SLOVENSKI STANDARD
oSIST prEN 15544:2021

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Lončene peči - Dimenzioniranje

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

Ortsfest gesetzte Kachelgrundöfen/Putzgrundöfen - Auslegung

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

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

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European foreword

This document (prEN 15544:2021) has been prepared by Technical Committee CEN/TC 295 “Residential solid fuel burning appliances”, the secretariat of which is held by BSI.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 15544:2009.

Introduction

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

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 efficiency.

Complying with the calculations of this document results in emission values less or equal for carbon monoxide 1 500 mg/m_n^3 (1 000 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.

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 should 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 should also be separately determined.

1 Scope

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 Kachelöfen (tiled 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 valid for Kachelgrundöfen/Putzgrundöfen (tiled/mortared stoves) equipped with fireclay as interior material, with an apparent density between 1,750 kg/m^3 and 2,300 kg/m^3, a degree of porosity from 17 % up to 33 % by volume and a heat conductivity from 0,90 W/mK up to 1,30 W/mK (temperature range 20 °C to 400 °C).

This document is valid for Kachelgrundöfen/Putzgrundöfen (tiled/mortared stoves) with combustion air supply from the side via a heating door frame or the standing grate of the heating door into the combustion chamber. The document is valid 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.

This document is applicable to combustion chambers:

- with an air-fuel ratio of between 1,95 and 3,95 according to the type test;
- with a maximum fuel less than 10 kg, but more than 5 kg;
- using other suitable materials as well as fireclay.

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

- from slow heat release appliances tested according to EN 15250 (or prEN 16510-2-5);
- inserts tested according to EN 13229 (or prEN 16510-2-2); or
- combustion chambers tested according to respective national standards (e.g. ÖNORM B 8303).

This document applies to 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 shall be burned in 78 ± 20 min).

This document is not valid for combinations with water heat exchangers for central heating or other heat absorbing elements like open water tanks and glass plates greater than 1/5 of the combustion chamber surface, etc. This document is not valid for mass-produced prefabricated stoves (slow heat release appliances) or partly prefabricated stoves (slow heat release appliances) according to EN 15250.

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 heating combustion*

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_N
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

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.

3.5
combustion chamber base
A_{BR}
area of a horizontal cut through the combustion chamber at the height of the lower edge of the firebox opening

3.6
combustion chamber height
H_{BR}
mean vertical distance between the combustion chamber base and the combustion chamber ceiling

3.7
combustion chamber surface
O_{BR}
sum of the inner surfaces of the combustion chamber

3.8
mean combustion chamber temperature
t_{BR}
value to calculate the thermal lift in the combustion chamber

3.9
burning rate
m_{BU}
mean fuel load divided by burning time

3.10
combustion chamber admeasurement
U_{BR}
admeasurement of the combustion chamber base

3.11
gas groove
additional opening for the conduction of the flue gas

3.12
flue pipe length
L_Z
length of the connecting line of all geometric centres of the flue pipe profiles from the combustion chamber exit to the connecting pipe entrance

3.13
Kachelgrundofen
tiled stove
Kachelofen

one off slow heat release appliance, which is adapted individually to local conditions and whose visible surface is predominantly made of tiles

3.14
short flue pipe section
section of the flue pipe, where the length of the section is shorter than the hydraulic diameter

3.15
minimum flue pipe length
L_{Zmin}
minimal acceptable length of the flue pipe

3.16
maximum load
m_B
load of the fuel at nominal heat output

3.17
minimum load
m_{Bmin}
load of the fuel at the lowest reduced heat output

3.18
nominal heat output
mean useable heat output of the heating appliance

3.19
Putzgrundofen
mortared stove
Putzofen
one off slow heat release appliance, which is adapted individually to local conditions and whose visible surface is predominantly plastered

3.20
storage period
nominal heating time
period of time specified by the producer where the nominal heat output is set free

3.21
efficiency
proportion (in percent) of the nominal heat output multiplied with the storage period to the total heat input

4 Calculations

4.1 Nominal heat output

The nominal heat output (P_{nv} of the stove shall be specified by the manufacturer so that the values of the stove can be calculated according to 4.2 to 4.10. When specified to heat a full house or building unit, the nominal heat output (Pn) shall correspond to the design heating load of the room or rooms to be heated. In the case of partial heating, in which only part of the design heating load of the installation room is covered, the nominal heat output (Pn) can be selected lower.

4.2 Load of fuel

4.2.1 Maximum load

The maximum load shall be at least 5 kg of fuel and shall be calculated as follows:

$$m_B = \frac{P_n \cdot t_n}{\frac{\eta_{min}}{100} \cdot 4.16} \quad (1)$$

NOTE 1 To calculate, a net calorific value of wood of 4,16 kWh*kg^{-1} is presumed.

where

m_B is the maximum load (kg);

P_n is the specified nominal heat output (kW);

t_n is the specified storage period (h);

η_{min} required minimum efficiency in %.

NOTE 2 The storage period can vary between 8 h and 24 h.

If tested combustion chambers are used, the maximum load at nominal heat output shall be the maximum fuel mass according to the type test.

4.2.2 Minimum load

The definition and calculation of the minimum load is only necessary if a reduced heat output is declared by the manufacturer. The minimum load shall be calculated as 50 % of the maximum load as follows:

$$m_{Bmin} = 0.5 \cdot m_B \tag{2}$$

where

m_B is the maximum load (kg);

m_{Bmin} is the minimum load (kg).

If tested combustion chambers are used, the minimum load at reduced heat output shall be the minimum fuel mass according to the type test. The share can deviate from the 50 % according to Formula (2).

4.3 Design of the essential dimensions

4.3.1 Combustion chamber dimensions

4.3.1.1 General

The height of the lowest opening shall be at least 5 cm above the floor of the combustion chamber.

NOTE Designing the dimensions of the combustion chamber serves two main purposes: firstly to ensure that sufficient room is available to contain the fuel needed to be charged and secondly that the requirements for clean combustion are met. Clause 4.3.1 does not apply to tested combustion chambers.

4.3.1.2 Combustion chamber surface

The dimension of the combustion chamber surface shall be calculated as follows:

$$O_{BR} = 900 \times m_B \tag{3}$$

where

m_B is the maximum load (in kg);

O_{BR} is the combustion chamber surface (in cm²).

For the calculation of the combustion chamber surface all its walls, the ceiling and the base including the area of the combustion chamber opening and the combustion chamber exit for the flue gas shall be regarded equally i.e. calculated as if there were no combustion openings or exits.

4.3.1.3 Combustion chamber base

The combustion chamber base can be varied between a minimum and a maximum value.

The minimum value results from the requirement that at maximum load a height of the fuel of 33 cm shall not be exceeded. Therefore the base shall be calculated using 100 cm² per kg fuel as follows:

$$A_{BRmin} = 100 \times m_B \tag{4}$$

where

m_B is the maximum load (in kg);

A_{BRmin} is the minimum combustion chamber base (in cm²).