

KAHHELAHJUD / KROHVITUD PINNAGA AHJUD.
DIMENSIONEERIMINE

One off Kachelgrundöfen/Putzgrundöfen
(tiled/mortared stoves) - Dimensioning

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN 15544:2023 sisaldab Euroopa standardi EN 15544:2023 ingliskeelset teksti.	This Estonian standard EVS-EN 15544:2023 consists of the English text of the European standard EN 15544:2023.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation and Accreditation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 22.02.2023.	Date of Availability of the European standard is 22.02.2023.
Standard on kättesaadav Eesti Standardimis-ja Akrediteerimiskeskusest.	The standard is available from the Estonian Centre for Standardisation and Accreditation.

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

ICS 97.100.30

Standardite reprodutseerimise ja levitamise õigus kuulub Eesti Standardimis- ja Akrediteerimiskeskusele. Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonsesse süsteemi või edastamine ükskõik millises vormis või millisel teel ilma Eesti Standardimis- ja Akrediteerimiskeskuse kirjaliku loata on keelatud.

Kui Teil on küsimusi standardite autorikaitse kohta, võtke palun ühendust Eesti Standardimis- ja Akrediteerimiskeskusega: Koduleht www.evs.ee; telefon 605 5050; e-post info@evs.ee

The right to reproduce and distribute standards belongs to the Estonian Centre for Standardisation and Accreditation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without a written permission from the Estonian Centre for Standardisation and Accreditation.

If you have any questions about copyright, please contact Estonian Centre for Standardisation and Accreditation:

Homepage www.evs.ee; phone +372 605 5050; e-mail info@evs.ee

EUROPEAN STANDARD

EN 15544

NORME EUROPÉENNE

EUROPÄISCHE NORM

February 2023

ICS 97.100.30

Supersedes EN 15544:2009

English Version

One off Kachelgrundöfen/Putzgrundöfen (tiled/mortared stoves) - Dimensioning

Poêles en faïence, poêles en maçonnerie fabriqués in situ - Dimensionnement

Ortsfest gesetzte Kachelgrundöfen/Putzgrundöfen - Auslegung

This European Standard was approved by CEN on 2 January 2023.

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.

CEN members are the national standards bodies of 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, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and United Kingdom.



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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Contents

Page

European foreword.....	3
Introduction	4
1 Scope.....	5
2 Normative references.....	6
3 Terms and definitions	6
4 Calculations.....	8
4.1 Nominal heat output.....	8
4.2 Load of fuel	9
4.2.1 Maximum load.....	9
4.2.2 Minimum load	9
4.3 Design of the essential dimensions	9
4.3.1 Combustion chamber dimensions	9
4.3.2 Calculated flue pipe length	11
4.3.3 Minimum flue pipe length.....	11
4.3.4 Gas slot profile.....	13
4.4 Calculation of the burning rate	14
4.5 Fixing of the air ratio	14
4.6 Combustion air flue gas.....	14
4.6.1 General.....	14
4.6.2 Combustion air flow rate.....	15
4.6.3 Flue gas flow rate	16
4.6.4 Flue gas mass flow rate	16
4.7 Calculations of the density.....	17
4.7.1 Combustion air density	17
4.7.2 Flue gas density.....	17
4.8 Calculation of the outside air temperature combustion air temperature and flue gas temperature	17
4.8.1 Mean outside air temperature and combustion air temperature.....	17
4.8.2 Mean combustion chamber temperature.....	18
4.8.3 Flue gas temperature in the flue pipe.....	18
4.8.4 Flue gas temperature in the connecting pipe.....	18
4.8.5 Flue gas temperature at chimney entrance mean flue gas temperature of the chimney and temperature of the chimney wall at the top of the chimney	19
4.9 Calculation of flow mechanics	19
4.9.1 General.....	19
4.9.2 Calculation of the standing pressure	19
4.9.3 Calculation of the flow velocity	19
4.9.4 Calculation of the static friction.....	20
4.9.5 Calculation of the resistance due to direction change.....	21
4.10 Operation control.....	22
4.10.1 Pressure condition	22
4.10.2 Dew point condition.....	23
4.10.3 Energy efficiency η	23
4.10.4 Flue gas triple of variates	23
Bibliography.....	24

European foreword

This document (EN 15544:2023) has been prepared by Technical Committee CEN/TC 295 “Residential solid fuel burning appliances”, 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 August 2023, and conflicting national standards shall be withdrawn at the latest by August 2023.

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 15544:2009.

The main changes compared to the previous edition are listed below:

- a) correction of editorial mistakes;
- b) correction of mistakes in formulae;
- c) calculation of the fuel load based on a variable efficiency instead of a fixed efficiency of 78 %;
- d) introduction of calculated flue pipe length;
- e) introduction of factors to calculate minimum flue pipe length depending on efficiency (Table 1);
- f) specification of water content and dimensions of the used log wood;
- g) calculation of the minimum load;
- h) specification how to deal with type tested combustion chambers;
- i) change of the portion of the glass plate compared to the inner surface of the combustion chamber;
- j) definitions of fair fuel ratio and calculated flue pipe length added;
- k) definitions of “construction with air gap” and “construction without air gap” updated;
- l) specification of the relation between nominal heat output and full house as well as partial heating;
- m) specification that in divergence to EN 13384-1 the dew point condition is calculated only for nominal heat output.

Any feedback and questions on this document should be directed to the users’ national standards body. A complete listing of these bodies can be found on the CEN website.

According to the CEN-CENELEC Internal Regulations, the national standards organisations 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, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.

Introduction

This document specifies a calculation method for the dimensioning of Kachelgrundöfen/Putzgrundöfen (tiled/mortared stoves).

This calculation method for the dimensioning of Kachelgrundöfen/Putzgrundöfen (tiled/mortared stoves) is based on appropriate literature as well as EN 13384-1, and where empirically determined correlations are used in addition to physical and chemical formulas.

In case of a calculation method for different interior materials than fireclay the proof of the compliance of the emission values and the efficiency shall be delivered separately. Also, the empiric data of the combustion chamber dimensions, the minimum flue pipe length, the burning rate as well as the combustion chamber temperature and the decrease of the temperature along the flue pipe shall also be separately determined.

1 Scope

The application of the calculations of this document enables a verification of the emission values carbon monoxide, nitrogen dioxide, organically bound carbon as well as dust and the energy efficiency.

Complying with the calculations of this document results in emission values less or equal for carbon monoxide $1\,500\text{ mg/m}_n^3$ ($1\,000\text{ mg/MJ}$), nitrogen dioxide 225 mg/m_n^3 (150 mg/MJ), organically bound carbon 120 mg/m_n^3 (80 mg/MJ) and dust 90 mg/m_n^3 (60 mg/MJ). If the calculations of this document are used in combination with suitable combustion chambers that prove lower emission values in a type test, these values are also considered to be complied with.

There might be national or local regulations, which impose stricter legal emissions and/or efficiency requirements.

This document specifies calculations for the dimensioning of Kachelgrundöfen/Putzgrundöfen (tiled/mortared stoves) based upon the required nominal heat output of the stove as declared by the producer. The Kachelgrundöfen/Putzgrundöfen (tiled/mortared stoves) are of individual one-off construction design. The document can be used for log wood fired Kachelgrundöfen/Putzgrundöfen (tiled/plastered stoves) that burn one fuel load per storage period with a maximum load between 10 kg and 40 kg (log wood with water content from 12 % to 20 %, thickness of 5 cm to 10 cm in diameter, length varies usually from 25 cm to 50 cm, and is oriented toward the combustion chamber dimensions) and a storage period (nominal heating time) between 8 h and 24 h.

This document is applicable for Kachelgrundöfen/Putzgrundöfen (tiled/mortared stoves) equipped with fireclay as interior material, with an apparent density between $1\,750\text{ kg/m}^3$ and $2\,300\text{ kg/m}^3$, a degree of porosity from 17 % up to 33 % by volume and a heat conductivity from $0,90\text{ W/mK}$ up to $1,35\text{ W/mK}$ (temperature range 20 °C to 400 °C).

This document is applicable for Kachelgrundöfen/Putzgrundöfen (tiled/mortared stoves) with combustion air supply from the side via a firebox door frame or the standing grate of the heating door into the combustion chamber. The document is applicable for an inflow speed of the combustion air between 2 m/s and 4 m/s.

This document also applies to the combination with combustion chambers that are suitable for one-off Kachelgrundöfen/Putzgrundöfen (tiled/mortared stoves) and for which compliance with the legally required emission values has been verified as part of a type test by an accredited and/or notified body.

The following general conditions apply to such combustion chambers:

- with an air-fuel ratio of between 1,95 and 3,95 according to the type test;
- with a maximum load from 5 kg to 40 kg;
- using other suitable materials as well as fireclay.

With regard to the type test, this document is applicable for combustion chambers which are tested:

- according to EN 15250 (or EN 16510-2-5¹);
- according to EN 13229 (or EN 16510-2-2); or
- according to respective national standards (e.g. ÖNORM B 8303).

¹ Under preparation. Stage at the time of publication: prEN 16510-2-5:2023.

This document is applicable for type tested combustion chambers designed for batch fired pellet burning if meeting the requirements according to this document (air-fuel ratio between 1,95 and 3,95, the load of the pellets burned in (78 ± 20) min).

This document is not applicable for:

- combinations with water heat exchangers for central heating or other heat absorbing elements like open water tanks, etc.;
- combustion chambers with glass plates greater than 1/5 of the combustion chamber surface;
- mass-produced prefabricated stoves (slow heat release appliances) or partly prefabricated stoves (slow heat release appliances) according to EN 15250 (or EN 16510-2-5¹).

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 13384-1, *Chimneys - Thermal and fluid dynamic calculation methods - Part 1: Chimneys serving one combustion appliance*

3 Terms and definitions

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

3.1

air-fuel ratio

ratio between the amount of air supplied to the combustion and the theoretically required amount of air

3.2

calculated flue pipe length

$L_{Z_calculated}$

length which is required to determine the flue gas temperatures in the flue pipe

3.3

construction with air gap

construction, with an air gap between the inner and the outer shell

Note 1 to entry: It is a construction with an air gap if the distance between the inner and outer shell is at least 2,5 cm and more than 50 % of the Kachelgrundofen/Putzgrundofen (tiled/mortared stove) is built in this way.

3.4

construction without air gap

construction, with no air gap between the inner and the outer shell

Note 1 to entry: It is a construction with no air gap if the distance between the inner and outer shell is less than 2,5 cm and at least 50 % of the Kachelgrundofen/Putzgrundofen (tiled/mortared stove) is built in this way.