



BSI Standards Publication

Residential solid fuel burning appliances

Part 1: General requirements and test methods

National foreword

This British Standard is the UK implementation of EN 16510-1:2022. It supersedes BS EN 16510-1:2018, which is withdrawn. Together with BS EN 16510-2-3:2022, it supersedes BS EN 12815:2001+A1:2004 which is withdrawn. Together with BS EN 16510-2-2:2022, it supersedes BS EN 13229:2001+A2:2004 which is withdrawn. Together with BS EN 16510-2-4:2022, it supersedes BS EN 12809:2001+A1:2004 which is withdrawn. Together with BS EN 16510-2-1 and BS EN 16510-2-6:2022, it supersedes BS EN 13240:2001+A2:2004 which is withdrawn.

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Häusliche Feuerstätten für feste Brennstoffe - Teil 1: Allgemeine Anforderungen und Prüfverfahren

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European foreword

This document (EN 16510-1:2022) 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of an identical text or by endorsement, at the latest by June 2023, and conflicting national standards shall be withdrawn at the latest by November 2025.

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 16510-1:2018, EN 12815:2001, EN 13240:2001, EN 13229:2001 and EN 12809:2001 as amended and corrected.

In relation to EN 16510-1:2018 the following changes have been made:

- modifications to align the document with the standardisation request M/577 and the parts 2 (to be harmonized);
- emission test procedures optimized;
- new test procedure for particulate matter (PM) measurement integrated;
- Clause 8 “Environmental sustainability” completely revised;
- Annex J “A-deviations” deleted.

The structure of EN 16510, *Residential solid fuel burning appliances*, is as follows:

- *Part 1: General requirements and test methods;*
- *Part 2-1: Roomheaters;*
- *Part 2-2: Inset appliances including open fires;*
- *Part 2-3: Cookers;*
- *Part 2-4: Independent boilers — Nominal heat output up to 50 kW;*
- *Part 2-5: Slow heat release appliances;*
- *Part 2-6: Mechanically by wood pellets fed roomheaters, inset appliances and cookers.*

Other sections of Part 2 will be added to cover residential solid fuel burning appliances not included in parts 2-1 to 2-6.

EN 16510-1 is used in conjunction with the appropriate Part 2. The Parts 2-1 to 2-6 contain clauses that supplement or modify the corresponding clauses in this Part 1. Part 1 together with the relevant Part 2 provides the requirements for each type of appliance.

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.

1 Scope

This document is applicable to residential solid fuel burning appliances of which the nominal space heat output is more than 6 % of the combined nominal space heat output and nominal water heat output (total heat output).

This document specifies requirements relating to the design, manufacture, construction, safety and performance (efficiency and emission) of appliances fired by solid fuel (hereafter referred to as “appliance(s)”) and provides instructions for them. Furthermore, it also gives provisions for the evaluation of conformity, i.e. initial type testing (ITT) and factory production control (FPC) and marking of these appliances.

This document specifies CO, NO_x, OGC and particulate matter (PM) emission test methods.

This document is as well applicable to appliances intended to carry the load of a chimney.

Appliances receiving combustion air through ductwork from outside the external envelope, which is not air tight, are not considered roomsealed.

This document is not applicable to appliances with boiler parts in contact with fire or flue gases other than when the boiler parts are manufactured from steel or cast iron.

This document is not applicable to appliances with a boiler intended for water systems having:

- water temperatures above 110 °C and/or an operating pressure of more than 300 kPa (3 bar);
- direct contact with sanitary hot water.

This document is not applicable to appliances to be operated with ventilating systems which are intended to operate with pressure below -15 Pa in the room of installation of the appliance in relation to the outside atmosphere.

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 303-5:2021, *Heating boilers — Part 5: Heating boilers for solid fuels, manually and automatically stoked, nominal heat output of up to 500 kW — Terminology, requirements, testing and marking*

EN 613:2000¹, *Independent gas-fired convection heaters*

EN 1561:2011, *Founding — Grey cast irons*

EN 1563:2018, *Founding — Spheroidal graphite cast irons*

EN 10029:2010, *Hot-rolled steel plates 3 mm thick or above — Tolerances on dimensions and shape*

EN 12828:2012+A1:2014, *Heating systems in buildings — Design for water-based heating systems*

EN 13384-2:2015+A1:2019, *Chimneys — Thermal and fluid dynamic calculation methods — Part 2: Chimneys serving more than one combustion appliance*

¹ As impacted by EN 613:2000/A1:2003.

EN 13501-1:2018, *Fire classification of construction products and building elements — Part 1: Classification using data from reaction to fire tests*

EN 14597:2012, *Temperature control devices and temperature limiters for heat generating systems*

EN 14792:2017, *Stationary source emissions — Determination of mass concentration of nitrogen oxides — Standard reference method: chemiluminescence*

EN 14793:2017, *Stationary source emissions — Demonstration of equivalence of an alternative method with a reference method*

EN 15456:2008, *Heating boilers — Electrical power consumption for heat generators — System boundaries — Measurements*

EN 15804:2012+A2:2019, *Sustainability of construction works — Environmental product declarations — Core rules for the product category of construction products*

EN 60335-2-102:2016, *Household and similar electrical appliances — Safety — Part 2-102: Particular requirements for gas, oil and solid-fuel burning appliances having electrical connections (IEC 60335-2-102:2004)*

EN 60730-1:2016², *Automatic electrical controls — Part 1: General requirements (IEC 60730-1:2013, modified)*

EN ISO 228-1:2003, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation (ISO 228-1:2000)*

EN ISO 228-2:2003, *Pipe threads where pressure-tight joints are not made on the threads — Part 2: Verification by means of limit gauges (ISO 228-2:1987)*

EN ISO 9606-1:2017, *Qualification testing of welders — Fusion welding — Part 1: Steels (ISO 9606-1:2012 including Cor 1:2012 and Cor 2:2013)*

EN ISO 9606-2:2004, *Qualification test of welders — Fusion welding — Part 2: Aluminium and aluminium alloys (ISO 9606-2:2004)*

EN ISO 16948:2015, *Solid biofuels — Determination of total content of carbon, hydrogen and nitrogen (ISO 16948:2015)*

EN ISO 16994:2016, *Solid biofuels — Determination of total content of sulfur and chlorine (ISO 16994:2016)*

EN ISO 18122:2015, *Solid biofuels — Determination of ash content (ISO 18122:2015)*

EN ISO 18123:2015, *Solid biofuels — Determination of the content of volatile matter (ISO 18123:2015)*

EN ISO 18125:2017, *Solid biofuels — Determination of calorific value (ISO 18125:2017)*

EN ISO 18134-1:2015, *Solid biofuels — Determination of moisture content — Oven dry method — Part 1: Total moisture — Reference method (ISO 18134-1:2015)*

² As impacted by EN 60730-1:2016/A1:2019 and EN 60730-1:2016/A2:2022.

ISO 7-1:1994, *Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation*

ISO 7-2:2000, *Pipe threads where pressure-tight joints are made on the threads — Part 2: Verification by means of limit gauges*

ISO 331:1983³, *Coal — Determination of moisture in the analysis sample — Direct gravimetric method*

ISO 334:2020, *Coal and coke — Determination of total sulfur — Eschka method*

ISO 501:2012, *Hard coal — Determination of the crucible swelling number*

ISO 562:2010, *Hard coal and coke — Determination of volatile matter*

ISO 609:1996, *Solid mineral fuels — Determination of carbon and hydrogen — High temperature combustion method*

ISO 687:2010, *Solid mineral fuels — Coke — Determination of moisture in the general analysis test sample*

ISO 1171:2010, *Solid mineral fuels — Determination of ash*

ISO 1928:2020, *Coal and coke — Determination of gross calorific value*

ISO 10849:1996, *Stationary source emissions — Determination of the mass concentration of nitrogen oxides — Performance characteristics of automated measuring systems*

ISO 19579:2006, *Solid mineral fuels — Determination of sulfur by IR spectrometry*

IEC 62301:2011, *Household electrical appliances — Measurement of standby power*

3 Terms and definitions

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

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

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

3.1 accumulator
part of the appliance designed for accumulation of the heat released by the Kachelofen/Putzofen heat generator and which releases this heat slowly

³ ISO 331:1983 is withdrawn.

3.2**accumulation heat output**

quantity of useful heat released by an appliance with accumulator (i.e. the heat output from both the appliance and the accumulator) when burning the test fuel batch as specified and achieved under defined test conditions in accordance with this document

Note 1 to entry: See A.4.10.

3.3**accumulator load**

quantity of heat which the fuel provides to the appliance for accumulation

3.4**air grilles**

components in the inlet and outlet openings to distribute and direct convection air flow

3.5**appliance enclosure**

assembly consisting of walls and ceiling of non-combustible materials which is built on site to surround a Kachelofen/Putzofen heat generator and heat exchanger and to form a space from which hot convection air is emitted into the living space, e.g. by air grilles

3.6**appliance family**

group of appliances of similar construction and/or performance characteristics where it is permissible to test only selected appliances in accordance with the requirements of this document

3.7**appliance with boiler**

heat generator consisting of a room heating component and a water heating component in one unit

3.8**ash content of the fuel**

solid matter remaining after the complete combustion of solid fuel

3.9**ashpan**

removable receptacle shaped to receive the residue falling from the firebed

3.10**ashpit**

enclosed chamber designed to receive the residue or the ashpan

3.11**ashpit loss**

part of the residue which is combustible

3.12**basic firebed**

quantity of glowing embers (no visible flame) which ensures ignition of the test fuel to be charged, defined by mass of glowing embers or CO₂-content in the flue gas

3.13

batch

1 fuel load, used during each cycle

3.14

batch charge

<for slow heat release appliances> proportion of the test load as specified for slow heat release appliances that can be added at specified intervals during the test period of the burning rate performance test

3.15

boiler

vessel in which water is heated, intended for fitting in or forming an integral part of a solid fuel appliance

3.16

boiler flueway

portion of the flueway formed wholly or in part by the surfaces of the boiler

3.17

boiler waterways

space within a boiler which contains water

3.18

bottomgrate

part of the appliance at the base of the combustion chamber which supports the firebed through which the residue falls into the ashpan or ashpit and through which combustion air and/or combustion gases may be drawn

3.19

burning area

part of the combustion chamber floor limited by (front and lateral) firebars or a geometrically given zoning which is clearly evident for the operator to identify the fuel loading area (e.g. a vertical recess of at least 40 mm)

Note 1 to entry: A painting or a little step/vertical recess of e.g. 2 mm is not regarded as a geometrically given zoning.

3.20

burning rate

mass of test fuel burnt per unit of time as fired

3.21

charging door

door which covers the refuelling opening

3.22

combustion air

air supplied to the combustion chamber which is entirely or partially used to burn the fuel

3.23

combustion air control device

manual or automatic mechanism for setting the primary and/or secondary air in accordance with the burning rate required

3.24**combustion air inlet**

integral component of the appliance e.g. for the connection of the combustion air pipe

3.25**combustion air selector**

device for adjusting the primary and/or secondary air according to the type of fuel burnt

3.26**combustion chamber**

part of the appliance in which the fuel is burnt

3.27**combustion chamber opening**

aperture in the combustion chamber through which an appliance may be fuelled

3.28**combustion gas baffle**

device to change the direction of flow of the combustion gases

3.29**combustion gases**

compounds in gaseous form produced inside an appliance when fuel is burned

3.30**constant volume sampling**

method to sample all exhaust gases of an appliance at constant flow rate

3.31**continuous burning appliance**

heating appliance designed for slow burning over an extended period of time (e.g. overnight) and meeting the requirements of the slow combustion test

3.32**conveyor system**

device for feeding the fuel from the hopper to the retort

3.33**cut-off device**

mechanism to block the supply of flue when the appliance is not in use

3.34**cycle**

period from reloading until the basic fire bed is reached

3.35**damper**

mechanism to change the resistance to flow of the combustion gas ways

3.36**de-ashing**

process of clearing a firebed and discharging the residue into the collecting receptacle

3.37

draught regulator

internal inlet device for admission of air downstream of the firebed, enabling the flue draught to be controlled

3.38

efficiency

energy efficiency in active mode

$\eta_{s,on}$

ratio of total heat output to total heat input during the test expressed as a percentage during the test

3.39

energy efficiency index

EEI

basis for a labelling scheme of the appliances in relation to the appliance's efficiency

3.40

firebed

ash, ember and fuel contained in the combustion chamber

3.41

fireplace recess

space formed in a wall or chimney breast constructed from non-combustible materials and into which a heating appliance may be installed and from which a chimney flue leads

3.42

flue draught

difference between the static pressure in the place of installation and the static pressure at the specified point in the measurement section

3.43

flue gas adaptor

insulated fitting between connection pipe and measurement section which allows in addition variations in size and shape of the flue components

Note 1 to entry: See Figure A.3.

3.44

flue gas connector

un-insulated duct through which flue gases are conveyed from the flue gas outlet of the appliance into the chimney flue

Note 1 to entry: See Figure A.3.

3.45

flue gas mass flow

mass of flue gas drawn off from the appliance per unit of time

3.46

flue gas temperature

temperature of the flue gas at the specified point in the measurement section

3.47**flue gas outlet**

integral component of the appliance for the connection to the connector

3.48**flue gas outlet temperature**

calculated temperature of the flue gas at the exit of the appliance

3.49**flueway**

that part of an appliance designed to convey combustion gases from the combustion chamber to the flue gas outlet

3.50**freestanding appliance**

appliance designed to operate without needing to be built into a fireplace recess or appliance enclosure and which is not connected to the building except by the flue gas connector

3.51**front firebars**

lateral deepening plate

grating or plate fitted at the front of the combustion chamber opening (lateral) to prevent spillage of fuel and ash or to change the combustion chamber capacity, or both

3.52**fuel hopper**

fuel store integrated with the appliance from which fuel is fed to the combustion chamber

3.53**fuel storage**

area forming part of the appliance, but not connected directly to the fuel charging area, in which fuel is stored prior to it being physically transferred by the user to the fuel charging position

3.54**gas sample**

portion of gaseous material on which observations can be made in order to provide data on the gaseous material from which it has been removed

Note 1 to entry: A sample is taken as being representative of the gaseous material if the same observations are supplied on any other samples taken from this gaseous material to furnish the same data within pre-set intervals.

3.55**heat input**

quantity of energy which the fuel provides to the appliance

3.56**heat output**

quantity of useful heat released by the appliance

3.57**hydrocarbon emissions**

OGC emissions

mean OGC concentration calculated to 13 % oxygen (O₂) content in the flue gas, measured in accordance with Annex E

3.58

inset appliance

appliance with or without doors designed to be installed into a fireplace recess or an appliance enclosure, or into a combustion chamber of an open fire

3.59

integral duct

pipe shaped integral part outside the main corpus of the appliance downstream the flue ways

3.60

intermittent burning appliance

heating appliance intended to be operated in short intervals for any period of time by successively refuelling

Note 1 to entry: An appliance may be either a continuous burning appliance or an intermittent burning appliance according to the fuel used.

3.61

leakage

volumetric flow that might spill into the installation room, at a certain inside pressure, through parts of the appliance according to the system limit that are not tight, e.g. at the connector or the combustion air pipe

Note 1 to entry: The air flow rate that is to be supplied, when a defined overpressure in the appliance is reached, in order to keep this overpressure.

Note 2 to entry: In this case, the limit of system depends on the type of appliance (see 4.1).

3.62

maximum water operating pressure

limiting water pressure at which the boiler of an appliance can be safely operated

3.63

local space heater

LSH

residential solid fuel burning appliance

3.64

nominal heat output

specified maximum expected heat output of an appliance when using the fuel load and refuelling periods specified in the operating instructions

3.65

nominal space heat output

heat output provided by convection and radiation to the room at nominal heat output

3.66

nominal water heat output

heat output to water, averaged during the test at nominal heat output

3.67

NO_x emissions

mean NO_x concentration expressed as NO₂ calculated to 13 % oxygen (O₂) content in the flue gas, measured in accordance with Annex D

3.68**open fire**

appliance without doors or intended for open operation only

3.69**operating tool**

device supplied with the appliance for handling movable and/or hot components

Note 1 to entry: For example, a glove is to be regarded as an operating tool.

3.70**part load heat output**

heat output achieved during the test under part load conditions

Note 1 to entry: See A.4.8.

3.71**part load space heat output**

heat output provided by convection and radiation to the room at part load heat output

3.72**part load water heat output**

heat output to water, averaged during the test at part load heat output

3.73**particulate emission sample gas volume**

total volume of gas collected during a cycle in the particulate emission sampling train

3.74**PM**

particles, measured via a heated filter in the measuring section

Note 1 to entry: See Annex F, F.2.

3.75**primary air**

combustion air which passes through the fuel bed

Note 1 to entry: Primary air does not necessarily have separate inlets nor does it necessarily pass through a bottomgrate.

3.76**recommended fuel**

fuel of commercial quality, listed in the appliance's instructions, and demonstrated to achieve the specified performance when tested in accordance with this document

3.77**recovery capability**

ability of a continuous burning appliance to re-ignite existing or newly charged fuel after a defined burning period without external assistance

3.78

heat output at slow combustion

heat output achieved during the test period under slow combustion conditions

Note 1 to entry: See A.4.9.

3.79

space heat output at slow combustion

space heat output achieved during the test period under slow combustion conditions

Note 1 to entry: See A.4.9.

3.80

water heat output at slow combustion

water heat output achieved during the test period under slow combustion conditions

Note 1 to entry: See A.4.9.

3.81

reference material

material or substance, one or more of whose property values is sufficiently homogeneous and well established to be used for the calibration of an apparatus, the assessment of measurement method, or for assigning values to materials

3.82

refuelling interval

period of time for which the combustion may be maintained in the appliance with a single load of fuel, without intervention by the user

3.83

residential space heating appliance fired by wood pellets

pellet stove

free standing or inset appliance with closed door only and automatically stoked by a conveyor system

Note 1 to entry: They may have an integral or external fuel hopper.

3.84

residue

ashes, including combustibles, which collect in the ashpit

3.85

resolution

smallest difference between indications, for an identifiable component, of a recording or display device that can be meaningfully distinguished

3.86

retort

retort burner pot

vessel forming the firebox of a wood pellet stove into which the pellets are automatically fed from the fuel hopper and in which they are burned

3.87**roomheater**

appliance having a fully enclosed combustion chamber with charging door(s) which are normally closed after refuelling, that distributes heat by radiation and/or convection and also provides hot water when fitted with a boiler

3.88**roomsealed appliance**

appliance in which the combustion circuit is sealed off from the area where the appliance is installed

Note 1 to entry: The appliance is receiving its combustion air via leak tight air ducts directly from outside.

Note 2 to entry: An appliance may receive its combustion air via ducts from outside, but cannot be classified as roomsealed if it does not fulfil the requirements according to Clause 4, types CA, CM and CC.

Note 3 to entry: It will not be possible for a dangerous amount of combustion gas to spill into the installation room in the case of a static overpressure in the appliance compared to the installation room.

3.89**sample line**

line provided to take a representative sample from a gas to be analysed and to transport it from the sample point to the analyser

3.90**safety heat exchanger**

device which allows excess heat to be released from an appliance

3.91**safety test**

abused test considering conditions in excess of what would be expected in worse case operation and carried out to give a factor of safety for distances to combustible materials

3.92**seasonal space heating energy efficiency**

η_s

ratio between the space heating demand, supplied by a solid fuel local space heater and the annual energy consumption required to meet this demand

3.93**secondary air**

air supplied for the purpose of completing the combustion of gases leaving the fuel bed

3.94**slow heat release appliance**

intermittent burning appliance having thermal storage capacity to accumulate heat into its mass such that it provides heat for a period of hours as specified after the fire has gone out

3.95**solid fuel**

naturally occurring or manufactured solid mineral fuels, natural or manufactured wood logs and peat briquettes

3.96

solid mineral fuel

solid mineral fuel/fossil solid fuel, coal, lignite, coke and fuels derived from these

3.97

standard condition

volume of gas at 273 K (0 °C) and 1 013,25 hPa

3.98

start-up device

mechanism different from the primary and secondary air valve system to divert the path of the heating gases and/or to change the combustion air opening cross section during the ignition period

3.99

steady-state

stage at which the values of the measured temperature in 2 consecutive cycles do not differ by more than 2 K

3.100

surround

outside components or assembly enclosing the appliance or parts of it

3.101

system boundary

parts of the appliance and installation in relation to the classification of the appliance

3.102

temperature in the fuel hopper

temperature at the hottest point, measured in the area of possible fuel storage

3.103

test

full procedure from start to end

EXAMPLE safety test is 1 test

3.104

test cycle duration

elapsed time between the start and the end of a cycle according to this document

3.105

test fuel

fuel of commercial quality being characteristic for recommended fuels to be used for testing appliances

3.106

thermal discharge control

mechanical device controlled by the maximum water temperature in the boiler which opens a valve to the water circuit of a safety heat exchanger when a specified maximum water temperature is reached

3.107

thermostat

temperature sensitive device which automatically changes the air inlet cross-sectional area or other functional devices of the appliance (e.g. water circulation pump if any)

3.108

total heat output

complete useful heat released by the appliance being the sum of water heat output and space heat output

3.109

type test pressure

pressure at which all waterways of the appliance are tested

3.110

water flow temperature

temperature of the heated water exiting the appliance

3.111

water return temperature

temperature of the cooled water entering the return tapping connectors of the appliance

3.112

wood pellet

solid fuel, usually in cylindrical form, made from untreated pulverized wood of the whole tree and compressed with or without the aid of binders (e.g. molasses, paraffin wax, glucose)

3.113

working surfaces

all touchable surfaces of an appliance designed to transmit heat to the surrounding space

Note 1 to entry: All external surfaces of an appliance including the flue gas connector in accordance with this document are classified as working surfaces because they are designed to transmit heat into the room in which they are installed.

4 Descriptive features

4.1 Designation of appliances

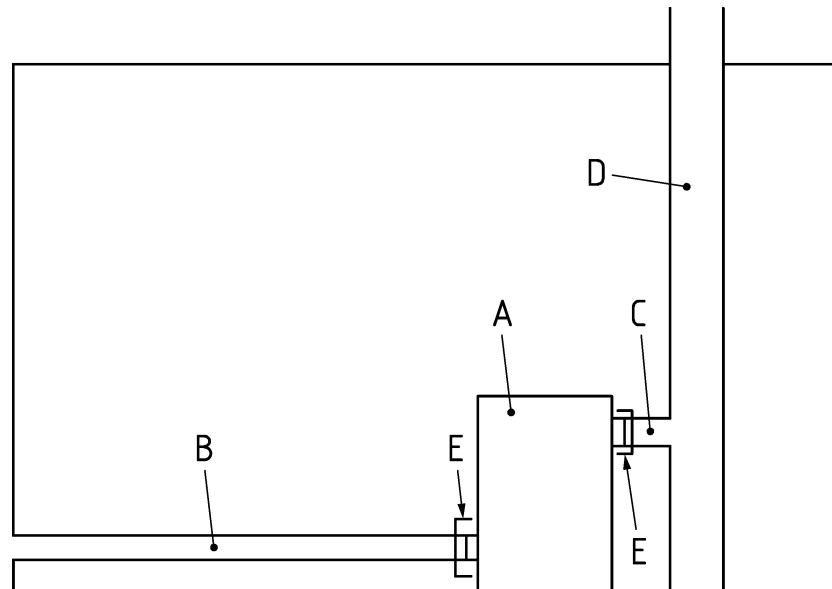
This document deals with different types of appliances as given in Table 1.

Table 1 — Types of appliances

Type	Room-Sealed	Leakage declaration	Combustion air supply connection	Door closure	Tightness requirement
Type B	-	No	No specific requirement	No specific requirement	No specific requirement
Type BE	-	No	Yes	No specific requirement	Appliance intended to be supplied with combustion air via a combustion air duct. No specific requirements for tightness
Type BF	-	Yes	Yes	No specific requirement	The leakage is tested in accordance with A.4.11.2.2 on delivery only. A leakage is measured and given in the instructions, no further requirement on the tightness.
Type CA	Yes	Yes	Yes	Mechanism to close the doors automatically	In accordance with 5.9 after closing the door without further action of the user
Type CM	Yes	Yes	Yes	Manually closed and locked door	In accordance with 5.9 after closing the door
Type CC	Yes	Yes	Yes	Manually closed and locked door controlled by an alarm or fail-safe system	In accordance with 5.9 after closing the door

4.2 System boundary

Figure 1 shows the system boundary limit of the appliance for room sealed operation as covered by the requirements of this document.



Key

- A appliance
- B combustion air duct
- C connecting flue pipe
- D chimney
- E system boundary limit

Figure 1 — System boundary limit for appliance

4.3 Production documentation

The parameters and characteristics considered when deciding the relation to either the family or range of appliances to be submitted for initial type testing (see Annex G) shall be recorded. Where changes are made to an appliance in either the design, raw material, component supplier, or the production process, which would significantly alter the performance characteristics of the appliance, especially in respect of one or more of the lists of characteristics detailed in Table G.1 shall be recorded. A copy of the parameters and characteristics considered in making the decisions shall be included in the production documentation for each appliance. To identify the appliance, related documents and/or scaled assembly drawings shall be available showing the basic design and construction of the appliance. The documentation and/or the drawings shall include at least the following information:

- the specification of the materials used in the construction of the appliance;
- the specified nominal heat output in kW using recommended fuels together with the specified minimum refuelling intervals for these fuels;
- combustion chamber dimensions.

If the appliance is fitted with a boiler or a water heat exchanger the following additional details shall be specified:

- the welding process used in the manufacture of the boiler shell;

NOTE The symbol for the type of weld used is sufficient.

- the permissible maximum operating water temperature, in °C;
- the permissible maximum operating pressure, in Pa and bar;
- the type test pressure, in Pa and bar;
- the water heat output, in kW.

4.4 Construction and materials

4.4.1 General construction

4.4.1.1 Design, manufacture and assembly

The shape and dimensions of the components and equipment and the method of design and manufacture and, if assembled on site, the method of assembly and installation, shall ensure that, when operated as specified in accordance with the test procedures of this document and exposed to the associated mechanical, chemical and thermal stresses, the appliance shall operate reliably and safely such that during normal operation no combustion gas posing a hazard can escape into the room in which the appliance is installed nor can embers fall out.

The requirement shall be satisfied by a visual inspection of the appliance after the heat output tests according to A.4.7 and A.4.8 (if existing) and safety tests according to A.4.10.

Non-combustible materials (materials according to the annex of Commission Decision (96/603/EU) or A1 materials according to EN 13501-1:2018) shall be used, except that it shall be permissible to use combustible materials for the following applications:

- components or accessories fitted outside the appliance;
- internal components of controls and safety equipment;
- operating handles;
- electrical equipment.

No part of the appliance shall comprise any material known to be harmful. Especially no part of the appliance shall comprise or contain asbestos. Hard solder, containing cadmium in its formulation, shall not be used.

When fired with fossil solid fuel fuels, the appliance shall have a bottomgrate and an ashpan.

Component parts, which require periodic replacement and/or removal shall be designed or marked for identification to ensure correct fitting. Provision shall be made for parts, which form a seal, to be located securely by means of bolts, gaskets or welding to prevent the leakage of air/water or combustion products. Adjacent surfaces between metal components in the combustion chamber or the flueways shall be gastight.

Where a seal is made with fire-cement, cement shall be well supported by adjacent metal surfaces.

NOTE Because the entire heat dissipating surfaces of the appliance including the flue gas outlet and the flue gas connector are working surfaces, there is no requirement for limiting the surface temperature of the appliance.

All operations which the user carries out, including loading and emptying of the appliance, adjusting controls and de-ashing shall be easy, safe and effective.

Where thermal insulation is used, it shall be made of non-combustible material and shall not be a known hazard to health in its applied position.

The thermal insulation shall withstand normal thermal and mechanical stresses.

4.4.1.2 Durability

The durability aspects of the appliance shall be satisfied by a visual inspection of the appliance after the heat output tests according to A.4.7 and A.4.8 (if existing) and safety tests according to A.4.10.

4.4.2 Integral boiler or heat exchanger

4.4.2.1 General

The following requirements for the integral boiler of an appliance shall be checked on the basis of drawings and declarations delivered by the manufacturer regarding the production process of the boiler including welding.

The boiler shell shall be constructed from cast iron and/or steel and shall be capable of operating at the maximum operating pressure as specified. The integral boiler shall be verified by the type pressure test in accordance with A.4.10.6.

The materials and dimensions for the boiler construction shall be in accordance with the specifications given in Tables 2 to 7.

4.4.2.2 Integral boilers constructed of steel

Welding processes shall meet the requirements of EN ISO 9606-1:2017 and EN ISO 9606-2:2004 as follows:

- only welders who are qualified in welding of the materials to be processed shall be used;
- equipment shall be available to allow defect-free welding to be carried out;
- supervision of the welding process shall be carried out by staff qualified in welding (at least one supervisor shall be qualified).

The materials shall be suitable for welding.

NOTE 1 The materials in Table 3 are suitable for welding and do not require additional heat treatment after welding.

The welded seams shall not show any cracks or lack of fusion and shall be defect free over the whole cross-section for butt welds. One-sided fillet welds, and half Y-welds which have been welded through, shall be kept substantially free from bending stresses. Smoke tubes, inserted stays and similar components need not be counter welded.

Double fillet welds are only permissible when sufficiently cooled. Projections into the flue gas side in areas of high thermal stresses shall be avoided.

Corner welds, edge welds and similar welded connections, which would be subject to high bending stresses during production and operation, are to be avoided.

When welding longitudinal stay bars or stay tubes, the shearing cross section of the fillet weld shall be 1,2 times the required stay bar or stay tube cross sectional area.

The permissible types of weld and appropriate material thicknesses are given in Table 2 and these parameters shall be met.

Welding fillers shall be suitable for the material being used.

NOTE 2 The terms given in Table 2 are in accordance with EN ISO 2553:2019; the reference numbers of welding processes are in accordance with ISO/TR 25901-3:2016, ISO 857-2:2005 and EN ISO 4063:2010.

Table 2 — Steel - Nominal minimum wall thicknesses

Application	Non-alloy steels mm	Stainless and corrosion resistant steels mm	Non-alloy steels for appliances burning wood only and having maximum water operating pressures of up to and including 0,2 MPa (2 bar) mm
Walls of water backed surfaced of the combustion chamber in contact with burning fuel or products of combustion	5	2	3
Walls of convection heating surfaces outside combustion chamber (except circular tubes)	4	2	3
Circular tubes used in convection part of heat exchanger	3,2	1,5	3,2
Water cooled grate tubes	4	3	3
Surfaces other than those above	3	2	3
NOTE 1 The nominal minimum wall thicknesses apply to pressure loaded sheets and tubes other than immersion coils, safety heat exchangers. NOTE 2 Thinner wall thicknesses are only permissible with proof of equivalent corrosion resistance, heat resistance and strength. NOTE 3 The nominal minimum wall thicknesses listed have been specified taking into consideration: — the maximum water operating pressure (as specified), — the material properties, — the heat transfer location.			

The tolerances on the nominal minimum wall thicknesses for non-alloyed steels given in Table 2 shall be as specified in EN 10029:2010.

Table 3 — Steel material types

References	Material type	Material numbers ^a
EN 10111:2008	DD11	1.0332
	DD12	1.0398
	DD13	1.0335
	DD14	1.0389
EN 10025-1:2004	E235	1.0308
	S235JR	1.0037
	S235JRG2	1.0038
	S235J0	1.0114
	S235J2G3	1.0116
	S275JR	1.0044
	S275J0	1.0143
	S275J2G3	1.0144
	S355JR	1.0045
	S355J0	1.0553
	S355J2G3	1.0570
	S355J2H	1.0576
	S355K2G3	1.0595
EN 10028-2:2017	P235GH	1.0345
	P265GH	1.0425
EN 10028-3:2017	P355NL1	1.0566
	P295GH	1.0481
	P355GH	1.0473
	16Mo3	1.5415
	15NiCuMoNb5-6-4	1.6368
	13CrMo4-5	1.7335
	10CrMo9-10	1.7380
	11CrMo9-10	1.7383
EN 10222-4:2017+A1:2021	P355QH1	1.0571
	P285QH	1.0478
EN 10120:2017	P245NB	1.0111
	P265NB	1.0423
	P310NB	1.0437
	P355NB	1.0557

References	Material type	Material numbers ^a
EN 10088-2:2014	X5CrNi18-10	1.4301
	X5CrNi17-12-2	1.4401
	X2CrNiMo17-13-2	1.4404
	X2CrTiNb18	1.4509
	X6CrNiTi18-10	1.4541
	X6CrNiNb18-10	1.4550
	X2 CrMnNiN 22-5-2	1.4162
	X2 CrNiN 23-4	1.4362
	X2 CrNiMoN 22-5-3	1.4462
	X1 NiCrMoCuN 25-20-7	1.4529
	X1 NiCrMoCu 25-20-5	1.4539
	X6CrNiMoTi17-12-2	1.4571
	X6CrNiMoNb17-12-2	1.4580
	X3CrNiMo17-3-3	1.4436
EN 10088-1:2014	X15CrNiSi20-12	1.4828
	X15CrNiSi25-21	1.4841
EN 10216-1:2013	P195TR1	1.0107
	P235TR1	1.0254
Materials and wall thicknesses other than those specified may only be used on production of appropriate evidence as regards at least their equivalent corrosion resistance, heat resistance and strength to non-alloy steel at the material thicknesses specified in 4.4.2.2 for the particular application/usage.		
^a In accordance with EN 10027-2:2015.		

4.4.2.3 Integral boilers constructed of cast iron

4.4.2.3.1 Cast iron parts subject to water pressure

The mechanical properties of cast iron used for parts subject to water pressure shall, as a minimum, correspond to the values listed in Table 4.

Table 4 — Minimum mechanical requirements for cast irons

Grey cast iron ^a	
Tensile strength R_m	$> 150 \text{ N/mm}^2$
Brinell hardness	160 HB to 220 HB
Spheroidal graphite iron ^b	
Tensile strength R_m	$> 400 \text{ N/mm}^2$
Elongation	18 % A3
^a In accordance with EN 1561:2011.	
^b In accordance with EN 1563:2018.	

4.4.2.3.2 Minimum wall thicknesses (cast iron)

The wall thickness of the casting section shall be not less than the minimum thicknesses listed in Table 5.

Table 5 — Cast iron - Minimum wall thicknesses

Nominal heat output (water and room combined) kW	Grey cast iron mm	Spheroidal graphite cast iron mm
< 30	3,5	3,0
≥ 30 and < 50	4,0	3,5

4.4.2.4 Integral Boiler shell tapings**4.4.2.4.1 Introduction**

The threads of boiler shell tapings, for flow and return pipes, shall be not less than the minimum thread size designation given in Table 6.

Where tapered threads are used, they shall be in accordance with the requirements of ISO 7-1:1994 and ISO 7-2:2000. Where parallel threads are used, they shall be in accordance with EN ISO 228-1:2003 and EN ISO 228-2:2003. The design and position of flow tapings shall be such that air is not retained within the boiler shell.

Table 6 — Minimum thread size designation of flow and return tapings

Nominal heat output (water and room combined) [kW]	Gravity circulation thread size designation ^a [""]	Pumped circulation thread size designation ^a [""]
≤ 22	1	1/2
> 22 ≤ 35	1 1/4	3/4
> 35 < 50	1 1/2	1
^a Designation in accordance with ISO 7-1:1994 and ISO 7-2:2000 or EN ISO 228-1:2003 and EN ISO 228-2:2003.		

If boilers are supplied with reducing bushes in horizontal flow tappings, these shall be eccentric and fixed so that the reduced outlet is uppermost. The minimum depth of tapping or length of thread shall conform to Table 7.

Table 7 — Minimum depth of tapping or length of thread

Thread size designation ^a [“]	Minimum depth or length of thread [mm]
1/2 to 1 1/4	16
1 1/2	19
^a Designation in accordance with ISO 7-1:1994 and ISO 7-2:2000 or EN ISO 228-1:2003 and EN ISO 228-2:2003.	

Where a drain socket is provided in the boiler shell, it shall be a minimum thread size designation of 1/2” and shall be in accordance with ISO 7-1:1994 and ISO 7-2:2000 or EN ISO 228-1:2003 and EN ISO 228-2:2003.

4.4.2.4.2 General

For appliances designed to be used in open systems, the minimum internal dimension of waterways throughout the main body of the appliance shall not be less than 20 mm except where waterways shall be locally reduced to facilitate manufacture or are in areas not in direct contact with burning fuel. In these cases, the width of the waterways shall not be less than 15 mm.

For heat exchangers with waterways consisting of tubes that are in direct contact with fire or hot combustion gases the internal diameter shall not be less than 20 mm.

4.4.2.4.3 Design of all integral boiler waterways

The design of the boiler shall ensure a free flow of water through all parts. To minimize the build-up of sediments, sharp or wedge-shaped waterways with a taper towards the bottom shall be avoided.

Where inspection holes are provided in the boiler to give access for inspection and cleaning of the waterways, they shall have a minimum dimension of (70 × 40) mm² or have a minimum diameter of 70 mm and be sealed with a gasket and cap. For appliances designed to be used in water systems with a pump, the flow resistance of the appliance shall be measured between the water inlet and water outlet of the appliance in accordance with A.2.5. The measured value shall be in accordance with the instructions.

4.4.2.4.4 Venting of the water sections

The boiler and its components shall be designed in such a way that their respective water sections can be vented.

The boiler shall be so designed that under normal operation in accordance with the installation instructions, no undue boiling noises occur.

4.4.2.4.5 Water tightness

Holes, for screws and similar components, which are used for the attachment or removal of parts, shall not open into waterways or spaces through which water flows.

This does not apply to pockets for measuring, control and safety equipment.

4.4.2.5 Heat exchangers that are not directly in contact with fire or flue gases

The heat exchanger components shall be selected and constructed so that they can withstand the maximum temperature which could occur at stagnation conditions and the thermal shocks they could be exposed to during the heating period.

Bushings and ducts, leading through the stove construction shall be constructed so that no leakage can occur caused by thermal expansion. The components and the materials of the heat exchanger shall be able to withstand the mechanical loads resulting from the heating up and cooling down of the heat exchanger.

The heat exchanger shall be capable of operating at the maximum operating pressure and temperature as specified.

The requirement shall be satisfied by a pressure test according to A.4.10.6 and in addition a visual inspection of the appliance after the heat output tests according to A.4.7 and A.4.8 (if existing) and safety tests according to A.4.10.

4.4.3 Cleaning of heating surfaces

All surfaces in contact with the combustion products shall be able to be cleaned.

For appliances with an integrated water heat exchanger, the surfaces of the water heat exchanger that are in contact with flames or hot combustion gases shall be accessible for cleaning. Means shall be provided for cleaning the appliance outlet and flue connector. Advice on how this cleaning is to be carried out shall be given in the appliance operating instructions.

Where cleaning and servicing requires the use of special tools (e.g. special brushes), these shall be supplied with the appliance.

4.4.4 Flue gas outlet

For vertical flue connection, the fitting shall overlap by at least 25 mm. Where a pipe diameter of 160 mm is exceeded, the overlap shall be at least 40 mm.

For non-vertical flue connections, the flue gas outlet shall be designed to allow fitting, internal or external, over a length of at least 40 mm, of a flue gas connector.

The flue gas outlet is a fixed and indispensable part of the appliance as tested and sold and shall not be extended for type test purposes. It is not part of the test rig and shall not be confused with the un-insulated flue gas connector (see A.2.1). However, if an extended flue gas outlet or fluepipe is part of the appliance design it shall be included for the type test provided that it is supplied as part of the appliance for fitting whenever the appliance is marketed.

A flue gas outlet adapter is allowed, even when the diameter of the adapter is different from the flue gas outlet. The test shall be performed with this adapter.

It is recommended that provision is made for sealing internal connections with heat resistant sealing compound and/or sealing rope if required.

4.4.5 Flueways

The size of the flueway in its minimum dimension shall be not less than 30 mm except it shall be permissible to reduce it to not less than 15 mm for appliances designed only to burn fuels other than bituminous coals and peat briquettes, and where an access door(s) is provided for cleaning the flueway. It shall be possible to clean the flueways of the appliance completely using commercially available tools or brushes, unless special tools or brushes are provided with the appliance.

For other than rectangular cross sections the equivalent hydraulic diameter of any cross section can be used.

4.4.6 Components built-in the flue ways

Any component built-in the flue ways (e.g. flue dampers or catalysts) shall not block the flue totally. A minimum of at least 20 cm² or 3 % of the cross-sectional area, whichever is greater, shall be unlockable.

A damper shall be easy to operate and incorporate an aperture within the blade, which in a continuous area occupies at least 20 cm² or 3 % of the cross-sectional area of the blade, whichever is greater. The continuous area shall prevent blockage and therefore be a circle or a part of a circle, an annular gap is not allowed.

The position of the damper shall be recognizable from the setting of the device.

4.4.7 Ashpan and ash removal

A means for the removal of the ash residue from the appliance shall be provided. When an ashpan is provided, it shall be at least capable of containing the combustion residue from two full charges of fuel whilst retaining sufficient space above to allow adequate primary air flow through the bottomgrate or firebed. If the ashpan resides in the appliance it shall locate in the ashpit in such a way that it allows the free passage of primary air and in such a position that it does not obstruct any primary air inlet control.

The ashpan shall be designed and constructed to ensure that:

- a) it effectively collects the residue from beneath the bottomgrate;
- b) it can be easily and safely withdrawn, carried and emptied when hot, using the tool(s) provided, without undue spillage of residue material.

NOTE The ashpan can be shovel shaped.

4.4.8 Bottomgrate

Where the bottomgrate is removable it shall be so designed or marked as to ensure correct fitting.

If a de-ashing mechanism is fitted it shall be capable of effectively de-ashing the firebed. The bottomgrate shall not become dislodged during the de-ashing process.

The preferred design with the charging door(s) and ashpit door(s) closed shall allow de-ashing to be carried out. The de-ashing shall be possible without undue effort.

If it is necessary to remove the ashpit door to de-ash the fire, the appliance shall be designed to minimize ash or fuel spillage during the de-ashing operation.

4.4.9 Combustion air supply

4.4.9.1 Primary combustion air control device

The appliance shall be fitted with a primary combustion air control device. The adjusting control shall be clearly visible or permanently marked so that its operation is readily understandable.

The design shall be such that during operation of the appliance, neither ash nor unburned fuel can prevent the movement or closure of the air inlet control.

The minimum or 'cold' setting of the primary combustion air control device shall be clearly marked and the method of adjustment shall be described in the user instructions.

For appliances with a boiler and combustion intended to be controlled by the water temperature, the thermostat operating on the primary combustion air control device shall have a variable temperature range and be of the immersion or dry pocket type. For appliances with sealed water systems the thermostat shall be of dry pocket type. The pocket shall be positioned so that the thermostat senses the highest temperature of the flow water of the appliance.

4.4.9.2 Secondary combustion air control device

Where a secondary combustion air control device is provided, the position of air entry shall be so designed that the passage of air is not restricted when the combustion chamber is filled to the recommended capacity.

In case of direct external air supply, a secondary combustion air control device is recommended for admission of air to minimize the risk of condensation and the accumulation of combustion gases.

4.4.10 Damper

If a flue damper is fitted it shall be of a type, which does not block the flue totally. The damper shall be easy to operate and incorporate an aperture within the blade, which in a continuous area occupies at least 20 cm² or 3 % of the cross-sectional area of the blade, whichever is greater. The continuous area shall prevent blockage and therefore be a circle or a part of a circle, an annular gap is not allowed.

The position of the damper shall be recognizable from the setting of the device.

4.4.11 Charging doors and ash-pit doors

When the appliance is equipped with a charging door, that door shall be large enough to allow the appliance to be filled with all types of recommended fuel. Charging doors and ash-pit doors shall be designed to prevent accidental opening and to facilitate closure.

The combustion chamber side bricks and in particular detachable flue baffle plate(s) shall be easily removable through the charging doors or any dedicated cleaning door.

4.4.12 Flue bypass device

Any flue bypass device shall be easily operable. The extreme positions corresponding to full opening and closing shall be stable and easily identifiable.

4.4.13 Internal flue gas diverter

Any internal flue gas diverter shall be capable of maintaining any position in which it is intended to be set and shall not isolate the combustion chamber from the flue gas outlet. If a diverter is intended to be removable then it shall either be permanently and legibly marked or so designed and/or identified as to ensure correct assembly.

Any diverter control shall be permanently and legibly marked to identify its set position to the user.

4.4.14 Front firebars

Front firebars shall be designed to retain the fuel or ash such that there is no undue spillage of ash or burning fuel from the appliance during normal operations, particularly during refuelling or de-ashing.

If the appliance is fitted with removable front firebars, they shall be of a design such that they can neither be incorrectly fitted nor accidentally dislodged.

4.4.15 Fossil solid fuel and peat briquettes burning appliances

When the recommended fuels are fossil solid fuel and peat briquettes, the appliances shall have a bottomgrate and an ashpan.

4.4.16 Draught regulator

If a draught regulator is fitted the device shall be easily accessible for cleaning.

NOTE It might be necessary to set the device out of operation for the tests according to A.4.7, A.4.8 and/or A.4.10.

4.4.17 Cut-off device for inset appliances without doors

If a cut-off device is fitted to an inset appliance according to EN 16510-2-2:2022 without doors, it shall be able to separate the flueway of the appliance to the chimney. The cut-off device shall not hinder control or cleaning of the connecting parts, and the device shall maintain the position in which it is set.

The marking of the position of the operating handle shall enable identification of the position of the cut-off device. The cut-off device shall only be installed into the flue gas collector, flue spigot or flue gas connector. The cut-off device shall only be used when the appliance is off to prevent heat loss from the room via the chimney and to prevent the fall of soot into the room when the chimney is swept.

4.4.18 Convection air outlet for inserts for Kachelofen/Putzofen

For the test in compliance with A.4.7 and EN 16510-2-2:2022, A.4.201 the temperature recorded at the core flow at a distance of 15 cm from outside of the air grilles of the convection air outlet for inserts for Kachelofen/Putzofen according to EN 16510-2-2:2022 shall not be greater than 85 °C when referenced to an ambient temperature of 25 °C.

4.4.19 Oven door of cookers

When open, side hinged oven doors of cookers according to EN 16510-2-3:2022 shall not obstruct the oven opening and shall be capable of opening to an angle greater than 90°.

When drop down doors of cookers according to EN 16510-2-3:2022 are completely open, they shall form an angle of between 85° and 90° to the vertical and remain in this position. When tested in accordance with EN 16510-2-3:2022, A.4.301.5, the drop-down door shall not sag by more than 15 mm, and the cooker shall not tilt.

4.4.20 Hotplate and top plate of cookers

The top plate of cookers according to EN 16510-2-3:2022 shall incorporate a metal or ceramic surface in the form of a hotplate. Part of the hotplate shall be designed as a boiling plate area.

When the cooker is assembled in accordance with the appliance installation instructions, complete with any legs or plinth supplied as an integral part of the appliance, the height from the floor to the cooking surface(s) shall be between 800 mm and 930 mm.

4.4.21 Main/additional ovens of cookers

Where a compartment or compartments are provided as an oven or ovens of cookers according to EN 16510-2-3:2022, their purpose shall be specified in the appliance operating instructions.

At least one of the oven compartments shall be provided with at least two shelf runner positions. When tested in accordance with the test method detailed in EN 16510-2-3:2022, A.4.301.4, the angle of inclination of any oven shelf when under load shall not exceed 10° from the horizontal.

4.4.22 Ashpit and ashpit cover/door of cookers

The ashpit of a cooker according to EN 16510-2-3:2022 shall be so designed that when the ashpan is in position it shall not restrict the primary air inlet.

The ashpit cover/door shall be designed to ensure that

- its closure is not prevented by spilled residue material;
- it cannot be accidentally dislodged;
- when hot it can be handled safely with the tools provided;
- the ashpit is of sufficient size to accommodate the ashpan.

When open, fire doors shall not obstruct the firebox opening and shall be capable of opening to an angle greater than 90°.

If fitted, hotplate charging doors shall either be removable or capable of being opened to an angle greater than 90°.

Designed air inlets around the periphery of the door(s) are permitted.

4.4.23 Oven temperature indicators for cookers

For a cooker with (an) oven(s) to which an oven temperature indicator is fitted, the indicator shall be readable without opening the oven door.

4.4.24 Air inlet for pellet appliances according to EN 16510-2-6

The appliance shall be fitted with either a thermostatically, electronically controlled primary air inlet control or a manual primary air inlet control. The adjusting control shall be clearly visible or permanently marked so that its operation is readily understandable. Where an appliance is designed for various sized pellets use a means shall be provided for the user to identify the correct set position of the primary air inlet control for each fuel size, if any.

Appliances fitted with a boiler shall be fitted with a water temperature actuated, thermostatically controlled fuel and air supply.

4.4.25 Retort for pellet appliances according to EN 16510-2-6

Where for appliances according to EN 16510-2-6 the retort is removable it shall be designed or marked to ensure correct assembly. If a de-ashing mechanism is fitted it shall be capable of de-ashing the fuel bed in the area of the retort.

The preferred design should allow de-ashing to be carried out with the ashpit door closed. The de-ashing operation should be possible without undue effort. If it is necessary to remove the ashpit door to de-ash the fire, the appliance should be designed such that there is no undue spillage of ash or fuel from the appliance during the de-ashing operation.

4.4.26 Heat output control device for pellet appliances according to EN 16510-2-6

The heat output control device for appliances according to EN 16510-2-6 shall be easily accessible and shall be permanently marked.

Its position in relation to its function shall be clearly recognizable

4.4.27 Hopper for pellet appliances according to EN 16510-2-6

For appliances according to EN 16510-2-6 with internal hoppers only, the hopper capacity shall be such as to maintain reduced heat output over at least 6 h and nominal heat output over at least 3 h without refilling. If a longer period of time is specified that can be maintained at nominal heat output without refilling this shall be verified.

For appliances with external hoppers, it shall be checked that the minimum size as specified fulfils the above requirements.

4.5 Sound level

Any appliance burning solid fuel that does not have a fan does not emit relevant noise.

Appliances which have a fan assisted combustion (no overpressure at the appliance's spigot, the fan is just to overcome the flow resistance of the appliance) or which have a convection air fan do not emit noise in a harmful level.

4.6 Load bearing capacity

Some appliances with an upper outlet may be able to carry the load of a chimney. The max. load the appliance may carry shall be specified in the appliance installation instructions. This is applicable for room heaters according to EN 16510-2-1, slow heat release appliances according to EN 16510-2-5, pellet stoves according to EN 16510-2-6 and combination appliances fired by wood logs and pellets according to EN 16510-2-7.

The ability to carry the specified load is tested during the safety test in A.4.10.2.

5 Safety requirements

5.1 Natural draught

Where it is specified

- that a continuous burning appliance can be connected to a chimney serving more than one appliance and;
- that the appliance can be operated with fossil solid fuel and peat briquettes as suitable fuels;

the following requirement shall be met.

When tested in accordance with A.4.10.5 either the flue draught throughout the test shall be not less than 3 Pa or, where the flue draught falls below 3 Pa, then over a further 10 h period from when the draught falls below 3 Pa - the total quantity of carbon monoxide in the flue gas, calculated as detailed in A.6.2.8 shall not be greater than 0,250 m³.

For any appliance exceeding the carbon monoxide value it shall be clearly labelled to indicate that it cannot be installed onto a shared flue (see 5.11).

5.2 Open operation of an appliance

For open appliances (appliances without doors) and for those which are intended for operation with charging doors open the following events shall not occur under the test conditions, described in A.4.10.3:

- any continuous escape of combustion gases, and
- any glowing ember dropping out.

For appliances with doors which are intended for open and closed operation according to the specification both modes of operation are to be regarded for safety tests, nominal heat output tests and, if specified, part load and slow combustion tests.

5.3 Strength and leak tightness of integral boiler shells

The boiler shell and its water carrying components shall not leak or become permanently deformed when subjected to the type pressure test, described in A.4.10.6, and during the nominal heat output test, described in A.4.7.

5.4 Temperature rise in the fuel storage (other than the fuel hopper)

When tested in accordance with A.4.7 and A.4.10, the temperatures measured in the fuel storage shall not exceed the ambient room temperature by more than 65 K.

5.5 Temperature rise of the operating components

If the manipulation of the operating components does not require the assistance of tools, the surface temperatures, measured only in the areas to be touched, shall not exceed the ambient room temperature by more than the following, when tested in accordance with A.4.7:

- 35 K for metal;
- 45 K for porcelain, vitreous enamel or similar materials;
- 60 K for plastics, rubber or wood.

If these temperatures are exceeded, the need to use an operating tool shall be indicated in the instructions. This tool shall be supplied with the appliance.

NOTE A suitable glove is regarded as a tool.

5.6 Protection of combustible materials

When tested in accordance with A.4.10 and A.2.2, Figure A.1, the protection measure(s) as specified shall not lead to an excess of the more than 65 K above room temperature at the hottest point of any adjacent walls, floor or ceiling or other structure constructed of combustible materials.

If necessary, the distances are increased until the temperature measured is below this value and the specification of the protection measures needs to be adapted accordingly.

5.7 Safety devices for appliances fitted with an integral boiler

5.7.1 General

EN 12828:2012+A1:2014 shall be followed.

All necessary safety and control devices which are not an integral part of the appliance shall be given in the installation instruction.

5.7.2 Appliances intended for sealed water systems

5.7.2.1 General

A safety device shall prevent the temperature in the boiler exceeding 110 °C at any operation condition of the appliance. This shall also be fulfilled in case of malfunction of the water circulation.

5.7.2.2 Thermal discharge control

For appliances fitted with a thermal discharge control, when tested in accordance with A.4.10.7, the control shall operate when the water flow temperature exceeds either 105 °C or the specified operating temperature, whichever is the lower.

The thermal sensor of the discharge control shall be positioned so that the thermostat senses the maximum temperature of the flow water of the appliance.

A thermal discharge control shall fulfil the requirements of EN 14597:2012.

5.7.2.3 Safety heat exchanger

For appliances fitted with a safety heat exchanger, the safety heat exchanger shall be dimensioned such as to ensure that the water temperature in the boiler does not exceed 110 °C, when the appliance is tested in accordance with A.4.10.7.

5.7.3 Safety devices for appliances fitted with a heat exchanger that are not directly in contact with fire

Heat exchangers that are not directly in contact with fire or flue gases shall fulfil the requirements 4.4.2.5.

A heat exchanger that is not directly in contact with fire or flue gases and where the design of the appliances is such that the water temperature in the heat exchanger does not reach 105 °C under the test conditions of A.4.10.7 shall be equipped with a pressure release valve (150 kPa; 1,5 bar) to ensure that over pressure is released from the heat exchanger.

5.8 Electrical safety and functional safety of electrical components

5.8.1 General

Safety aspects for electrical components shall cover both

- the requirements on electrical safety regarding common hazards such as electrical shock or fire by overheating of electrical components and
- the safety of control functions in the case of malfunction of the electrical components at abnormal operation, where these components can be used as sensor, control or actuator (functional safety).

The electrical safety regarding common hazards of the appliance and the electrical components are handled in 5.8.2 whereas 5.8.3 handles the functional safety of relevant control functions.

NOTE The electrical safety can be specified on the basis of EN 60335-2-102:2016 and is not subject to type testing.

5.8.2 Electrical safety

The electrical safety of the appliance and the interfaces (e.g. connectors) between control devices shall comply with EN 60335-2-102:2016.

The electrical safety of control devices shall comply with either EN 60335-2-102:2016, EN 60730-1:2016² or its relevant part 2 or with the electrical requirements of the standards listed in EN 60335-2-102:2016, Annex ZBB.

The documentation of the electrical connections for the individual components shall be provided by means of an electrical wiring and connection diagram.

5.8.3 Functional safety of control functions with electrical components

For abnormal operation as fault condition according to EN 60335-2-102:2016, 19.11.2 f) (failure of integrated circuits), only output signals which cause only one malfunction shall be considered as relevant. Combinations of output signals which cause malfunction in more than one actuator are not considered relevant in the sense of abnormal operation because it is unlikely that any hazardous situation can occur.

For safety relevant control functions which are fulfilling the requirements of class B or class C of EN 60730-1:2016² failure of the control function does not need to be taken into account.

5.8.4 Risk assessment

A risk assessment of the appliance shall be performed. EN ISO 12100:2010, ISO/TR 14121-2:2012 or CENELEC Guide 32:2014 give information on how to carry out the risk assessment.

Completeness, correctness and plausibility of the risk assessment is verified on the basis of the risks given below and using the guidance according to Annex K. This verification is mainly a documental control and may influence the details of the safety tests (A.4.10).

The risk assessment shall cover each relevant risk, especially the following:

- malfunction of combustion air supply if applicable;
- blockage of the chimney if applicable;
- risk of explosion if applicable;
- single failure of electrical components if applicable.

If an appliance according to EN 16510-2-6 shuts down for the reason of an unsafe situation this shall be such that a restart shall only be possible manually. For these risks, an automatic restart shall not be allowed.

For all electric hazards, the low voltage directive (LVD) (2014/35/EU) is expected to be followed.

Force majeure risks shall not be taken into consideration (i.e. any event or occurrence which is outside the reasonable control of the manufacturer concerned and which is not attributable to any act or failure to take preventative action).

5.9 Safety requirements of roomsealed appliances

5.9.1 Tightness related to CO-emission

For appliances of type CA, CM and CC (see Table 1) the following requirements shall be met.

The mean value of CO concentration as measured in the combustion products of the appliance, given in ppm is measured during the test at nominal heat output according to A.4.7 and at part load heat output according to A.4.8 (combustion air control devices are set at the settings as specified).

The product of the CO concentration in the flue gas [ppm] (at 13 % O₂) and the leakage of the appliance [m³/h] (standard condition) determined according to A.4.11.2.2, A.4.11.2.3 and A.4.11.2.4 shall not exceed the value of 2 400 [ppm m³/h] (standard condition) at nominal heat output and at part load heat output (if specified).

NOTE The value of 2 400 [ppm m³/h] (standard condition) results from an assumed typical room size of 80 m³ and WHO recommendation of max 30 ppm CO in the room.

5.9.2 Overall leakage rate

For appliances of type CA, CM and CC (see Table 1) the following requirements shall be met.

In addition, the leakage of the appliance determined according to A.4.11.2.2, A.4.11.2.3 and A.4.11.2.4 shall not exceed 3 m³/h (standard condition).

The installation instructions shall give detailed information on the combustion air supply ducts and the flue gas connector in relation to tightness.

5.10 Minimum distances from non-combustible walls

The minimum distances from non-combustible walls d_{non} shall be specified in the installation instructions.

If minimum distances from non-combustible walls which differ from those to combustible walls are specified and if the value is below 50 mm, the test at nominal heat output according to A.4.7 shall be carried out using the distances of these instructions for non-combustible walls instead of the distances to combustible walls.

5.11 Requirements for appliances suitable for a shared flue system

The appliance shall not have a combustion chamber opening of more than 0,05 m² or shall be fitted with self-closing doors that leave an opening of not more than 0,05 m².

5.12 General safety aspects of the water system

All appliances with water systems are expected to comply with the PED (97/23/EC or 2014/68/EU from 2016 on).

NOTE Appliances having a pressure-volume product > 50 bar l need be tested by a Notified Body under PED and appliances having a pressure-volume product ≤ 50 bar l can be self-declared by the manufacturer.

6 Operation requirements

6.1 General

The following Table 8 gives an overview of the test to be carried out on the appliance operation.

Table 8 — Overview of the tests to be carried out on the appliance operation

	P_{nom} ^{a, b}	P_{part} ^{a, b}	P_{slow} ^b
Heat output (P)	x	x ¹	x ¹
Efficiency (η)	x	x ¹	-
Emission	x	x ¹	x ¹
Recovery	-	-	x ¹
Minimum flue draught (p)	at least 12 Pa (see Figure 2), a higher value might be specified	$p_{\text{part}} = \frac{P_{\text{part}}}{P_{\text{nom}}} \times P_{\text{nom}}$ min. 6 Pa or according to instructions	6 Pa
Minimum burning period	x	Give info in report	x ¹
Where $P_{\text{part}} < 0,4 \times P_{\text{nom}} + 2 \text{ kW}$ for appliances ≥ 5 kW (at P_{nom}) and $P_{\text{part}} < 0,8 \times P_{\text{nom}}$ for appliances < 5 kW (at P_{nom})			
The following is based on the decision of the manufacturer and to be given accordingly: x value to be given and verified x ¹ value to be given and verified if part load and/or slow combustion is specified - value not to be given and verified a Intermittent burning appliances b Continues burning appliances			

For appliances with doors which are intended for closed operation only according to the specification the doors shall be closed for safety tests, nominal heat output tests and, if specified, part load and slow combustion tests.

For appliances with doors which are intended for open and closed operation according to the specification both modes of operation are to be regarded for safety tests, nominal heat output tests and, if specified, part load and slow combustion tests. In this case, the values for efficiency and emissions shall be determined and given in both modes.

For appliances without doors the safety tests, nominal heat output tests and, if specified, part load and slow combustion tests shall be carried out open.

Test results for emissions and efficiency shall be derived from the same cycles.

6.2 Flue gas temperature and flue gas outlet temperature

6.2.1 General

When tested in accordance with A.4.7 and A.4.8, the flue gas temperature shall be measured and the mean value shall be used for efficiency and flue gas outlet temperature calculations only.

The flue gas outlet temperature shall be calculated by adding 20 % of the mean value of the flue gas temperature to this mean flue gas temperature. The calculated flue gas outlet temperature shall be recorded in the installation instructions.

6.2.2 Flue gas temperature at safety test

When tested in accordance with A.4.10.4 the flue gas temperature shall be measured and the mean value of the cycle giving the highest mean value is determined...

The election of the appropriate chimney based on the Tclass shall be such as the designated max. temperature of the chimney shall not be exceeded by this highest mean value by more than 100 K. The chimney designation shall be at least T400 G

EXAMPLE For a T400 designated chimney the value shall not exceed 500°C.

6.3 Emissions

6.3.1 General

The tests for emissions as well as efficiency shall be carried out burning the specified test fuels representing the recommended fuels listed in the operating instructions. Except for wood logs all tests shall be carried out on 2 consecutive cycles and these cycles shall be considered for the calculation of the mean value of the relevant emissions. For wood logs 3 cycles shall be considered for the mean value, 2 of these shall be consecutive.

All emissions are to be measured for all appliances, for appliances with a combustion chamber door, the door shall be closed for the measurements.

NOTE 1 Due to excess air for open appliances the emission determination might not be very accurate.

The mean values are subject to the verification in accordance with 6.3.2, 6.3.3, 6.3.4 and 6.3.5.

For nominal heat output follow A.4.7, for part load heat output follow A.4.8 and for heat output at slow combustion follow A.4.9.

NOTE 2 CR 1404:1994 gives advice on the measuring procedure of CO, CO₂ and O₂.

6.3.2 Carbon monoxide emission

At all heat output rates as specified the mean carbon monoxide concentration calculated to 13 % oxygen (O₂) content, (dry, 273 K, 1 013 hPa) in the flue gas shall be less than or equal to the specified value expressed in mg/m³.

Threshold levels for carbon monoxide emission are given in Table 9.

6.3.3 NO_x emissions

At all heat output rates as specified the mean NO_x concentration expressed as mg NO₂/m³ calculated to 13 % oxygen (O₂) content, (dry, 273 K, 1 013 hPa) in the flue shall be less than or equal to the specified value expressed in mg/m³.

Threshold levels for NO_x emissions are given in Table 9.

See also Annex D (normative) for measurement procedure.

6.3.4 Emission of organic gaseous carbon (OGC)

At all heat output rates as specified the mean organic gaseous carbon concentration as mg C/m³ calculated to 13 % oxygen (O₂) content, (dry, 273 K, 1 013 hPa) in the flue gas shall be less than or equal to the specified value expressed in mg/m³.

Threshold levels for OGC emission are given in Table 9.

See also Annex E (normative) for measurement procedure.

6.3.5 Particulate matter (PM) emissions

At all heat output rates as specified the mean particulate matter concentration expressed as mg/m³ for PM calculated to 13 % oxygen (O₂) content, (dry, 273 K, 1 013 hPa) in the flue gas shall be less than or equal to the specified value expressed in mg/m³.

Threshold levels for PM emissions are given in Table 9.

See also Annex F (normative) for measurement procedure.

6.3.6 Threshold levels for emissions according to appliance types

Table 9 — Threshold levels for emissions according to appliance types

Emission	Appliance types	Threshold at 13 % O ₂
Organic gaseous compounds (OGC) expressed as C	open fronted residential solid fuel burning appliances	see appliance specific part 2 of EN 16510 series
	closed fronted residential solid fuel burning appliances using solid fuel other than compressed wood in the form of pellets including cookers	
	closed fronted residential solid fuel burning appliances using compressed wood in form of pellets including cookers	
Carbon monoxide (CO)	open fronted residential solid fuel burning appliances	
	closed fronted residential solid fuel burning appliances using solid fuel other than compressed wood in the form of pellets including cookers	
	closed fronted residential solid fuel burning appliances using compressed wood in form of pellets including cookers	
Nitrogen oxides (NO _x) expressed as NO ₂	open fronted residential solid fuel burning appliances, closed fronted residential solid fuel burning appliances and cookers using biomass	
	open fronted residential solid fuel burning appliances, closed fronted residential solid fuel burning appliances and cookers using fossil solid fuel	
Particulate matter (PM)	open fronted residential solid fuel burning appliances	
	closed fronted residential solid fuel burning appliances using solid fuel other than compressed wood in the form of pellets and cookers	
	closed fronted residential solid fuel burning appliances using compressed wood in form of pellets	

The thresholds according to Table 9 for OGC, NO_x, CO and PM are related to nominal heat output. If F(2) and / or F(3) according to Tables A.5 and A.6 are not equal to zero the thresholds according to Table 9 for OGC, NO_x, CO and PM are related to part load heat output as well.

6.4 Efficiency

6.4.1 General

The tests for efficiency shall be carried out burning the specified test fuels representing the recommended fuels listed in the operating instructions. Except wood logs all tests shall be carried out on 2 consecutive cycles and these cycles shall be considered for the creation of the mean value of efficiency. For wood logs 3 cycles shall be considered for the mean value, 2 of these shall be consecutive.

The mean value of the efficiency expressed as % in an integer shall be greater than or equal to the specified efficiency value. The efficiency is determined at nominal heat output (in accordance with A.4.7) and if specified at part load heat output (in accordance with A.4.8). The efficiency is not determined for heat output at slow combustion.

6.4.2 Seasonal space heating efficiency

The seasonal space heating efficiency is calculated according to A.6.2.1.5 and has to be given according to Clause 10.

The threshold values according to Table 10 shall be achieved or exceeded.

Table 10 — Threshold levels of seasonal space heating efficiency according to appliance types

Appliance types	Threshold level
open fronted solid fuel local space heaters	see appliance specific part 2 of EN 16510 series
closed fronted solid fuel local space heaters using solid fuel other than compressed wood in the form of pellets	
closed fronted solid fuel local space heaters using compressed wood in the form of pellets	
Cookers	

Sauna stoves are not covered by the requirement of this clause.

6.4.3 Energy efficiency index (EEI)

The energy efficiency index (EEI) is calculated according to A.6.2.1.6 and has to be given according to Clause 10.

6.4.4 Energy efficiency class

The energy efficiency class is to be determined according to the following Table 11.

Table 11 — Energy efficiency classification based on the energy efficiency index (EEI)

Energy efficiency class	Energy efficiency index (EEI)
A++	$EEI \geq 130$
A+	$107 \leq EEI < 130$
A	$88 \leq EEI < 107$
B	$82 \leq EEI < 88$
C	$77 \leq EEI < 82$
D	$72 \leq EEI < 77$
E	$62 \leq EEI < 72$
F	$42 \leq EEI < 62$
G	$EEI < 42$

NOTE Sauna stoves are currently excluded from an energy class determination

6.5 Flue draught

The flue draught values, related to the appliance's nominal heat output, given in Figure 2, shall be taken as the values for the static pressure to be applied in the measurement section (see Figures A.10, A.11 and A.12) when undertaking the nominal heat output test in accordance with A.4.7, the part load heat output test in accordance with A.4.8, the slow combustion test for continuous burning appliances in accordance with A.4.9 and the safety test in accordance with A.4.10.

Where the flue draught values given in Figure 2 need to be exceeded in order to obtain the specified nominal output, the required flue draught shall be clearly stated in the appliance's installation instructions.

This means that a value above 12 Pa, but not below 12 Pa may be specified.

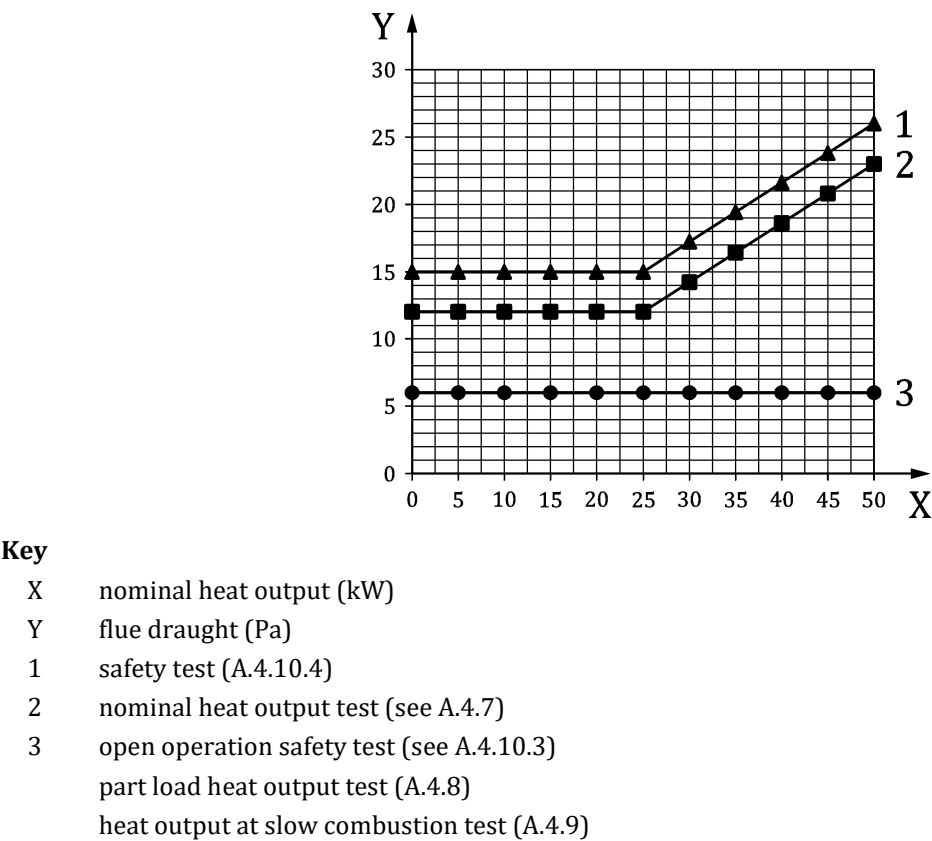


Figure 2 — Flue draught values

When undertaking the nominal heat output test in accordance with A.4.7 the flue draught shall be set to the value given in Figure 2 or, if necessary, such higher value as specified and the mean value shall be within ± 1 Pa of this specified flue draught value. During the test the individual measurements shall be within ± 2 Pa of this specified flue draught value.

It is not allowed to set the value at 11 Pa for a given value of 12 Pa.

For the slow combustion test for continuous purpose or part load heat output test for intermittent purpose in accordance with A.4.8 the flue draught shall be a target value of 6 Pa as given in Figure 2 and shall be kept within ± 1 Pa of this specified value. For the temperature safety test in accordance with A.4.10 the appliance shall be tested at a target flue draught 3 Pa greater than that used during the nominal heat output test and the static pressure shall be kept within $\begin{pmatrix} +2 \\ 0 \end{pmatrix}$ Pa of this specified value.

6.6 Recovery test

At the conclusion of the slow combustion test described in A.4.9, it shall be possible to satisfactorily revive the fire.

Recovery shall be deemed to be satisfactory if the refuel charge is visibly ignited under the test conditions described in A.4.9.4 within a time of 20 min with a flue draught of $\left(10^{+2}_0\right)$ Pa.

For cookers according to EN 16510-2-3:2022 recovery shall be deemed to be satisfactory if the refuel charge is visibly ignited under the test conditions described in A.4.9 within a time of 30 min with a flue draught of $\left(10^{+2}_0\right)$ Pa.

For independent boilers according to EN 16510-2-4:2022 recovery shall be deemed satisfactory if a small part of the fuel is visibly ignited within 30 min with a flue draught of (6 ± 1) Pa under the test conditions specified in EN 16510-2-4:2022, A.4.9.4.

6.7 Refuelling intervals

When tested in accordance with A.4, and when the appliance is operated with closed doors, the minimum times for maintenance of combustion with one added batch of fuel shall be not less than the values given in Table 1 of those parts 2 of EN 16510 series related to wood log and mineral fuel burning appliances, as appropriate to the appliance type and/or the test fuel used.

Table 12 — Minimum refuelling intervals

Information is given as Table A.2 in the relevant part 2 of EN 16510 (see above).

Where the refuelling interval at nominal heat output as specified is greater than the minimum refuelling interval given in Table 1 of the relevant parts 2 of EN 16510 series, or where a refuelling interval for appliances under part load heat output conditions is stated, then the specified value shall be verified when tested during the tests in accordance with A.4.7 and A.4.8. If either no refuelling interval or no part load heat output is specified no test is to be performed for part load heat output conditions.

The slow and part load test batches shall be according to the specification. The nominal fuel load shall be calculated using the refuelling intervals, the specified efficiencies and the calorific values of the fuels as detailed in A.4.2. The slope formed by the batch shall not obstruct, even partially, any flue.

6.8 Space heat output

The space heat output value in kW as specified shall be demonstrated when measured in accordance with A.4.7 or A.4.8.

6.9 Water heat output

The water heat output value in kW as specified shall be demonstrated when measured in accordance with A.4.7 or A.4.8 if any.

6.10 User operations

All operations which the user carries out, including loading and emptying of the appliance, adjusting controls and de-ashing, shall be easy, safe and efficient. These requirements shall be assessed during all the performance tests.