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ICS 13.080.99; 93.020

English Version

**Earthworks - Chemical tests - Part 1: Determination of loss  
on ignition**

Terrassements - Essais chimiques - Partie 1 :  
Détermination de la perte au feu

Erdarbeiten - Chemische Prüfverfahren - Teil 1:  
Bestimmung des Glühverlusts

This European Standard was approved by CEN on 23 January 2023.

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

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EN 17685-1:2023 (E)

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## European foreword

This document (EN 17685-1:2023) has been prepared by Technical Committee CEN/TC 396 “Earthworks”, the secretariat of which is held by AFNOR.

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of an identical text or by endorsement, at the latest by September 2023, and conflicting national standards shall be withdrawn at the latest by September 2023.

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**EN 17685-1:2023 (E)****Introduction**

The method described in this document has been developed from EN 15935:2021 which was prepared by CEN/TC 444 "Environmental characterization of solid matrices". Adjustments were made to make the method more suitable for the materials used in earthworks, particularly for the pretreatment of the sample.

This document specifies a method for the determination of the loss on ignition ( $w_{LOI}$ ) of fine, intermediate, composite and coarse soils, organic soils and anthropogenic materials (according to EN 16907-2) after ignition under air at 550°C. A method is given in Annex B in order to estimate the organic matter content ( $C_{OM}$ ) from the value of  $w_{LOI}$ . The organic matter content  $C_{OM}$  is used for the classification of soils with organic matter content  $C_{OM}$  greater than 2 % according EN 16907-2 (Table 4 in EN 16907-2:2018).

Other methods to estimate the organic content is e.g. wet burning with  $H_2O_2$  or  $KMnO_4$ .

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## 1 Scope

This document specifies a method for the determination of the loss on ignition ( $w_{LOI}$ ) of fine, intermediate, composite and coarse soils, organic soils and anthropogenic materials (according to EN 16907-2) after ignition under air at 550°C.

NOTE The loss of mass suffered by these materials at 550 °C is usually due to the release of volatile compounds, water (absorbed, crystalized or structural) and gases from decomposition of organic matter and inorganic substances such as sulfur, sulfides or hydroxides (e.g. H<sub>2</sub>O, CO<sub>2</sub>, SO<sub>2</sub>).

A method is given in Annex B in order to estimate the organic matter content ( $C_{OM}$ ) from the value of  $w_{LOI}$  for clayey soils.

## 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.

EN ISO 17892-12, *Geotechnical investigation and testing - Laboratory testing of soil - Part 12: Determination of liquid and plastic limits (ISO 17892-12)*

ISO 3310-1, *Test sieves — Technical requirements and testing — Part 1: Test sieves of metal wire cloth*

## 3 Terms and definitions

No terms and definitions are listed in this document.

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

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

## 4 Abbreviations and symbols

$C_{OM}$	Organic matter content, deduced from $w_{LOI}$	dimensionless (%)
$D_{max}$	Maximum diameter of particles in a soil mass	mm
LOI	Loss On Ignition	
$m_c$	Mass of the empty crucible	g
$m_1$	Mass of the crucible containing the dried sample	g
$m_2$	Mass of the crucible containing the ignited sample	g
$w_L$	Liquid limit according to EN ISO 17892-12	dimensionless (%)

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$w_{LOI}$	Loss on ignition: Mass fraction lost by burning up a dried sample to constant mass at a specified temperature	dimensionless (%)
$w_R$	Residue on ignition: Mass fraction remaining after burning up a dried sample to constant mass at a specified temperature	dimensionless (%)

## 5 Principle of the test

A weighted dried test portion is burned in a furnace to constant mass at  $(550 \pm 25)$  °C under air. The difference in mass before and after the ignition process is used to calculate the loss on ignition. The determination is performed on a dried sample.

NOTE 1 Carbonates dissociate at temperatures higher than 550°C.

NOTE 2 Interferences and sources of error: LOI is a parameter, thus there is no interference connected to its determination. However, the determination of LOI is used for the assessment of the content of organic matter  $C_{OM}$  in the sample.

- Elementary carbon in the sample will be included in the loss on ignition value. Furthermore, any volatilization or chemical reaction of inorganic compounds will also be included in the loss on ignition value;
- Chemically bound water can be released during heating, thereby contributing to the loss on ignition;
- Samples containing iron, other metals in low bonding state or in metallic state can be oxidized during heating, thereby undergoing a mass gain and contributing to an underestimation of the loss on ignition;
- Sulfides present in the sample can be oxidized to sulfate during heating, thereby undergoing a mass gain and contributing to an underestimation of the loss on ignition;
- Calcium hydroxide can suffer a dehydration, thereby undergoing a mass loss and contributing to an overestimation of the loss on ignition;
- Calcium oxide can react with carbon dioxide to form calcium carbonates, thereby undergoing a mass gain and contributing to an underestimation of the loss on ignition;
- In addition to mineral soil particles, the weighed ashes after ignition can contain some residues of the ignited organic matter.

## 6 Apparatus

**6.1 Drying oven**, of the forced-draft type and capable of maintaining a temperature of  $(110 \pm 5)$  °C throughout the drying chamber. Any air circulation shall not be so strong that any transport of particles can take place.

**6.2 Crucible**, suitable for ignition at 550°C, e.g. made of nickel platinum, porcelain or fused silica, approximately 25 mm to 70 mm diameter.

The diameter of the crucible is to be selected so that the requirements for the test portion and the maximum filling height can be met.

**6.3 Muffle furnace**, or equivalent equipment, capable of maintaining a temperature of  $(550 \pm 25)$  °C.

**6.4 Metal plate**, or comparable plate, suitable for the initial cooling of crucibles.



**6.5 Desiccator**, with an active drying agent, such as silica gel.

**6.6 Balance**, with a maximum permissible measurement error less than 0,1 % weighted sample.

**6.7 Test sieve**, conforming to ISO 3310-1, of 2 mm aperture.

## 7 Pretreatment

The test shall be carried out on the whole sample. The laboratory sample shall be taken and reduced by successively crushing-disintegrating it with the appropriate means, and quarter it until obtain a representative portion of all the material.

The minimum mass necessary for the test, depending on  $D_{\max}$  is given in Table 1.

**Table 1 — Mass material required (g)**

<b>Dmax (mm)</b>	<b>Minimum mass for the laboratory sample Soils</b>
$32 < D \leq 63$	5000
$16 < D \leq 32$	2500
$8 < D \leq 16$	1500
$4 < D \leq 8$	500
$2 < D \leq 4$	100
$D \leq 2$	50

Prepare a representative test specimen by:

- Sieving through a 63 mm sieve;
- Drying the entire material at a temperature of  $(110 \pm 5)$  °C until constant mass with successive weightings after additional drying of at least 1 h apart not differing by more than 0,1 %;
- Sieving through a 2 mm sieve and keep the fraction passing the 2 mm sieve. Crushing the retained fraction on the 2 mm sieve until particles dimensions smaller than 2 mm and adding it to the passing fraction;
- Reducing the sample with a rotary sample divider;
- Sieving through a 2 mm sieve;
- Weigh the material passing the 2 mm sieve.

The mass shall be greater or equal to 50 g.

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## 8 Test procedure

Perform the following procedure on at least two samples:

- Place a crucible in the furnace and heat to  $(550 \pm 25)$  °C for at least 20 min. Transfer the crucible from the furnace to a desiccator after initial cooling on a metal plate and finish cooling to ambient temperature;
- Weigh the empty crucible ( $m_c$ );
- Place into the crucible 0,5 g to 15 g of the test portion. The sample layer in the crucible should not exceed a height of 5 mm. Weigh the crucible and its contents ( $m_1$ );

Sample in crucibles should not exceed a height of 5 mm in order to avoid the decrease of the LOI value by the own refractive behaviour of the same sample at higher thicknesses. Therefore, a big-sized crucible may be necessary if a sample of 5 g to 15 g is tested;

It is recommended for sludge, peat, treated biowaste, and waste to test a sample of 0,5 g to 5 g. For soils with low amount of organic matter, it is recommended to test a sample of 5 g to 15 g;

- Place the crucible into the furnace. Raise the furnace temperature to  $(550 \pm 25)$  °C and hold this temperature for at least 2 h. If the test portion has high organic content, losses may occur as a result of rapid ignition or deflagration of the sample. In this case, heat the sample slowly to  $(250 \pm 15)$  °C over a period of 1 h, allowing pyrolysis of the sample. Then the temperature is raised slowly to  $(550 \pm 25)$  °C also over a period of 1 h, temperature that is finally kept for at least 2 h;
- Place the hot crucible containing the residue on ignition on a metal plate for a few minutes. While still warm, transfer the crucible to a desiccator and leave to cool to ambient temperature. As soon as the ambient temperature is reached, weigh the crucible containing the ignition residue ( $m_2$ ).

## 9 Expression of results and determination of the loss on ignition

The loss on ignition of a total dried test sample shall be calculated from Formula (1) and the residue on ignition of the dry matter of a solid sample expressed in percent shall be calculated from Formula (2):

$$w_{LOI} = \frac{m_1 - m_2}{m_1 - m_c} \times 100 \quad (1)$$

$$w_R = 100 - w_{LOI} \quad (2)$$

where:

- $w_{LOI}$  is the loss on ignition of the dry mass of a solid sample, in percent (%);
- $w_R$  is the residue on ignition of the dry mass of a solid sample, in percent (%);
- $m_c$  is the mass of the empty crucible, in grams (g);
- $m_1$  is the mass of the crucible containing the dried sample, in grams (g);
- $m_2$  is the mass of the crucible containing the ignited sample, in grams (g).