BRITISH STANDARD

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15270:2007

Pellet burners for small heating boilers — Definitions, requirements, testing, marking

The European Standard EN 15270:2007 has the status of a British Standard

ICS 97.100.30

BSI
British Standards

National foreword

This British Standard is the UK implementation of EN 15270:2007.

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A list of organizations represented on this committee can be obtained on request to its secretary.

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Pelletbrenner für kleine Heizkessel - Definitionen, Anforderungen, Prüfung, Kennzeichnung

This European Standard was approved by CEN on 3 November 2007.

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Foreword

This document (EN 15270:2007) has been prepared by Technical Committee CEN/TC 57 “Central heating boilers”, the secretariat of which is held by DIN.

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of an identical text or by endorsement, at the latest by June 2008, and conflicting national standards shall be withdrawn at the latest by June 2008.

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1 Scope

This European Standard relates to pellet burners having a maximum heat input of not more than 70 kW, intended for fitting with appropriate boilers for hot water, and intended for high quality pellets in accordance with CEN/TS 14961:2005 Annex A. This standard contains requirements and test methods for safety, combustion quality, operating characteristics and maintenance of pellet burners and covers and also all external equipment that influences the safety systems. This standard also contains information on how to enable a correct match between pellet burner and boiler.

Pellet burners that are sold as a complete unit together with their own dedicated boilers are not covered.

NOTE Other fuels will be considered in future amendments to this standard.

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 230:2005, *Automatic burner control systems for oil burners*

EN 298:2003, Automatic gas burner control systems for gas burners and gas burning appliances with or without fans

EN 12067-2:2004, Gas/air ratio controls for gas burners and gas burning appliances – Part 2: Electronic types

CEN/TS 14961:2005, *Solid biofuels – Fuel specifications and classes*

EN 15036-1, *Heating boilers – Test regulations for airborne noise emissions from heat generators – Part 1: Airborne noise emissions from heat generators*

CEN/TS 15404, *Solid recovered fuels – Methods for the determination of ash melting behaviour by using characteristic temperatures*

prEN 15456, *Heating boilers — Electrical power consumption for heat generators — System boundaries - Measurements*

EN 60335-2-102, *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, modified)*

EN 60529, *Degrees of protection provided by enclosures (IP code) (IEC 60529:1989)*

EN 60730-1:2002, *Automatic electrical controls for household and similar use — Part 1: General requirements (IEC 60730-1:1999,modified)*

EN 60730-2-5:2002, *Automatic electrical controls for household and similar use — Part 2-5: Particular requirements for automatic electrical burner control systems (IEC 60730-2-5:2000, modified)*

3 Terms, definitions and symbols

For the purpose of this standard, the following terms and definitions apply.

NOTE For reference use only the equivalent terms in Danish, English, French, German and Swedish, are found in informative Annex A.

3.1
pellet burner
device for burning pellets where the control can be of different types; on-off, mechanical, modulating or multi stage. The pellets can be fed horizontally, from above or from below

3.2
modulating burner
burner where the throughput may be infinitely varied between the lower and upper limits

3.3
multistage burner
burner where several firing stages can be utilised. Burners with only two firing rates are included in this category

3.4
ignition device
device used to ignite the pellets in the burner head of a pellet burner, it can be either manual, automatic or with a basic fire bed. The ignition can be caused by a hot air element, automatic ignition with liquid or gaseous fuels, electric coil or electric glow plug

3.5
basic fire bed
quantity of glowing embers which ensures ignition of the test fuel to be charged

3.6
conveyor system, auger, feed screw
mechanical arrangement, normally incorporating a feed screw, used for transporting the pellets from the fuel hopper to the burner head

3.7
fuel hopper
fuel store from which fuel is fed to the pellet burner

3.8
storage with external fuel hopper
external fuel store from which fuel is fed to the pellet burner and which is separate from the pellet burner. It can be located either inside or outside the room where the pellet burner is located

3.9
storage with integral fuel hopper
integral fuel store container from which fuel is fed to the pellet burner and which is integral with the pellet burner

3.10
burner head
part of a pellet burner where the pellets are burned

3.11
back burning
situation in which the flames from the burning pellets in the burner head propagate and ignite the pellets in the conveyor system

3.12
temperature limiter
safety level B device that causes the safe shutdown and lockout of the fuel supply and/or the combustion air supply respectively if the limiter value exceeds a pre-set limit. According to EN 14597 it is a device of Type “TB”

3.13
safety temperature limiter
safety level C device that causes the safe shutdown and lockout of the fuel supply and/or the combustion air supply respectively if the limiter value exceeds a pre-set limit. According to EN 14597 it is a device of Type "STB"

3.14
sprinkle system
safety device that allows small droplets of water to be released onto the pellets in the conveyor system if back burning occurs

3.15
drop chute
sloping channel, through which the pellets fall from a conveyor system into a burner head or into moving equipment

3.16
cell feeder
device that intermittently interrupts the fuel stream thus only allowing a small amount of pellets at a time to be supplied to the burner, thereby preventing the flue gases from reaching the hopper

3.17
fire damper
mobile closure within a duct which is designed to prevent the passage of fire

3.18
combustion air supply
air required by the pellet burner to ensure the safe and efficient combustion of pellets and supplied into the combustion chamber, which is entirely or partially used to burn the pellets in the burner head

3.19
ash discharge
arrangement for removing the ash from the burner head or the combustion chamber which may be automatically controlled

3.20
non volatile lockout
shutdown condition such that a restart can be accomplished only by a manual reset and by no other means

3.21
volatile lockout
shutdown condition such that a restart can be accomplished by restoration of the electrical supply after its loss or by manual reset

3.22
heat input, in kW**,**
amount of heat as a function of time released by the burner at a given throughput

3.23
maximum heat input, in kW,
maximum heat input, at continuous burning, as specified by the manufacturer

3.24
minimum heat input, in kW**,**
minimum heat input, at continuous burning, as specified by the manufacturer

3.25
excess air ratio
ratio between the effectively introduced quantity of air and the theoretically required quantity of air

3.26
safety device
device providing one or more safety related functions or parts of a safety related function, built in one physical unit

3.27
safety system
system including the entire set of safety related controls and safety related measures or a part of it to provide the safety of the pellet burner or the part of it

3.28 Symbols, descriptions and units

Symbols used in this standard are listed in Table 1.

All gaseous volumes are expressed in m³, and referred to 0 °C and 1,013 bar.

Table 1 — Symbols, descriptions and units

Symbol	Description	Unit
a	Ash content in the test fuel at dry bases	mass fraction in %
B_d	Mass of test fuel referred to the test duration	kg/h at dry bases
B_w	Mass of test fuel referred to the test duration	kg/h at firing
C_C	Carbon content of the test fuel	mass fraction in %
C_{CO}	Carbon monoxide content of the dry flue gases	volume fraction in %
C_{CO2}	Carbon dioxide content of the dry flue gases	volume fraction in %
C_{OGC}	Calculated content of organic gaseous compounds	mg/m³ dry flue gas at 10 % O_2
C_r	Carbon content of residues referred to quantity of test fuel	mass fraction in %
$C_{THC,m}$	Measured total hydrocarbon content expressed in mg/m³ methane equivalents in wet flue gas	mg/m³ methane
$C_{THC,p}$	Measured total hydrocarbon content expressed in mg/m³ propane equivalents in wet flue gas	mg/m³ propane
G_d	Actual specific dry flue gas volume	m³/kg fuel
G_w	Actual specific wet flue gas volume	m³/kg fuel

Table 1 — *(continued)*

Symbol	Description	Unit
C_H	Hydrogen content	mass fraction in % s
m_r	Total residue in boiler after test	kg
$O_{2,\,m}$	Measured oxygen content in dry flue gas	% as mean value
OGC	Organic gaseous compound	
Q_{ib}	Heat input	kW
R	Total residue referred to the mass of test fuel	mass fraction in %
t	Test duration	h
THC	Total hydrocarbon content	mg/m³
T_{amb}	Ambient temperature	°C
T_{return}	Return temperature	°C
T_{flow}	Flow temperature	°C
C_W	Moisture content	mass fraction in %
λ	Excess air ratio	

4 Classification and groupings for pellet burners

4.1 Classification

For the purpose of this standard pellet burners are classified in accordance with the following:

Methods of control and grouped as detailed in 4.2;

Means of ignition and grouped as detailed in 4.3;

External or integral fuel hopper;

Combustion chamber;

Monobloc or other type of burner.

4.2 Methods of control of pellet burner

Methods of control are grouped as follows:

a. On-off control;

b. Modulating control;

c. Multi-stage control.

4.3 Means of ignition

Means of ignition are grouped as follows:

a. Manual ignition;

b. Automatic electric ignition;

c. Pilot fire;

d. Hot air element;

e. Automatic ignition with liquid or gaseous fuels.

5 Requirements

5.1 Design

5.1.1 General design

5.1.1.1 Materials

The quality of materials, form and dimensioning of the components shall ensure that the pellet burner is capable of operating safely and during a reasonable economic life time, if installed, operated, maintained and adjusted correctly under the conditions specified by the manufacturer and exposed to the related mechanical, chemical and thermal stresses.

The materials of construction shall withstand all normally occurring chemical, mechanical and thermal stresses.

The construction of the burners shall be such that no instability, distortion or breakage likely to impair its safety can occur.

Levers and similar devices which have to be operated by the installer or user shall be appropriately identified and they shall not show any changes that could affect their normal functioning under normal conditions of use, maintenance and adjustment.

Housings not made of corrosion-resistant material shall be suitably protected with an efficient anti-corrosion coating.

Asbestos or asbestos-containing materials shall not be used.

Fireproof materials for construction, lining and insulation see Annex B.

5.1.1.2 Design

The construction and design of the pellet burner shall be such that when burning the correct fuel in accordance with the scope of this standard it operates safely at the specified input (input range) given by the manufacturer and that the performance requirements given in 5.3 are met.

Constructional parts accessible during use and maintenance shall be free from sharp edges and corners that might cause damage or personal injury during use or maintenance.

The feed screw in the burner shall mechanically withstand blocking without permanent damage to mechanical or electrical components.

5.1.1.3 Mounting

The pellet burner shall be so designed so that it can be easily attached to the boiler as defined in the installation manual of the manufacturer.

The connection shall be designed to withstand a possible gas explosion inside the boiler.

The pellet burner components shall be arranged and secured in such a manner that the correct operating position and above all, the correct position of the burner orifices cannot be altered during operation. Means shall be provided to ensure that the correct position shall be maintained, if the components are dismantled and reassembled. Accidental dismantling shall not be possible.

Parts of the burner that are set or adjusted at the stage of manufacture and which should not be adjusted by the user or installer shall be sealed. Instructions on how to make the seal between the burner and the boiler shall be provided, and all necessary materials shall be supplied with the burner.

The burner shall be fitted with means of securely attaching it to the boiler. A bolted joint shall only be accepted if the burner is accessible for ash removal without dismantling of the bolted joint.

Burners that can be withdrawn or swivelled out of position without the use of tools shall be interlocked (e.g. by means of limit switches) in such a way that they cannot be operated in the withdrawn or swivelled position. The interlock device shall be fail safe in design and, where it is a limit switch, it shall comply with H.27 of EN 60730-2-5:2002.

5.1.1.4 Accessibility for maintenance and use

Components requiring regular maintenance shall be arranged or designed so that they are easily detachable. Furthermore, they shall be designed or marked in such a way that if the manufacturer's instructions are followed they cannot be replaced incorrectly.

Any parts subject to wear shall be accessible for replacement.

Sensors for the safety systems must be accessible for inspection and cleaning.

The manufacturer shall give information on how to clean the feed screw, especially when a water sprinkler system has been actuated.

5.1.1.5 Handling of ashes

The burner shall be so designed that ashes can easily be removed. When this necessitates removing the burner, it shall be easy to perform.

If the burner is fitted with an automatic ash discharge system, this shall be in the form of an enclosed system or discharge the ashes into a water container.

If it is a necessity to use a special tool to remove the ashes from the burner, this shall be provided by the manufacturer.

5.1.2 Equipment

5.1.2.1 Motors and fans

Motors and fans shall be so protected by suitable guards, shields or screens of adequate size, strength and durability that they are not liable to be touched accidentally. The degree of protection shall be at least IP 20, according to EN 60529. Removal of such guards, shields or screens shall only be possible with the use of tools.

Mechanical drives (belt, chain drives etc), when used, shall be so designed or positioned as to afford protection to the operator. The correct tension is important. This can be achieved either by automatic means or manually. In the latter case access shall only be possible by the use of tools.

5.1.2.2 Burner controls

All controls and safety devices shall perform correctly at ambient temperature between 0 °C and 60 °C. If a lower minimum or a higher maximum temperature is declared by the manufacturer, then the control or safety devices shall perform at that lower or higher temperature.

The long term performance test according to EN 230 shall take place with the above min and max temperature values.

Electronic parts of safety devices shall not be exposed to temperatures higher than their maximum design temperature.

Safety related devices shall fulfil the fault requirements specified in 5.2.12.1.

If the burner is equipped with any of the following functions or components, they shall fulfil the requirements given in Annex C:

a) Automatic burner control including flame detector device;

b) Pellet-air ratio control device.

5.1.2.3 Ignition devices

The ignition device shall ensure safe ignition under the normal conditions of operation.

5.1.2.4 Fuel hopper

For a burner incorporating an integral fuel hopper, the hopper shall be made of non combustible material. The hopper shall have a tight fitting lid with a closing device that ensures a proper sealing, e.g. a spring catch, so that the leakage rate does not exceed 10 m³/h at 5 Pa positive pressure.

Any integral fuel hopper shall incorporate a device that interrupts the supply of fuel, if the lid is open. The device shall fulfil the requirements according to H.27 of EN 60730-2-5:2002.

5.1.2.5 Cell feeder or a fire damper

For burners with a cell feeder or a fire damper, the leakage through the device shall not exceed 1 m³/h at 5 Pa positive pressure.

5.1.2.6 Water sprinkler system

If the burner is equipped with a water sprinkler system, the water container shall have a level switch or a pressure switch and a volume of at least 5 l.

5.1.3 Interface to boiler

The manufacturer shall provide sufficient information to ensure that the burner matches the boiler to which it is intended to be installed.

The requirements for the boiler to which the burner can be attached shall be described in the technical documentation and shall specify at least the following items:

a. combustion chamber: minimum dimensions for volume, length, width, height (the direction of the flame and the position of the burner head shall be considered here). Those minimum dimensions shall be used in the testing boiler;

b. dimension of opening in the boiler required to fit the burner;

c. with/without additional combustion air supply openings in the boiler;

d. size of surface and efficiency of heat exchanger and boiler water temperature. This may be described as rated output of the boiler for oil and the estimated equivalent for pellets;

e. maximum heat output;

f. pressure range in the combustion chamber;

g. water content;

h. mechanical and electrical connections;

i. need of any controls and safety devices on the boiler;

j. type and dimensions of chimney.

5.2 Safety

5.2.1 General

Potential hazards caused by the burner or the operation of the burner with consideration of the behaviour of the boiler shall be avoided by either constructional means or by the use of safety devices. Safety shall be maintained in the event of possible failures in the safety device itself.

The manufacturer shall undertake a risk assessment covering all potential hazards of the burner and the measures how to avoid or control them including allocation of safety levels. The safety levels are defined as follows:

1. safety level A: Control functions which are not intended to be relied upon for the safety of the application. A functional safety assessment is not required;

2. safety level B: Control functions which are intended to prevent an unsafe state of the appliance. Failure of the control function will not lead directly to a hazardous situation. A single fault assessment of the control including software class B according to EN 60730-1 is required;

3. safety level C: Control functions which are intended to prevent special hazards such as explosion or whose failure could directly cause a hazard in the appliance. A second fault assessment of the control including software Class C according to EN 60730-2-5 is required.

This risk assessment shall cover at least the following:

a. elements given in 5.2.2 to 5.2.11;

b. burner functions start-up, purge, ignition, flame supervision, flue gas flow, control of heat demand, pellet-air ratio control.

In the risk assessment one of the above mentioned safety levels shall be allocated to any identified hazard.

An example of risk analysis for back burning is given in Annex D and an example of the risk analysis with allocation of the appropriate safety levels for control functions using electronic devices is given in Annex E.

The actuation of any safety system shall at least result in cutting off the fuel feed.

5.2.2 Safety against back burning

Back burning in any state of operation differing from normal operation shall be prevented either by constructional means or by use of safety devices or any other means that gives an equal level of safety.

The hazard of back burning is classified as a risk corresponding to safety level C in accordance with 5.2.1.

The failure of the feed screw drive shall not result in any dangerous situation.

The burner shall have at least two different safety systems to prevent back burning from the burner head.

At least one of the safety systems shall operate regardless of the state of the power supply. If one of the safety systems of the burner is in the form of an emergency discharge of the fuel, this shall be discharged into the boiler. The discharge shall be limited to the amount of fuel in the feed screw. The content of the hopper shall not be discharged in this manner. In this case the burner shall have an emergency power supply (e.g. electrical battery back up or mechanical-thermo-mechanical device). At least one of the safety systems shall continue to provide protection in the event of interruption of the fuel feed (e.g. blockage of the feed screw).

Any loss of power supply shall result in neither smoke leakage from the pellet burner nor back burning.

In normal operation the temperature in the fuel supply shall not exceed 85 °C. Sensors for the safety systems shall be actuated before the temperature exceeds 95 °C.

If the burner is equipped with a drop chute, the difference between the upper and lower fuel levels in the drop chute shall be at least 150 mm as measured from the highest point of the lower pellets level. This distance must be at least 250 mm if the maximum heat input of the burner exceeds 15 kW.

5.2.3 Safety against fuel overload of the boiler or interruption in fuel supply

The operation of the burner with the feed screw set to operate continuously at maximum speed shall not result in any dangerous situation.

The test at overload mode according to 6.6.1.3 can be omitted if a safety device, safety level C according to 5.2.1 prevents an overload mode.

The boiler shall be equipped with a safety device that stops the fuel supply in the event that there is either insufficient or no combustion in the burner head.

The test for interruption of fuel supply according to 6.6.1.3 can be omitted if a safety device, safety level B or C according to 5.2.1 is used.

In the ignition phase a safety device shall stop the fuel supply after a safety time which shall be declared by the manufacturer of the burner start up function, if there is no or insufficient combustion. At the end of the safety time there shall be no critical amount of fuel in the burner head, if the ignition of the fuel fails. A failure in the safety device to detect insufficient combustion shall not lead to a dangerous situation.

5.2.4 Voltage variation

In the case of variation in the electrical power supply between 85 % and 110 % of the nominal value, there shall be no deterioration, which prohibits the normal use of the burner.

A decrease of the electrical power supply to below 85 % of the nominal value shall not lead to a dangerous situation.

Automatic restart of the burner after a power failure is permitted only if by self checking of the burner control system first has verified that all the safety systems are in operation.

Loss of power supply or decrease of power supply to the burner shall not cause back burning or smoke passing out through the pellet burner.

5.2.5 Surface temperatures of accessible parts

The surface temperature of accessible parts of the burner likely to come in contact with combustible material shall not exceed 85 C.

The temperatures of the adjusting, control and safety devices shall not exceed the value stated by the manufacturer of the device and their operation shall remain satisfactory under the conditions specified in 6.6.1.5.

The surface temperatures of knobs and levers, intended to be manipulated, shall not exceed the ambient temperature by more than:

a) 35 K for metals;

b) 45 K for porcelain or equivalent materials;

c) 60 K for plastics or equivalent materials.

5.2.6 Leakage of combustion products

Under normal conditions there shall be no significant leakage of combustion products into the surroundings. The tightness shall be ensured also after maintenance of the burner. Any pressurized parts containing combustion products shall be sealed in a sufficiently durable way to maintain its tightness (at least from one maintenance period to the next).

5.2.7 Resistance to over-heating

Under the conditions specified in 6.6.1.7 the components of the burner shall not suffer any deterioration other than the normal alterations due to combustion.

5.2.8 Lock-out and re-start

Where operation of a protective device or a safety shut-down of a safety device appears a non-volatile lock-out shall occur.

Automatic restart after operation of any of the burner's safety systems shall only be permitted after a manual reset.

5.2.9 Safety against overheating the boiler water

The burner shall include a function which stops the operation of the burner if the temperature of the water in the boiler to which it may be fitted exceeds the allowable value for the heating boiler.

5.2.10 Safety against loss of combustion air supply

The loss of combustion air supply shall not result in a CO content measured in the boiler that exceeds 5 %.

5.2.11 Safety against variation of combustion chamber pressure

Variation of combustion chamber pressure shall not result in a dangerous situation.

5.2.12 Electric safety

5.2.12.1 Electrical safety of devices

Those controls which are in accordance with the electrical requirements of EN 60730-1 are considered fulfilling the electrical requirements of this standard, therefore the requirements of 5.2.12.2 do not apply.

Controls according to safety level C shall be designed according to H.27 of EN 60730-2-5:2002 and controls according to safety level B shall be designed according to a single fault assessment and software class B according to H.27 of EN 60730-1:2002.

5.2.12.2 Electrical safety of the pellet burner

For the electrical safety of the burner, including devices which are not shown to fulfil 5.2.12.1 and including the interface of devices fulfilling 5.2.12.1, the requirements of EN 60335-2-102 shall apply.

5.3 Performance requirements

5.3.1 Emissions of carbon monoxide (CO), organic gaseous compound (OGC) and dust

When tested according to the methods described in 6.6.2.2 for maximum heat input and in 6.6.2.3 for minimum heat input, the burner shall for all cases tested meet the emission limits for all three parameters (CO, OGC and dust) of Table 2 appropriate to the emission class.

Table 2 — Emission classes

Emission class	Limits for emissions mg/m³ at 10 % O_2 [a)]		
	CO	OGC	Dust
1	15 000	1750	200
2	5 000	200	180
3	3 000	100	150
4	1 000	75	75
5	500	50	30

[a)] Referred to dry flue gas at 0 °C and 1,013 bar.

NOTE National regulations have to be taken into consideration.

5.3.2 Proportion of unburned fuel in the residue

The proportion of combustible material in the residue shall not exceed 50 % by weight of the residue when tested according to 6.6.3.

5.3.3 Excess air ratio

The mean value of the excess air ratio λ during the tests shall not exceed the following:

at nominal heat input: $\lambda \leq 2{,}0$.

5.3.4 Electrical consumption

The electrical power consumption at start, at stand-by and at normal operation shall be determined according to prEN 15456 and the maximum value at stand-by shall be given on the data plate.

5.3.5 Start and ignition

The burner shall ignite when the control system calls for ignition.

Burners with a basic fire bed shall ignite reliably when, after 16 h of stand-by operation, the heat demand is increased instantaneously by an amount of 40 % of maximum heat input.

Burners with automatic ignition devices shall ignite directly from a cold state.

5.3.6 Long term stability (optional test)

If the manufacturer declares long term stability according to this standard the following conditions shall be fulfilled:
- No slag formation shall occur that significantly degrades the combustion characteristics during the test.
- Emissions of CO and OGC shall meet the requirements in Table 2.

NOTE A suitable optional test method is described in Annex F.

5.3.7 Noise

The noise emission from the pellet burner when operating at maximum heat input shall be determined in accordance with 6.6.7 and the mean measured value noted in the product description and on the data plate.

6 Testing

6.1 General

The tests shall include the construction and operating characteristics of the burner. Functional requirements and especially performance requirements shall be tested in a test boiler rig according to 6.2 under consideration of the parameter of the interface. The test boiler rig which is set to simulate the type or types of boiler to which the manufacturer claims it can be fitted. For the parameter of the interface the values according to 6.2 shall be used unless the manufacturer has stated otherwise.

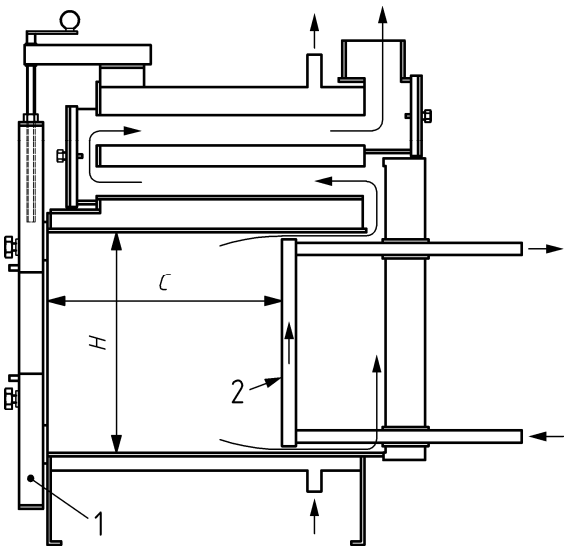
6.2 Test boiler rig

Unless otherwise stated by the manufacturer, the burner shall be mounted in the test boiler rig detailed in Figure 1 in accordance with the installation instructions for the burner.

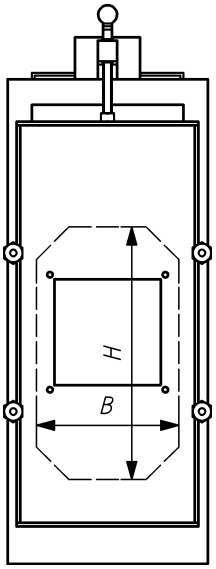
The test boiler rig arrangement shall enable all load conditions within the specified output range of the burner while maintaining the water temperatures as specified in 6.6.2.2.

In the test boiler rig detailed in Figure 1 the boiler wall and the moveable rear wall shall be water cooled. The door and the backside of the boiler are not water cooled. There shall be a slot between the wall and the surrounding boiler wall of 15 mm for the flue gas to pass.

If the manufacturer states that this burner is only intended for a specific boiler, then the burner shall be tested on that boiler.



a) Side view, section



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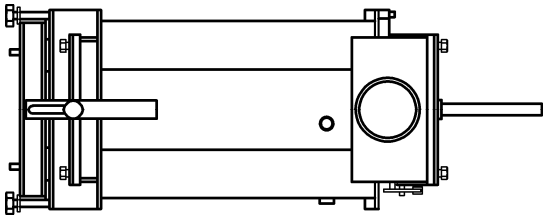
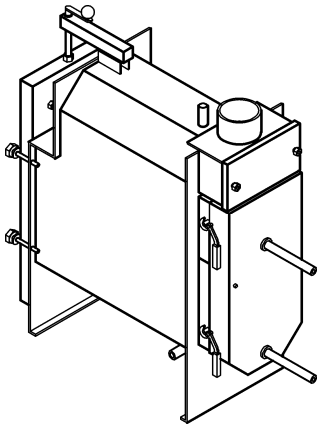


c) Top view



d) Three dimensional view

Key

H Height of combustion chamber

B Width of combustion chamber

C Adjustable length of combustion chamber

1 Movable door for adjusting the burner in the vertical position

2 Movable and water cooled rear wall

Minimum distance between burner head and upper wall of combustion chamber as stated by manufacturer.

Dimensions in mm

Boiler size	***B***	***C***	***H***
small	300	200 to 650	500
large	600	200 to 950	500

Figure 1 — Test boiler rig

6.3 Measurement and calculation parameters and measurement accuracy

Parameters to be measured or calculated during the tests and the maximum tolerances to be kept, see Table 3. For measurement methods, see Annex G and for calculation of OGC, see Annex H.

Table 3 — Parameters to be measured or calculated and maximum tolerances

Measured parameters	**Clause**	**Maximum tolerances**
CO_2 –concentration	G.1	± 0,4 % volume CO_2
CO concentration	G.2	± 5 % of limit value
O_2 –concentration	G.3	± 0,4 % volume O_2
THC concentration	G.4	± 7 % of the measuring range
Dust content in mg/m^3	G.5	< 5 % of the limit of the emission class
Flue gas temperature	G.6	± 5 K
Ambient temperature (same as combustion air temperature)	G.7	± 2 K
Water flow- and return temperatures	G.8	—
Water temperatures (in the radiator circuit, flow and return)	G.9	—
Surface temperature	G.10	± 2 K
Pressure in the boiler combustion chamber	G.11	± 5 % of measured value
Electrical energy supplied	6.6.5	± 0,1 % of measured value
Length of combustion chamber		± 3 %
Calculated parameters	**Clause**	**Maximum tolerances**
CO concentration	G.10	± 5 % of the limit of the emission class
Heat input	G.12	± 3 % of measured value
OGC concentration	Annex H	± 5 % of the limit of the emission class

6.4 Test fuel

The tests shall be carried out with wood pellets. The test wood pellets shall be of class “chemically untreated wood excluding bark” in accordance with CEN/TS 14961 and the deformation temperature of the ashes shall not be less than 1 400 ºC measured according to CEN/TS 15404. The moisture content and the calorific value of the test fuel used shall be determined. If the manufacturer states that the burner is intended for use with larger pellet diameters or pellets with other characteristics the test shall be performed with these pellet qualities and as described in 6.6.2.1 a) and b).

6.5 Examination

6.5.1 General

The burner shall be checked to ensure its conformity with the relevant construction document provided, prior to its installation on the test rig.

6.5.2 Design examination

The burner including fuel hopper, if existing, shall be visually examined to check that the requirements for materials, design, mounting, accessibility for maintenance and use, as well as handling of ashes are met.

6.5.3 Equipment examination

The burner shall be examined visually to check that motors and fans as well as existing mechanical drives are made of non-combustible material and protected in accordance with 5.1.2.1. Check also that cleaning tools are available in accordance with 5.1.1.5. The following checks shall also be carried out:

a. Check that the burner has sufficient means of securely attaching it to the boiler so that no accidental dismantling is likely to occur and that the mounting requirements of 5.1.1.3 are met.

b. If the burner can be removed without the use of tools, check that there is a switch that disconnects the firing when the burner is not in place.

c. In case of a burner with integral fuel hopper, check that this is made from non-combustible material and has a tight fitting lid with a closing device in accordance with 5.1.2.4. The leakage of the hopper shall be measured under a positive pressure of 5 Pa and shall not exceed the value according to 5.1.2.4.

d. Check also that the burner has a device that interrupts the fuel supply if the lid is open in accordance with 5.1.2.4.

e. In case of a burner with a cell feeder or a fire damper, test the leakage of the device with a positive pressure of 5 Pa to ensure that the requirements of 5.1.2.5 are met.

Other safety related burner controls shall be examined according to the relevant standard including the specified deviations mentioned in 5.2.1.

6.5.4 Check interface to boiler

Checks shall be made, that all the relevant aspects of the interface to the boiler are described in the technical documentation and that the requirements of 5.1.3 are met.

6.6 Test cases

6.6.1 Safety tests

6.6.1.1 General

The safety test procedure involves testing the burner for the following possible faults of the burner as detailed in Table 4.

Table 4 — Test to be performed during the safety test

Functional fault	Test to be performed	clause
Feed rate too high	Feed screw set to operate continuously at maximum speed	6.6.1.3
Feed rate too low	Feed screw motor disconnected	6.6.1.2
Loss of air supply	Air fan disconnected by wire Air intake covered	6.6.1.9
Loss of power	All power disconnected including pumps	6.6.1.4
Combustion chamber pressure	Draught increased to 50 Pa at stand-by until stable condition	6.6.1.10
Open hopper lid	Hopper left open at normal draught until stable condition	6.6.1.2
Empty hopper	Full load operation until empty hopper	6.6.1.6
Burner detaching	Check for existence of switch or need for tools to detach burner	6.5.3
No ignition	Test for safe ignition for burners with basic fire bed after 16 hours of stand-by	6.6.6

6.6.1.2 Test of safety against back-burning

The following checks shall also be carried out:

a. Check the number and types of safety systems to protect against back burning.

b. Check that at least one of the safety systems works regardless of the state of the power supply (see 6.6.1.4 and 6.6.1.8).

c. Check also, that at least one of the safety systems is still available after the supply of fuel to the burner head has been stopped.

d. If the burner is fitted with a water spray, measure the volume of the water container and check that it includes a level switch or pressure switch.

e. Check the drop distance of any drop chute is according to clause 5.2.2 to stop the propagation of back burning.

f. For a safety system with emergency discharge of the fuel into the boiler, check that it is supplied with an emergency power supply (e.g. battery back up).

g. If the burner is fitted with an integral fuel hopper, measure the temperature in the hopper, when performing the test at maximum heat input, at minimum heat input and at the start and ignition test. The temperature shall be measured as close to the fuel feed screw as possible.

h. In case of an integral fuel hopper, check that no dangerous situation (e.g. smoking, back burning) arises from opening the lid under normal circumstances or from leaving the lid open. It is acceptable to discharge fuel slowly through the feed screw to avoid back burning if this is done automatically. The safety of the burner shall also be checked with the fuel feed screw disconnected to simulate failure of the drive while operating at full load.

The requirements specified in 5.2.2 shall be satisfied.

6.6.1.3 Safety test of consequences of fuel overload and effect of a blockage of the fuel supply

The safety of the burner shall be checked with the feed screw set to operate continuously at maximum speed.

The functionality of the safety device for the shut-down of the fuel line shall occur by prevention of the ignition after release of fuel if no or insufficient combustion in the burner head happens.

The test for blocked fuel line shall be achieved by insertion of a metallic object into the feed screw.

The requirements specified in 5.2.3 shall be satisfied.

6.6.1.4 Voltage variation

Test the pellet burner at maximum heat input and with an electrical supply at 100 % of the rated voltage. Interrupt the electrical supply to the burner and check that no back-burning occurs or that no smoke passes out through the pellet burner.

After the test, carried out at maximum heat input, a test shall be performed at 85 % of the rated voltage with the exception of three-phase a. c. motors, if any. A check shall be made that all safety functions are in operation after the electrical power supply has been decreased.

The requirements specified in 5.2.4 shall be satisfied.

6.6.1.5 Measurement of surface temperatures of accessible parts

When performing the test at maximum heat input 6.6.2.2 the surface temperatures of parts of the burner that can be touched after reaching steady state conditions shall be measured.

The requirements specified in 5.2.5 shall be satisfied.

6.6.1.6 Measurement of leakage of combustion products

When performing the test specified in 6.6.2.2 a check shall be performed to determine that no combustion products are leaking from the burner to the surroundings. To simulate a leaking lid gasket, check that no smoke emerges from the hopper when the lid is open and the burner is operating at maximum heat output. Also check that the hopper is not filled with smoke after running out of fuel under normal conditions.

The requirements specified in 5.2.6 shall be satisfied.

6.6.1.7 Check of resistance to over-heating

After completion of the tests specified in 6.6.2.2, it shall be ascertained, at room temperature, that the burner materials or components do not exhibit any deformation, maladjustment or degradation.

The requirements specified in 5.2.7 shall be satisfied.

6.6.1.8 Lock-out and restart

Operate the burner at maximum heat input and release any safety systems, which are operated by a temperature sensor, by e.g. a hot air gun. A check shall be made that the burner stops the fuel feed and that the burner cannot be restarted until all safety systems have been reset (e.g. that the water container has been filled), and that the automatic restart after operation of any safety system is not possible.

A check shall be made to confirm that the burner cannot restart automatically after a failure in power supply unless a self check has shown that all safety systems are in operation.

The requirements specified in 5.2.8 shall be satisfied.

6.6.1.9 Loss of combustion air supply

The safety of the burner shall be checked at maximum heat input under the following conditions:

— failure of the combustion air fan;

— failure by the closing of the combustion air hatches.

In each case only one failure shall be assumed.

The requirements specified in 5.2.10 shall be satisfied.

6.6.1.10 Combustion chamber pressure

The safety of the burner shall be checked at the combustion chamber pressure as given by the burner manufacturer.

The requirements specified in 5.2.11 shall be satisfied.

6.6.1.11 Electric safety

The test shall be carried out according to the standards given in 5.2.12.

6.6.2 Performance tests

6.6.2.1 General

Before the tests start the burner shall have attained constant operating conditions.

The manufacturer shall indicate at which combustion chamber pressure the test shall be performed.

The mean values of CO_2, O_2, CO, OGC and dust (NOx where appropriate) contents shall be determined over the entire test period.

6.6.2.2 Testing at continuous operation at maximum heat input

The purpose of this test is to check the maximum heat input of the burner as given by the manufacturer during continuous operation together with the excess-air ratio and emission levels at this input. The test duration shall be at least 6 h after the boiler has reached thermal equilibrium. During the test the mean value of the flow temperature shall be between 70 °C and 90 °C and the mean temperature difference between flow and return shall be between 10 K and 25 K.

Also, equation (1) shall apply:

$$\frac{\left(T_{\text{flow}} + T_{\text{return}}\right)}{2} - T_{\text{amb}} \geq 40{,}0 \qquad \text{in K} \tag{1}$$

where

T_{flow} is the flow temperature in °C;

T_{return} is the return temperature in °C;

T_{amb} is the ambient temperature in °C.

The mean values of CO_2 or O_2, CO, OGC (and NOx where appropriate) contents shall be determined over the entire test period.

The manufacturer shall state the length and height of the combustion chamber in the test boiler at which the test shall be carried out.

To determine the dust content the test period is divided into at minimum 4 equal time sections. The measurements shall begin in each case at the start of the sections, with the first measurement taken when the test begins. The suction time per filter is limited to 30 min. The average dust content is determined from the four, 30 min values at minimum.

6.6.2.3 Testing at reduced heat input

Reduced heat input tests shall be conducted at the manufactures' declared reduced input stages. The manufacturer shall also indicate at which fuel and air settings (e.g. air fan speed, air damper settings) each test point shall be tested at, and whether the adjustment is done manually or automatically. The combustion chamber dimensions (length and height) shall be the same as in the test with maximum heat input. The waterside flow temperatures stated under 6.6.2.2 shall also apply in this test, with the exception of the difference between the flow and return temperature. The pellet burner shall be operating continuously. The test duration at each test point shall be 6 h.

The mean values of CO_2, O_2, CO, OGC and dust (NOx where appropriate) contents shall be determined over the entire test period.

6.6.2.4 Testing at start-up phase

The purpose of this test is to check the safety, reliability, emission levels and electrical consumption at the start-up phase. The starting phase begins when a start-signal is given from the burner controller and ends when the flue gas temperature reaches a value within 10 K of the mean value determined in 6.6.2.2 to 6.6.2.3. Emissions of CO_2, O_2, CO and THC concentrations are measured during the start-up phase. The test shall be performed for all declared input stages including reduced input stages. The test shall be performed on a warm boiler. All automatic methods of ignition are permitted, e.g. pilot flame, basic fire bed, electrical glow plug or hot air element

6.6.3 Determination of the proportion of unburned fuel in the residue

The proportion of the unburned fuel is the difference between the residue on the bottom of the boiler, expressed as a percent of the total mass of fuel burnt during the test, and the ash content of the fuel used during the test. It is calculated as detailed in equations 2 and equation 3.

After the test at maximum heat input, the residuals are collected carefully, from the burner and the bottom of the boiler, and weighed. The percentage of unburned fuel is then determined through:

$$R = \frac{m_r}{B \cdot t} \cdot 100\% \quad (2)$$

$$C_r = R - a \quad (3)$$

where

R is the total residue referred to the mass of test fuel, mass fraction in %;

m_r is the total residue in boiler after test, in kg;

B is the mass of test fuel referred to the test duration, in kg/h at dry bases;

t is the test duration, in h;

C_r is the carbon content of residues referred to quantity of test fuel, mass fraction in %;

a is the ash content in the test fuel, mass fraction in % at dry bases;

6.6.4 Determination of the excess air ratio

The excess air ratio shall be determined from the measurement of CO_2 in the flue gases through equation (4):

$$\lambda = \frac{CO_{2,max}}{CO_2} \qquad (4)$$

This shall be made for the test at maximum heat input (6.6.2.1) and for the test at minimum heat input (6.6.2.1).

6.6.5 Check of electrical consumption

The total electrical consumption of the burner and its equipment shall be determined according to prEN 15456 during the start, during normal operation and during stand-by and for burners with electrical ignition also during ignition.

6.6.6 Start and ignition test

For burners with basic fire-bed:

Operate the burner for 16 h without any heat being extracted from the boiler. Check that the burner ignites reliably by recording the CO_2-concentration and the flue gas temperature.

For burners with automatic ignition devices:

Check the ignition directly from cold with no embers and without 16 h of standby.

6.6.7 Noise measurement

The noise emission from the pellet burner when operating at maximum heat input shall be determined in accordance with EN 15036-1 for inclusion of the mean value in the instruction manual in accordance with 5.3.7.

6.7 Replacement of individual parts and equivalent components

Replacement of individual parts of the pellet burner that have been tested with all the required additional devices as one unit is only possible if they are replaced with equivalent parts. The pellet burner then still complies with the requirements of this standard.

Components and subgroups are equivalent replacement parts if it has been established that they have the same safety function and suitability.

7 Conformity evaluation

For conformity evaluation see Annex I.

8 Marking

Every burner shall have a data plate fitted permanently in a visible position giving at least the following information:

a. name and company domicile of the manufacture;

b. trade designation, type, production number;

c. year of construction;

d. maximum heat input of the pellet burner, in kW;

e. electrical supply, in V;

f. emission class;

g. maximum electric power consumption at stand-by in W;

h. noise emission in dB (A)

The plate shall not, under normal operating conditions, discolour so as to make its information difficult to read.

9 Operating instructions

9.1 Instruction manual

The instruction manual shall contain a description of the product, installation instructions as well as operation and maintenance instructions for operation and maintenance.

The instruction manual shall be written in the language of the country in which the product is sold.

9.2 Product description

The product description shall include at least the following points:

a. general description of the construction and method/principle of operation of the burner;

b. list of the components included in it, with their names;

c. information on the grades of fuel for which the burner is intended;

d. technical data: maximum heat output, output stages, dimensions, noise emission and electric power requirements;

e. description of the safety systems incorporated and of how they work;

f. description of the features of the control system and of the settings, adjustments etc. that can be made.

9.3 Installation instructions

The installation instructions shall include the following points:

a. minimum combustion chamber size required (height and/or depth) for the burner to provide complete combustion (applies only to pellet burners) for the boiler type or types to which the burner may be fitted;

NOTE This is not applicable to a new boiler which is sold as a complete unit together with its own dedicated pellet burner which is not covered by this standard.

b. distance between the flame and the cooling surface;

c. dimensions of the boiler door;

d. with or without secondary air supply;

e. pressure in the combustion chamber;

f. resistance and maintenance of:

i. exhaust outlet area;

ii. heat exchange area, and

iii. vertical or horizontal position;

g. brick or ceramics lining inside the burner;

h. description of how the burner is to be connected and sealed to the boiler;

i. description of the electrical connections to the product, including a circuit diagram;

j. list of the requirements in respect of unobstructed space around the burner, minimum distance from flammable materials, bearing capacity of the floor and the fire prevention of the space;

k. where appropriate, a description of how fuel supply from an external store is arranged.

9.4 Operation and maintenance instructions

The operation and maintenance instructions shall include at least the following points:

a. information on the recommended pellet quality, with instructions on how the fuel is to be handled in order to avoid crushing, powdering etc.;

- description of how to light and extinguish the burner;
- description of how to fill fuel;
- description of how to remove ash from the boiler, and how frequently this needs to be done;
- description of the adjustments that can be made, and of how they are made, e.g. how to adjust the burner power for different operating conditions;
- specification of inspection intervals, and of what such inspection shall comprise;
- specification of service intervals, and of what is needed for maintenance of the product;
- details of maintenance that must be exercised when using the burner;

- how, and how frequently, to inspect the safety systems;

b. fault-tracing diagram, showing the most common reasons for operational problems and how to deal with them;

c. description of how wearing parts, defective sensors etc. can be removed and replaced when necessary;

d. description of how to check for condensation in the flue and what should be done if it is found.

9.5 Instructions for the installer

In addition to the points set out above under 'Installation instructions', the instructions for the installer shall contain at least the following:

a. detailed step-by-step description of how to install the product;

b. specification of how to seal the burner to the boiler, including a list of materials;

c. how to commission, adjust and check the performance of the equipment.

The installer shall provide the end user with a document containing:

d. type of burner installed;

e. type of boiler;

f. recorded flue gas temperature;

g. recorded CO and CO_2 content.

10 Test report

The test report shall contain at least the following information:

a. name and address of the test laboratory, with details of the place of testing if this differs from the address given;

b. unambiguous identification of the test report and indication of the total number of pages in it;

c. name and address of the pellet burner manufacturer;

d. description and identification of the pellet burner tested;

e. list of the pellet burner documentation;

f. date of arrival of the item for testing, together with the date/time of performing the tests;

g. reference to this test method description;

h. actual dimensions of test boiler chamber;

i. position of the burner head in the test boiler chamber;

j. test results as listed below:

1. details of uncertainties of measurement;

2. signatures of the persons responsible for the testing and the date of issue of the report;
3. statement that the test report applies only to the particular item tested.

The results from tests according to 6.6.2.2 and 6.6.2.3 shall comprise:

k. duration of testing;

l. quantity of fuel supplied; analysis of test fuel and maximum CO_2 – value;

m. useful energy quantity;

n. mean values of the ambient temperature;

o. power supplied;

p. mean value of boiler temperature;

q. mean values of CO_2-and CO-concentrations;

r. maximum value of CO_2-concentration;

s. mean value of O_2-concentration;

t. mean value of THC-concentration;

u. mean value of CO-concentration in mg/ m³ of dry gas at 10 % O_2;

v. mean value of OGC-concentration in mg/m³ of dry gas at 10 % O_2;

w. mean value for the dust content in mg/m³ dry gas at 10% O_2;

The results from tests according to 6.6.2.4 shall comprise:

x. mean value of CO-concentration;

y. mean value of CO_2-concentration;

z. mean value of O_2-concentration;

a.a. mean value of THC-concentrations;

Annex A
(informative)

Vocabulary

Table A.1 — Terms in Danish, English, French, German and Swedish

English term	French term	German term	Danish term	Swedish term
Air supply	Amenée d'air	Luftversorgung	Lufttilførsel	Lufttillförsel
Ash discharge, ash removal	Cendrier, décendrage	Entaschung, Ascheentfernung	Askeudtag	Uraskning
Automatic ignition/kindling	Allumage automatique	automatische Zündung	Automatisk optænding	antända
Back burning (Back fire Blow back fire)	Retour de flamme	Rückbrand	Tilbagebrand	Tillbakabrand
Basic fire bed	Lit de braises initial	Gluterhaltung, Glutbett	Pausefyring Grundglødelag	Underhållsfyr glödbädd
Burner head	Tête du brûleur	Brennerkopf	Brænderhoved	Förbränningshuvud
Burner head (retort)	Tête du brûleur	Brennerkopf	rænderhoved / retord	Förbränningshuvud / Brännorrör
Cell feeder	Cellule d'alimentation	Zellradschleuse	Cellesluse:	Cellmatare
Chute-feed system	Système d'alimentation à glissière	Zuführung über Rutsche	Slidske system	För att ge ett säkerhetsavstånd
Cleaning point cover	tion du point de age	—	Renselem:	Askluka
Combustion air fan	Ventilateur d'air de combustion	Verbrennungs-luftgebläse	Forbrændings-luftbrlæser	Fläkt för förbränningsluft
Combustion chamber, firebox	Chambre de combustion	Brennkammer	Fyrboks:	Förbränningskammare
Conveyer system (Auger, feed screw)	Système d'alimen-tation (vis d'alimen-tation)	Förderschnecke, Zuführschnecke, intern/extern	Transportanlæg (trækstation):.Snegl	matningsskruv
Control function	Régulation	Überwachung	Styringsfunktion	Styrfunktion
Downwards draught	Tirage inversé	Abwärts-gerichteter Zug	Omvendt forbrænding	Omvänd förbränning
Drop chute	Conduite d'alimentation	Fallschacht	Faldskakt:	fallschakt
Electric coil	Résistance électrique	Elektrospule	Spole	Elektrisk spiral
Electric control unit	Système de régulation électrique	elektrische Über-wachungseinrichtung (Feuerungsautomat)	Styring/styreenhed	Styrkort
Electric glow plug	Résistance électrique pour allumage	Elektrische Glühkerze	Gløderør	Glödstift
Ember	Braise	Glut	Gløder	Glöd

Table A.1 *(continued)*

English term	French term	German term	Danish term	Swedish term
Enclosed cell feeder	Cellule d'alimentation intégrée	integrierte Zellradschleuse	Indbygget cellesluse	Inbyggd cellmatare
external fuel hopper	Trémie de combustible extérieure	mit externem Brennstoffvorrat (z.B . Jahres-Silo)	Forbrugslager.	Med externt bränsleförråd
Feeding control	Régulation de l'alimentation	Förderüberwachung	Niveaukontrol/fyldemelder	Nivåvakt
Fire damper	—	Brandschutzklappe	Brandspjæld	Brandspjäll
Flame burning direction	Sens de propagation de la flamme	Brennrichtung der Flamme	Flammeretning	Lågans riktning:
Flame detector (supervisor)	Détecteur de flamme	Flammensensor	Fotocelle	Flamvakt
Flue system	Système d'évacuation des fumées	Abgasanlage	Aftrækssystem:	Rökgassystem
Fuel fed to burner	Alimentation du brûleur en combustible	Brennstoffförderung zum Brenner	Brændelsfremføring	Bränsletillförsel
Fuel hopper	Trémie de combustible	Füllraum	Brændselsmagasin	Mellanförråd, matningsficka
Glow	Rayonnement	Glut	Ulme	Sken, ljus
Hatch	Trappe	—	Afspærringsspjæld	Avstängningsspjäll
Horizontal draught	Tirage horizontal	waagerechter Zug	Horisontal forbrænding	Framåtbrinnande
Ignition device	Système d'allumage	Zündeinrichtung	Optændingsanordning	Tändanordning:
Integral fuel hopper	Trémie à combustible intégrée	mit integriertem Brennstoffvorrat (Brennstoffvorratsbehälter)	Forbrugslager i fyrrummet	Med inbyggt bränsleförråd
Kindling	allumage	—	Optænding	Upptändning
Non volatile lockout	Mise en sécurité	nicht veränderbare Störabschaltung	Sikkerhedsafbryder med manuel genindkobling	Avstängning med manuell återställning
Over fed	Suralimentation	Zuführung von oben	Drop stoker	Övermatad
Pellet burner	Brûleur à granulés	Pelletbrenner	Stoker	pelletsbrännare
Primary combustion zone	Zone de combustion primaire	Primär-Verbrennungsbereich	Primær forbrændingsxone	Primär förbränningszon
Purge	Purge	Durchlüftung	—	Ventilering
Safety catch	Poignée de sécurité	—	Mekanisk sikring af låget,	Mekanisk säkring av locket
Safety devices	Dispositifs de sécurité	Sicherheitseinrichtung	Sikkerhedsindretning	Säkerhetsdon
Safety systems	Systèmes de sécurité	Sicherheitssystem	Sikkerhedssystem	Säkerhetssystem
Safety temperature limiter	Limiteur de température de sécurité	Sicherheitstemperaturbegrenzer	Sikkerhedstermostat	Överhettningsskydd
Secondary combustion zone	Zone de combustion secondaire	Sekundär-Verbrennungsbereich	Sekundær forbrændingszone	Sekundär förbränningszon
Security distance	Distance de sécurité	Sicherheitsabstand	Sikkerhedsafstand	Säkrehetsavstånd
Side fed	Alimentation latérale	seitliche Zuführung	Sideindføring	Sidomatad

Table A.1 *(continued)*

English term	French term	German term	Danish term	Swedish term
Temperature limiter	Limiteur de température	Temperaturbegrenzer	—	Temperatur begränsare
Under fed, bottom fed	Alimentation par le bas	Zuführung von unten (Unterschubfeuerung)	Underfeed stoker	Undermatad
Upwards draught	Tirage normal	aufwärtsgerichteter Zug	Gennemforbrænding	Uppåtbrinnande
Water sprinkler system	Système de jet d'eau	Wassersprühsystem (Sprinkler)	Automatisk vandoverrislingsonlmg:	Sprinklersystem
Volatile lockout	Verrouillage ferme	veränderbare Störabschaltung	—	Avstängning med automatisk återställning

Annex B
(informative)

Fireproof non-metallic materials for pellet burners

B.1 General

In general non-metallic materials with an operating temperature of 800 °C to 1 000 °C or higher are referred to as fireproof or refractory materials.

For construction, lining and insulation of fireboxes and burners a number of different refractory materials may be considered. These are:

a) Refractory castables;

b) Refractory bricks and mortar;

c) Ceramic fibre products.

Cast iron or heat resistant types of steel may also be used for these purposes.

B.2 Refractory castables

a) Low cement castables;

b) Traditional castables;

c) Insulating castables;

d) Gunning mixes;

e) Ramming mixes.

B.3 Refractory bricks and mortar

a) Chamotte bricks;

b) High alumina bricks;

c) Insulating bricks;

d) Semi insulating bricks;

e) Air drying mortar;

f) Temperature hardening mortar.

(See also EN 1094-2 and EN 12475-4.)

B.4 Ceramic fibre products

a) Vermiculite boards;

b) Fibre blankets, ropes and papers.

(See also EN 1094-1 and EN 1094-3.)

For more information refer to ISO 2245 or ASTM C155.

Annex C
(normative)

Requirements for electronic burner start up functions and pellet-air ratio controls

C.1 Burner start up function including flame supervision (Automatic burner control including flame detector device)

C.1.1 General

The burner start up function shall be described.

Before pellets are conveyed into the combustion chamber, all necessary self-tests shall be performed and the start conditions have to be checked to be within the declared range.

A risk assessment for this function shall be done considering Annex C according to the risk and safety level allocation.

If the risk assessment results in requiring safety level C, then C.1.2 shall apply. If safety level B applies similar requirements with single fault assessment only and software Class B according EN 60730-1 apply.

C.1.2 Electrical and functional requirements

The burner start up function shall be in line with the following requirements as particularly referred to in EN 230:

a) Constructional requirements according to clause 6 of EN 230:2005,

b) safety time of < 10 s as required in 7.3.2 b) of EN 230:2005, is not applicable for pellet fired appliances.

c) repetition or re-start is allowed for 3 times, if the start conditions are reached,

d) flame detectors may also be based on temperature sensing elements,

e) fault assessment in lock-out is not required,

f) protection against environmental influences according to clause 8 of EN 230:2005,

g) only the assessment for safety level C shall be according to clause 9 of EN 230:2005. For safety-level B EN 60730-1 applies with a single fault assessment and measures for software-Class B if applicable,

h) marking, installation and operating instructions shall be based on clause 11 of EN 230:2005.

C.2 Pellet - air ratio control function

An electronic pellet - air ratio control is a closed loop modulating system consisting of the electronic control, actuating elements for the pellet flow and the air flow as a minimum, and allocated feedback signals.

If the pellet - air ratio control function shall be considered, EN 12067-2 can be consulted with consideration that whenever gas is mentioned, substitute it with pellets.

A fault assessment during lock out, as required in 7.8 of EN 12067-2:2004 by reference to EN 298 is not required.

A reaction time of 3 s as required in 9.1.2 b) of EN 298:2003, is not applicable for pellet fired appliances.

Annex D
(informative)

Example of risk assessment to prevent back burning

Table D.1 — Risk assessment on safety measurements to prevent back burning in pellet burners

Critical situation in operation	Means to ensure safety in case of failure in operation	Failure in safety measure	Means to ensure safety in case of failure in safety measure
fuel line full, no transportation to the boiler	Interruption of line for fuel supply by drop chute and 2 feed screws, with a higher fuel flow in the feed screw next to the boiler	Feed screw next to boiler stops, 2nd feed screw continues working	1. direct drive of feed screw next to boiler (connected by positive coupling), 2. feed screw driven by the same motor using an indirect drive (e. g. chain)
	Limiter (safety level A) for the fuel height, stop of fuel supply at achieving the limited height	Limiter for fuel height does not work correctly	Limiter for fuel height which stops the fuel supply at a certain level
	Limiter (safety level B) for the fuel height, stop of fuel supply at achieving the limited height.	No need to take a failure in the safety device into consideration	—
draught into direction of the fuel storage	Tight fuel hopper including lid or other openings (sealed, closing by positive coupling)	Lid open	Lid with a contact to cause an emergency discharge of fuel and then stop combustion if the lid is open
	Opening to equalise the pressure between fuel line and surrounding (supplement of air to the fuel line to hinder draught)	Opening closed for example by dirt	Pressure limiter (safety level B) to monitor fuel line; stops fuel supply at limit value Temperature rises continuously also without fuel by thermal conduction, no need to take a failure in the temperature limiter into consideration

Table D.1 — *(continued)*

Critical situation in operation	**Means to ensure safety in case of failure in operation**	**Failure in safety measure**	**Means to ensure safety in case of failure in safety measure**
Flow of sparks to the fuel hopper	Self closing lid in the fuel line if there is no transportation of fuel	Lid blocked	Lid with a contact to cause an emergency discharge of fuel and then stop combustion if the lid is open
	Cell feeder or a fire damper, made of non combustible material	No need to take a failure in the safety device into consideration	—
	Spark damper (type tested)	No need to take a failure in the safety device into consideration	—
Overheating of fuel line	Temperature resistant, non combustible materials and a first temperature limiter [a)] which initiates the action of the water sprinkler system [b)] or another fire extinguisher	Temperature rises continuously also without fuel	Second temperature limiter[a)] with water sprinkle system[b)] or another fire extinguisher
	Temperature resistant, non combustible materials and a fire collar (type tested for this application)	Temperature raise continuously also without fuel	Second temperature limiter[a)] with water spray system[b)] or another fire extinguisher
	Temperature resistant, non combustible materials and a safety temperature limiter [a)] which initiates the action of the water spray system [b)] or another fire extinguisher	No need to take a failure in the safety temperature limiter into consideration	—

[a)] Temperature limiters have to meet the requirements of EN 14597, type TB; and safety temperature limiter EN 14597, type STB; for a water sprinkler system or emergency discharge of fuel they must operate at not more than 85 °C.

[b)] A water container for a sprinkler system must have a volume of at least 5 l and be fitted with a level switch. If the spray system is connected to the mains water supply, the system must incorporate a pressure switch.

Annex E
(informative)

Example of risk assessment and the allocation of safety level for control functions using electronic devices for pellet burners

Table E.1 — Risk assessment of control functions that may influence the safe operation of the pellet burner

Control function	Failure / Fault of the function	Assumed risk under fault conditions	Time characteristic	Safety level, if the risk is assumed	Comments
Burner start up					
Purge	No purge or shortened purge time	none	—	A	—
Pellet transport into the burner	Combustion chamber is still too hot	CO-concentration with explosion	Temporarily during start up	C	—
	Too less pellets	none	—	A	—
	Too much pellets	CO-concentration with explosion	Temporarily during start up	B or C	—
		Overheat → risk of fire	—	B	Risk covered by 4.1.5.11.2 of EN 303-5:1999, (rapid disconnection)
Ignition	No ignition	None. (If repetition happens → overheat → risk of fire)	—	A (B)	—
	Ignition does not interrupt	Risk of fire, if the igniter is not designed for permanent load.	—	B	—
	Delayed ignition	Incorrect mixture: CO, soot → explosion, risk of fire	Temporarily	B	—
Flue gas flow	No chimney flow (not enough draught)	Exhaust stack in the combustion chamber or chimney → risk of Explosion	Temporarily	B or C	—
		Gas flow into the room (building)	—	C	—

Table E.1 — *(continued)*

Control function	Failure / Fault of the function	Assumed risk under fault conditions	Time characteristic	Safety level, if the risk is assumed	Comments
Flame supervision	Flame sensor simulates flame and ignition is delayed	Overheat → risk of fire	—	B	—
Burner in running position					
Control of heat demand	Too much pellets	Overheat → risk of fire	Permanent	B	—
Flame supervision	Loss of flame	none	Up to the end of the burning cycle	A	—
	Flame not detected because of the detector or amplifier	During the actual running cycle no risk is expected, because the flame is available. During the next Start–up cycle the flame supervision function shall be ensured	—	B	—
Pellet-air ratio control	Too less fuel	none	—	A	—
	Too much fuel (e. g.: flue gas sensor simulates too much O_2)	CO-concentration with explosion	some minutes	C	—
		Soot with risk of chimney fire	some days	B	

Annex F
(informative)

Long term stability test (optional)

F.1 Test Procedure

This long-term stability test is optional. If it is performed the following procedure and requirements are recommended:

The burner shall be operated for 72 h by a thermostat at 65 % to 75 % of the maximum heat input.

The CO and OGC concentrations in the flue gas shall be measured for at least two firing cycles at the start and finish of this test period respectively. The burner head (or equivalent) shall be inspected on completion of the test, looking for signs of slag formation.

Calculate also the mean values of the emissions of CO and OGC for 15 min at the beginning and at the end of the test.

Calculate the change according to equation (F.1) and (F.2):

$$\Delta CO = \frac{CO_{stop} - CO_{start}}{CO_{start}} \quad \text{in } \% \qquad \text{(F.1)}$$

$$\Delta OGC = \frac{OGC_{stop} - OGC_{start}}{OGC_{start}} \quad \text{in } \% \qquad \text{(F.2)}$$

F.2 Requirements

No slag formation shall occur that significantly degrades the combustion characteristics during the test.

The emissions of CO and OGC shall not deteriorate more than 50 % from the values recorded at the start of the test and shall meet the requirements in Table 2.

Annex G
(informative)

Measurement methods for some physical parameters

G.1 Measurement of CO_2 concentration

Measure the CO_2 concentration with a suitable continuously recording instrument e.g. infrared analyser. The measuring range shall be (0 to 20) % CO_2 or (0 to 25) % CO_2. Place the probe in the centre of the measurement section and at a suitable distance from the boiler. Means of cooling, cleaning and drying the flue gas sample shall be incorporated in the sampling line.

G.2 Measurement of CO concentration

Measure the CO concentration with a suitable continuously recording instrument e.g. infrared analyser. The measuring range shall be (0 to 10 000) mg/m^3 (0 to 1) % CO or (0 to 30 000) mg/m^3 (0 to 3) % CO. Place the probe in the centre of the measurement section and at a suitable distance from the boiler. Means of cooling, cleaning and drying the flue gas sample shall be incorporated in the sampling line.

G.3 Measurement of O_2 concentration

Measure the O_2 concentration with a suitable continuously recording instrument. Place the probe in the centre of the measurement section and at a suitable distance from the boiler. Means of cooling, cleaning and drying the flue gas sample shall be incorporated in the sampling line.

G.4 Measurement of total hydrocarbons (THC)

G.4.1 General objective and applicability

This method is intended to determine the total hydrocarbon content in flue gases from appliances burning solid fuels. This method uses an instrument equipped with a flame ionisation detector (FID). The measurement is continuous. The result obtained is expressed as equivalents of a reference substance, usually methane or propane. The measurement concerns only the total hydrocarbon content and does not give any information of separate constituents.

G.4.2 General procedure

The measurement is extractive, i.e. the test gas flow is drawn from the measuring point and is analyzed in a free-standing instrument. The measuring point shall be in the centre of the flue gas pipe and be placed three diameters after the flue gas outlet of the appliance. If there is a damper or any other device which will give rise to inhomogenities in the flow the measuring point shall be moved to a position where the flow is homogenous. The measuring system shall be heated to 195 °C.

G.4.3 Equipment

The measuring system consists of the following components:

a) Instrument with flame ionisation detector (FID). Measuring range, usually between 0 to 10, and

b) (0 to 100 000) mg/m^3. The instrument shall be equipped with a heated filter.

Gas probe with a filter for particulates. The probe shall consist of a suitable material, such as corrosion resistant steel. The filter shall be heated so that condensation is avoided. This requires a temperature in the filter of 195 °C.

Sample line: The sample line shall be heated to the same temperature as the filter. The inner line shall be of PolyTetraFluoroEthylene (PTFE) and be exchangeable. The sample line shall be as short as possible.

G.5 Measurement of dust

The dust content shall be determined using a gravimetric or an electrostatic method or other national methods or practices meeting the error limits requirements given in 6.3. To minimize the errors of measurements, the instruments shall be installed in a zone of as constant temperature as possible and shall be in operation some time before the commencement of the test.

NOTE Observe that CEN/TC 295 elaborates a method for measuring dust in flue gases. When an European Standard for dust in flue gases is available this should be used.

G.6 Measurement of flue gas temperature

Measure the flue gas temperature continuously during testing by a thermocouple of type K or N. The thermocouple shall be located in the centre of the measurement section. The distance between the measurement section and the test boiler rig shall correspond with at least three chimney diameters.

G.7 Measurement of ambient temperature

Measure the ambient temperature continuously during testing by a thermocouple of type K. The thermocouple shall be protected from radiation for example by an open ended cylindrical metal screen, maximum 50 mm in diameter and at least 85 mm long.

G.8 Measurement of water flow and return temperatures

Continuously measure the flow and return temperatures of the radiator circuit with calibrated Pt-100 sensors.

G.9 Water flow in radiator circuit

Continuously measure the liquid flow rate in the radiator circuit by means of a calibrated instrument.

G.10 Measurement of surface temperature

The surface temperature of the burner shall be measured at the hottest point where parts of the burner that can be touched.

G.11 Pressure ratio in the combustion chamber

Measure the pressure in the boiler combustion chamber at least once during the test period, or allow it to be continuously measured.

G.12 Calculation of heat input

The heat input Q_{ib} is calculated from the mass of tested fuel B_w and its net calorific value h_i.

Annex H
(normative)

Determination of organic gaseous compounds content

H.1 Calculation of organic gaseous compounds (OGC)

H.1.1 Description of method

This method describes how to calculate the contents of organic gaseous compounds expressed in mg/m³, referred to 0 °C and 1,013 bar, dry exit flue gas at 10 % O_2. The calculation is based on a continuous measurement of the total hydrocarbon (THC) content as described above.

H.1.2 Calculation assumptions

The following data shall be known to perform the calculation:

— total hydrocarbon content in methane or propane equivalents, mean value;

— O_2, CO_2, CO content, mean value;

— carbon, hydrogen and moisture content of the test fuel;

— carbon content of the residue passing through the grate, referred to the quantity of the test fuel fired (C_r).

H.1.3 Calculations of organic gaseous compounds (OGC)

The OGC shall be determined from equations (H.1) or (H.2):

as (methane equivalents)

$$C_{OGC} = \frac{(C_{THC,m} \times 12)}{22{,}36} \times \frac{(21-10)}{21-O_{2,m}} \times \frac{G_w}{G_d} . \qquad \text{(H.1)}$$

or

as (propane equivalents)

$$C_{OGC} = \frac{(C_{THC,p} \times 36)}{21{,}93} \times \frac{(21-10)}{21-O_{2,m}} \times \frac{G_w}{G_d} \qquad \text{(H.2)}$$

where

C_{OGC} is the calculated content of organic gaseous compound, mg/m³ dry flue gas at 10 % O_2;

$C_{THC,m}$ is the measured total hydrocarbon content expressed in mg/m^3 methane equivalents, in wet flue gas;

$C_{THC,p}$ is the measured total hydrocarbon content expressed in mg/m^3 propane equivalents, in wet flue gas;

G_w is the actual specific wet flue gas volume, m³/kg fuel;

G_d is the actual specific dry flue gas volume, m³ /kg fuel;

$O_{2,m}$ is the measured oxygen content in dry flue gas, % as mean value.

The actual specific flue gas volume in wet condition, G_w, shall be calculated according to equation (H.3):

$$G_w = \frac{(C_C - C_r)}{(0{,}536 \times (CO_2 + CO))} + 1{,}24 \times \frac{(9 \times C_H + C_W)}{100} \quad \text{(H.3)}$$

The actual specific dry flue gas volume, G_d, shall be calculated according to equation (H.4):

$$G_d = \frac{(C_C - C_r)}{0{,}536 \times (CO_2 + CO)} \quad \text{(H.4)}$$

where

C_C is the carbon content of the test fuel;

C_r is the carbon content of the residue in % of mass;

C_H is the hydrogen content in % of mass;

C_W is the moisture content in % of mass.

H.2 Uncertainty of measurement

The total uncertainty of the calculated OGC value, according to this instruction, is ± 5 % of the calculated value.

Annex I
(informative)

Conformity evaluation

I.1 Test laboratories and test samples, procedure

Every type of burner shall be tested as a complete unit in each case.

The suppliers provide certification for the electrical accessories of the burner and the control and monitoring devices to state that they meet the requirements of the relevant EN-standards.

If a different accessory is used than what was previously used, its suitability shall also be established. Proof is regarded as having been submitted if this accessory has already been tested by one of the test laboratories - where appropriate in a different apparatus - and has been found safe for use.

If one manufacturer produces burners of different inputs but of the same design and with the same accessories, generally it is adequate to test two burners of different burner inputs. Generally the smallest and largest burner of one series type are subjected to a complete type test.

For a pellet burner in a product range that has the same constructional design it is sufficient to test only the smallest and largest pellet burner provided the ratio of the maximum heat input of the smallest to largest pellet burner is less than or equal to 2:1. If, however, within the same product range, this ratio is larger than 2:1 then so many intermediate sizes shall be tested that the ratio of 2:1 is not exceeded.

I.2 Types of test and test documents for burners

I.2.1 Type test

The type test is a test requested by the manufacturer to establish whether a burner meets the requirements of the standard. For this, it is generally sufficient for the manufacturer to make available to the test laboratory two burners of different burner inputs from one design series.

If requested, an authorised representative of the manufacturer may be present at the tests.

The type test is carried out as a functional test and as an endurance test as specified in 6.7. The applicant is informed of the result of the test by means of a written report.

I.2.2 Type test in the overall system

If the manufacturer requests, the test may be carried out with the burners built into appliances, heat generators, systems etc.

I.2.3 Examination of drawings

The manufacturer may request an examination of drawings if:

a) changes or supplements have been made to the burner design compared with the previous design; or if

b) burners of different input stages of the same construction have been manufactured by a manufacturer but proof of conformity with the standard has only been supplied for individual input stages (see I.1).

The extent of the examination of drawings depends on whether the changes resulting from a) or b) have an effect or not on the requirements of this standard being met. Burners that during drawing examination in all significant aspects conforming with burners according to this standard are also regarded to fulfil this standard.

I.2.4 Supplementary test

The supplementary test is a test to establish the effect of devices subsequently built into the burner on its method of operation.

The supplementary test is generally carried out if the design of individual parts of the burner has been changed.

The manufacturer shall submit a burner that has already been tested to the relevant test laboratory for a supplementary test if it has undergone technical changes following the type tests which call into question its conformity with the requirements of this standard.

If agreed with a test laboratory, a supplementary test may be dispensed with if it is just a question of a necessary adaptation of type tested burners to a specific installation because of the effects of the fuel, combustion chamber or system. These measures are only permitted if,

a) they are carried out by trained personnel;

b) flame stability is maintained;

c) heat input is not increased;

d) safety criteria are not diminished;

e) combustion characteristic values, e. g. for CO contents and OGC contents remain within the permissible limits;

f) success of the measures taken is documented by records for the test laboratory.

I.2.5 Type retest

Anyone may apply for type re-testing of burners at the competent test laboratory if they have objections to the conformity of the burner with the requirements of the standard. The type retest shall be carried out by an accredited independent test laboratory, (and not the same test laboratory that carried out the first type test).

The type retest shall be carried out basically as a type test. If the objections cover one or a few individual requirements of the standard, the type retest may be carried out as a supplementary or drawing test at the discretion of the test laboratory If there are deviations from conformity of the burner with requirements of the standard, the manufacturer may be forbidden to put the type designation on the particular burner.

I.2.6 Test documentation for burners

The test laboratory requests the manufacturer or operator of the system (applicant) to submit the following documents in duplicate:

— permanent drawings, e.g. photocopies. The drawings shall include the necessary cross-sectional diagrams so that they give a clear picture of the design of the burner and all its major parts. In addition, an assembly drawing shall be submitted;

— photograph of the burner;

— description of the burner, containing details on the type of construction and design of the burner including instructions for installation and information on its input ranges;

— information on equipping the burner with electrical accessories and their designation, manufacturer and types including information on which parts belong to the normal equipment;

— declaration by the manufacturer that the electrical accessories and their assembly comply with the regulations of the relevant EN-standards;

— details on the type designation of the burner;

— declaration by the manufacturer that the materials meet all the chemical, mechanical and thermal requirements;

— information on the fuel specified in the scope for which the burner is intended;

— information on the installed load of the burner;

— instructions for installation, adjustment and operation of the burner and circuit, wiring or function diagrams with dimensions given in metric units.

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