SLOVENSKI STANDARD
SIST EN 15544:2009

01-december-2009

Lonļ ene peļ i - Dimenzioniranje

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

Ortsfest gesetzte Kachelgrundöfen/Putzgrundöfen - Auslegung

Poêles en faïence/kachelöfen - Dimensionnement

Ta slovenski standard je istoveten z: EN 15544:2009

ICS:

97.100.30	Grelniki na trdo gorivo	Solid fuel heaters

SIST EN 15544:2009 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 15544

July 2009

ICS 97.100.30

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 19 June 2009.

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 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 Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION

COMITÉ EUROPÉEN DE NORMALISATION

EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 15544:2009: E

Contents

Page

Foreword

This document (EN 15544:2009) 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of an identical text or by endorsement, at the latest by January 2010, and conflicting national standards shall be withdrawn at the latest by January 2010.

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

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, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

This standard specifies a calculation method for the dimensioning of Kachelgrundöfen/Putzgrundöfen (tiled/mortared stoves) based upon the required nominal heat output of the stove as declared by the producer. If the calculations of this standard are observed, the minimum energy efficiency of 78% and the emission values of 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) will be observed too.

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.

NOTE In case of a calculation method for different interior materials than fireclay the proof of the compliance of the emission values should be delivered separately. Furthermore 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 determined.

1 Scope

This standard 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 standard can be used for log wood fired Kachelöfen (tile stoves) that burn one fuel load per storage period with a maximum load between 10 kg and 40 kg and a storage period (nominal heating time) between 8 h and 24 h.

This standard is valid for Kachelgrundöfen/Putzgrundöfen (tiled/mortared stoves) equipped with fireclay as interior material, with an apparent density between 1,750 kg/m³ and 2,200 kg/m³, a degree of porosity from 18 % up to 33 % by volume and a heat conductivity from 0,65 W/mK up to 0,90 W/mK (temperature range 20 °C to 400 °C).

This standard is valid for Kachelgrundöfen/Putzgrundöfen (tiled/mortared stoves) with sidewise combustion air supply of the combustion chamber and an inflow speed from 2 m/s to 4 m/s, whereas the height of the lowest opening is at least 5 cm above the bottom of the combustion chamber.

This standard is not valid for combinations with water heat exchangers for central heating or other heat absorbing elements like glass plates greater than 1/6 of the combustion chamber surface, open water tanks, etc. It is also not valid for combinations with heating/fireplace elements according to EN 13229. Furthermore this standard is not valid for mass-produced prefabricated or partly prefabricated slow heat release appliances according to EN 15250.

NOTE Although for the purposes of this standard these calculations are applicable only to the requirements of this standard, the same calculations can be used for other purposes, e.g. to verify emission levels and energy efficiency in case of burning log wood or wood briquettes according to the producer's manual.

2 Normative references

The following referenced documents are indispensable for the application 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 appliance*

3 Terms and definitions

3.1
construction with air gap
construction, with an air gap between the inner and the outer shell

3.2
construction without air gap
construction, with no air gap between the inner and the outer shell

3.3
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

3.4
combustion chamber height H_{BR}
mean vertical distance between the combustion chamber base and the combustion chamber ceiling

3.5
combustion chamber surface O_{BR}
sum of the inner surfaces of the combustion chamber

3.6
mean combustion chamber temperature t_{BR}
value to calculate the thermal lift in the combustion chamber

3.7
burning rate m_{BU}
mean fuel load divided by burning time

3.8
combustion chamber admeasurement U_{BR}
admeasurement of the combustion chamber base

3.9
gas groove
additional opening for the conduction of the flue gas

3.10
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

3.11
Kachelgrundofen/tiled stove (also Kachelofen)
one off slow heat release appliance, which is adapted individually to local conditions and whose visible surface is predominantly made of tiles

3.12
short flue pipe section
section of the flue pipe, where the length of the section is shorter than the hydraulic diameter

3.13
minimum flue pipe length L_{Zmin}
minimal acceptable length of the flue pipe

3.14
maximum load m_B
load of the fuel at nominal heat output

3.15
minimum load m_{Bmin}
load of the fuel at the lowest reduced heat output

3.16
nominal heat output
mean useable heat output of the heating appliance

3.17
Putzgrundofen/mortared stove (also Putzofen)
one off slow heat release appliance, which is adapted individually to local conditions and whose visible surface is predominantly plastered

3.18
storage period (nominal heating time)
period of time specified by the producer where the nominal heat output is set free

3.19
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 required nominal heat output (P_n) of the stove shall be specified by the producer so that the dimensions of the stove can be calculated in accordance with clauses 4.2 to 4.10.

4.2 Load of fuel

4.2.1 Maximum load

The maximum load of fuel shall be calculated as follows:

$$m_B = \frac{P_n \times t_n}{3,25} \tag{1}$$

NOTE 1 To calculate the factor 3,25 in equation (1), a net calorific value of wood of 4,16 kWh*kg^{-1} and an efficiency of 0,78 (78%) was 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).

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

4.2.2 Minimum load

The minimum load shall be calculated as 50 % of the maximum load as follows:

$$m_{Bmin} = 0,5 \times m_B \tag{2}$$

where

m_B is the maximum load (kg);

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

4.3 Design of the essential dimensions

4.3.1 Combustion chamber dimensions

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.

4.3.1.1 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 cm^2).

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.

4.3.1.2 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 cm^2).

The maximum area of the base of the combustion chamber shall be defined as a result of equations (3) and (6) as follows:

$$A_{BRmax} = \frac{900 \times m_B - (25 + m_B) \times U_{BR}}{2} \tag{5}$$

where

m_B is the maximum load (in kg);

A_{BRmax} is the maximum combustion chamber base (in cm^2);

U_{BR} is the combustion chamber admeasurement (in cm).

When the base is square, the proportion of length to width can be varied from 1 to 2, but there shall be a minimum width of 23 cm.

4.3.1.3 Combustion chamber height

The minimum combustion chamber height shall be defined as follows:

$$H_{BR} \geq 25 + m_B \tag{6}$$

where

m_B is the maximum load (in kg);

H_{BR} is the combustion chamber height (in cm).

On the basis of the specifications of the combustion chamber base and the combustion chamber surface the combustion chamber height shall be calculated as follows:

$$H_{BR} = \frac{900 \times m_B - 2 \times A_{BR}}{U_{BR}} \qquad (7)$$

where

m_B is the maximum load (in kg);

A_{BR} is the combustion chamber base (in cm^2);

H_{BR} is the combustion chamber height (in cm);

U_{BR} is the combustion chamber admeasurement (in cm).

4.3.2 Minimum flue pipe length

4.3.2.1 Construction without air gap

The minimum flue pipe length shall be calculated as follows:

$$L_{Zmin} = 1{,}3 \times \sqrt{m_B} \qquad (8a)$$

where

m_B is the maximum load (in kg);

L_{Zmin} is the minimum flue pipe length (in m).

4.3.2.2 Construction with air gap

The minimum flue pipe length shall be calculated as follows:

$$L_{Zmin} = 1{,}5 \times \sqrt{m_B} \qquad (8b)$$

where

m_B is the maximum load (in kg);

L_{Zmin} is the minimum flue pipe length (in m).

4.3.3 Gas groove profile

The gas groove profile shall be calculated as follows:

$$A_{GS} = 1 \times m_B \qquad (9)$$

where

A_{GS} is the profile of the gas groove (in cm^2);

m_B is the maximum load (in kg).