KIVISÜSI JA KOKS
Küttevääртuse määramine

Coal and coke
Determination of gross calorific value
(ISO 1928:2020, modified)

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-ISO 1928-MOD:2021 „Kivisüsi ja koks. Küttevääртuse määramine“ sisaldab rahvusvahelise standardi ISO 1928:2020 „Coal and coke. Determination of gross calorific value“ modifitseeritud ingliskeelset teksti.	This Estonian Standard EVS-ISO 1928-MOD:2021 consists of the modified English text of the International Standard ISO 1928:2020 „Coal and coke. Determination of gross calorific value“.
Ettepaneku rahvusvahelise standardi ümbertrüki meetodil ülevõtuks on esitanud EVS/TK 57, standardi avaldamist on korraldanud Eesti Standardimis- ja Akrediteerimiskeskus.	Proposal to adopt the International Standard by reprint method has been presented by EVS/TK 57, the Estonian Standard has been published by the Estonian Centre for Standardisation and Accreditation.
Standard EVS-ISO 1928-MOD:2021 on jõustunud sellekohase teate avaldamisega EVS Teatajas.	Standard EVS-ISO 1928-MOD:2021 has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation and Accreditation.
Standard on kättesaadav Eesti Standardimis- ja Akrediteerimiskeskusest.	The standard is available at the Estonian Centre for Standardisation and Accreditation.

Käsitlusala

See dokument käsitleb meetodit tahkete mineraalsete kütuste ülemise küttevääртuse määramiseks konstantsel ruumalal ja referentstemperatuuril 25 °C kalorimeetrilises põletusanumas, mis on kalibreeritud sertifitseeritud bensoehappe põletamisega.

Saadud tulemus on analüüsitava proovi ülemine küttevääртus konstantsel ruumalal koos kõigi põlemisproduktide veega vedela vee kujul. Praktikas on kütus põletatud konstantsel (atmosfääri) rõhul ja vesi ei kondenseeru, vaid eraldub auruna koos suitsugaasidega. Nendes tingimustes on tegelik põlemise soojus kütuse ülemine küttevääртus konstantsel rõhul. Võib kasutada ka ülemist küttevääртust konstantsel ruumalal, valemid on esitatud mõlema väärtuse arvutamiseks.

Üldised põhimõtted ja kalibreerimisprotseduurid ning kütuste testid on esitatud põhitekstis, samal ajal kui eri tüüpi kalorimeetrilise aparatuuri kasutamisse puutuv on kirjeldatud lisades A kuni C. Lisa D sisaldab loendeid kirjeldatud kalorimeetrite tüüpide kohta kalibreerimiseks ja kütuste testimiseks. Lisa E annab näiteid mõnede arvutuste illustreerimiseks. Lisa F käsitleb kalorimeetriliste põletusanumate ohutut kasutamist, hooldust ja testimist.

MÄRKUS Märksõnad: tahked kütused, süsi, koks, **[MOD]** põlevkivi **[MOD]**, testid, määramine, küttevääртus, arvutusmeetodid, kalorimeetria.

Selles standardis on tehtud järgmised muudatused:

Sellesse standardisse on sisse viidud täiendused, mis võimaldavad standardi alusel määrata põlevkivide (sh kukersiidi) küttevääртust ja arvestada Eesti põlevkivi eripäradega, mis on vajalikud nii korrektseks põlevkivide kvaliteedi määramiseks kui ka põlevkivide kasutusvõimaluste hindamiseks. Täiendused, mille algus ja lõpp on tähistatud märgisega **[MOD]**, on sisse viidud järgmistesse peatükkidesse/ jaotistesse:

— peatüki 1 märkus,
— peatükk 2,
— peatükk 7,
— peatüki 8 jaotis 8.1,
— peatüki 10 jaotised 10.2a ja 10.4.2a,
— peatüki 12 jaotis 12.2.1.1a,
— lisa E jaotis E.3.3a.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 75.160.10

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2. www.iso.org/directives

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received. www.iso.org/patents

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword — Supplementary information

This document was prepared by Technical Committee ISO/TC 27, *Coal and coke*, Subcommittee SC 5, *Methods of analysis*.

This fourth edition cancels and replaces the third edition (ISO 1928:2009), which has been technically revised.

The main changes compared to the previous edition are as follows:

— change the document title within the scope of TC 27,

— editorially update symbols within formulae,

— update references,

— expand on some derivations,

— remove ambiguity around crucible masses, and

— specify the analysis sample.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

WARNING — Strict adherence to all of the provisions specified in this document should ensure against explosive rupture of the combustion vessel, or a blow-out, provided that the combustion vessel is of proper design and construction and in good mechanical condition.

1 Scope

This document specifies a method for the determination of the gross calorific value of a solid mineral fuel at constant volume and at the reference temperature of 25 °C in a combustion vessel calorimeter calibrated by combustion of certified benzoic acid.

The result obtained is the gross calorific value of the analysis sample at constant volume with all the water of the combustion products as liquid water. In practice, fuel is burned at constant (atmospheric) pressure and the water is not condensed but is removed as vapour with the flue gases. Under these conditions, the operative heat of combustion is the net calorific value of the fuel at constant pressure. The net calorific value at constant volume can also be used; formulae are given for calculating both values.

General principles and procedures for the calibrations and the fuel tests are specified in the main text, whereas those pertaining to the use of a particular type of calorimetric instrument are described in Annexes A to C. Annex D contains checklists for performing calibration and fuel tests using specified types of calorimeters. Annex E gives examples illustrating some of the calculations. Annex F provides guidance around safe use, maintenance and testing of the calorimeter combustion vessel.

NOTE Descriptors: solid fuels, coal, coke, **[MOD]** oil shale **[MOD]**, tests, determination, calorific value, rules of calculation, calorimetry.

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 651. Solid-stem calorimeter thermometers

ISO 652. Enclosed-scale calorimeter thermometers

ISO 687. Solid mineral fuels — Coke — Determination of moisture in the general analysis test sample

ISO 1770. Solid-stem general purpose thermometers

ISO 1771. Enclosed-scale general purpose thermometers

ISO 5068-2. Brown coals and lignites — Determination of moisture content — Part 2: Indirect gravimetric method for moisture in the analysis sample

ISO 11722. Solid mineral fuels — Hard coal — Determination of moisture in the general analysis test sample by drying in nitrogen

ISO 13909-4. Hard coal and coke — Mechanical sampling — Part 4: Coal — Preparation of test samples

ISO 17247. Coal and coke — Ultimate analysis

ISO 18283. Hard coal and coke — Manual sampling

[MOD] EVS 664. Solid fuels — Sulphur content — Determination of total sulphur and its bonding forms

EVS 668. Oil shale — Determination of moisture

EVS 670. Trade oil shale **[MOD]**

3 Terms and definitions

3.1 Terms and definitions

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

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/

3.1.1
gross calorific value at constant volume
absolute value of the specific energy of combustion for unit mass of a solid fuel burned in oxygen in a calorimetric combustion vessel under the conditions specified

Note 1 to entry: The products of combustion are assumed to consist of gaseous oxygen, nitrogen, carbon dioxide and sulfur dioxide, of liquid water (in equilibrium with its vapour) saturated with carbon dioxide under the conditions of the combustion vessel reaction, and of solid ash, all at the reference temperature.

Note 2 to entry: Gross calorific value is expressed in units of joules/gram.

3.1.2
gross calorific value at constant pressure
absolute value of the specific energy of combustion, for unit mass of a solid fuel burned in oxygen at constant pressure, instead of constant volume in a calorimetric combustion vessel

Note 1 to entry: The hydrogen in the fuel, reacting with gaseous oxygen to give liquid water, causes a decrease in the volume of the system. When the fuel carbon reacts with gaseous oxygen, an equal volume of gaseous carbon dioxide is formed and, hence, no change in volume occurs in combustion of the carbon. The oxygen and nitrogen in the fuel both give rise to an increase in volume.

3.1.3
net calorific value at constant volume
absolute value of the specific energy of combustion, for unit mass of a solid fuel burned in oxygen under conditions of constant volume and such that all the water of the reaction products remains as water vapour (in a hypothetical state at 0,1 MPa), the other products being as for the gross calorific value, all at the *reference temperature* (3.1.8)

3.1.4
net calorific value at constant pressure
absolute value of the specific heat (enthalpy) of combustion, for unit mass of the fuel burned in oxygen at constant pressure under such conditions that all the water of the reaction products remains as water vapour (at 0,1 MPa), the other products being as for the gross calorific value, all at the *reference temperature* (3.1.8)

3.1.5
adiabatic calorimeter
calorimeter that has a rapidly changing jacket temperature

