1 Scope

DRAFT 22.2.2001 Heikki Oravainen

This European Standard specifies requirements relating to the design, manufacture, construction, safety and performance (efficiency and emission) instructions and marking together with associated test methods and test fuels for type testing residential roomheaters tired by solid fuel..

This Standard is applicable to non-mechanically fired appliances which are listed under categories 1 a, and 2a of table 1. These appliances provide heat into the space where they are installed. Additionally, where fitted with a boiler, they also provide domestic hot water and/or central heating. These appliances may burn either solid mineral fuels, peat briquettes, natural or manufactured wood logs or be multi-fuel in accordance with the appliance manufacturer's instructions.

Insert a new paragraph 3 as follows:

This standard also covers freestanding, intermittent burning, slow heat release appliances defined in part 3.

This standard is not applicable to appliances with fan assisted combustion air.

Table 1 Categorisation of appliances

	a) Freestanding or inset appliances without functional modification	b) Freestanding or inset appliances which have functional modification	c) Inset appliances for fireplace recess and enclosure
1 Appliances operating with firedoors closed	prEN 13240	prEN 13229	prEN 13229
2 Appliances operating with firedoors closed or open	prEN 13240	prEN 13229	prEN 13229
3 Open fires without firedoors	prEN 13229	prEN 13229	prEN 13229

NOTE 1: Without functional modification means " modification of the surround of an appliance, that only changes the transmission of heat, without effect on combustion".

NOTE 2: The manufacturer shall state the type of appliance which he is submitting for test; the laboratory shall test the appliance using the standard appropriate to that claim.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 1561:1997	Founding. Grey cast irons
EN 1563:1997	Founding. Spheroidal graphite cast iron
EN 10025:1993	Hot rolled products of non-alloy structural steels. Technical delivery conditions
EN 10028-2: 1993	Specification for flat products made of steels for pressure purposes: Part 2: Non-alloy and alloy steels with specified elevated temperature properties
EN 10029:1991	Specification for tolerances on dimensions, shape and mass for hot rolled steel plates 3 mm thick or above
EN1 0088-2: 1995	Stainless steels. Part 2: Technical delivery conditions for sheet/plate and strip for general purposes
EN 10111:1998	Continuously hot-rolled low carbon steel sheet and strip for cold forming. Technical delivery conditions
EN 10120:1997	Steel sheet and strip for welded gas cylinders
ISO 7-l: 1994	Pipe threads where pressure-tight joints are made on the threads- Part 1: Designation, dimensions and tolerances.
ISO 7-2: 1982	Pipe threads where pressure-tight joints are made on the threads- Part 2: Verification by means of limit gauges.
ISO 228-l: 1994	Pipe threads where pressure-tight joints are not made on the threads Part 1: Designation, dimensions and tolerances.
ISO 228-2: 1982	Pipe threads where pressure-tight joints are not made on the threads Part 2: Verification by means of limit gauges.

3 **Terms and definitions**

For the purposes of this European Standard, the following terms and definitions apply:

3.1
air **grilles**
components in the inlet and outlet openings to distribute and direct convection air flow

3.2
air inlet control
manual or automatic device which controls the quantity of air supplied for combustion

3.3
appliance with boiler
heat generator consisting of a room heating component and a water heating component in one unit

3.4
ash content of the fuel
solid matter remaining after the complete combustion of solid fuel

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3.5
ashpan
removable receptacle shaped to receive the residue falling from the firebed.

3.6
ashpit
enclosed chamber designed to receive the residue or the ashpan

3.7
ashpit loss
part of the residue which is combustible

3.8
basic firebed
quantity of glowing embers which ensures ignition of the test fuel to be charged

NOTE: The basic firebed may be specified by the manufacturer.

3.9
boiler
vessel in which water is heated, intended for fitting in or forming an integral part of a solid fuel appliance

3.10
boiler flueway
portion of the flueway formed wholly or in part by the surfaces of the boiler

3.11
bottomgrate
part of the appliance at the base of the firebox 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

3.12
bottomgrate bars; firebars
bars supporting the fuelbed, separate or integral with a surrounding frame

3.13
charging door
door which covers the refuelling opening

3.14
combustion air
air supplied to the firebox which is entirely or partially used to burn the fuel

3.15
combustion gases
compounds in gaseous form produced inside an appliance when fuel is burned

3.16
continuous burning appliance
heating appliance designed to provide a source of heat by continuous burning and meeting the requirement of the slow combustion test

3.17
de-ashing
process of clearing a fuelbed and discharging the residue into the collecting receptacle

3.18
de-ashing mechanism
device to agitate or disturb the ash to facilitate its removal from the firebed

NOTE: It may also be used to change the bottomgrate operating position on some appliances.

3.19
direct water system
hot water system in which stored domestic hot water is heated directly by hot water circulating from the boiler

3.20
draught regulator
inlet device for admission of air downstream of the firebed, enabling the flue draught to be controlled

3.21
efficiency
ratio of total heat output to total heat input during the test period expressed as a percentage during the test period

for slow heat release appliances this should be changed to be:
ratio of total heat output plus accumulated heat to total heat input during the test period
NOTE: Efficiency is determined indirectly from losses in flue gas and in the residue which is similar to other appliances.

3.22
firebox; combustion chamber
that part of the appliance in which the fuel is burned

3.23
firebox opening
aperture in the firebox through which an appliance may be fuelled

3.24
firedoor
door through which the fire may be viewed and which may be opened to allow refuelling of the firebed

3.25
fireplace enclosure
assembly consisting of walls and ceiling of non combustible materials which is built on site to surround a 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

3.26
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

3.27
flue **by-pass device**
device which in the open position allows flue gases to pass directly to the flue spigot/socket

NOTE: This can be used as a preheating aid to overcome chimney condensation.

3.28
flue damper
mechanism to change the flow of the combustion gases

3.29
flue draught
differential between the static pressure in the place of installation and the static pressure at the flue gas measurement point

3.30
flue gases
gaseous compounds leaving the appliance flue spigot or socket and entering the flue gas connector

3.31
flue gas connector
duct through which flue gases are conveyed from the appliance into the chimney flue

3.32
flue gas mass flow
mass of flue gas drawn off from the appliance per unit of time

3.33
flue gas temperature
temperature of the flue gas at the specified point in the measurement section

3.34
flue spigot; flue socket
integral part of the appliance for connecting the flue gas connector thus permitting the deliberate escape of products of combustion into the chimney flue

3.35
flueway
that part of an appliance designed to convey combustion gases from the firebox to the flue spigot/socket

3.36
freestanding appliance
appliance designed to operate without the need for being built into a tireplace recess or fireplace enclosure and which is not connected to the building except by the flue gas connector

3.37
front firebars
grating or plate fitted at the front of the firebox opening to prevent spillage of fuel and ash or to change the firebox capacity, or both

3.38
fuel hopper

fuel store integral with the appliance from which fuel is fed to the firebox
3.39

heat input
quantity of energy which the fuel provides to the appliance

3.40
heat output
quantity of useful heat released by the appliance

insert following definition

heat release rate
rate of heat released from the appliance

3.41
indirect water system
hot water system in which stored domestic hot water is heated by a primary heater through which hot water from the boiler is circulated without mixing of the primary (heating) water and the stored domestic hot water

3.42
inset appliance
appliance with or without doors designed to be installed into a fireplace recess or an enclosure, or into a firebox of an open fire

3.43
integral fuel storage container
enclosed 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

3.44
intermittent burning appliance
heating appliance designed to provide a source of heat by intermittent burning and meeting the requirement of the reduced combustion test

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

3.45
maximum water operating pressure
limiting water pressure at which the boiler of an appliance can be safely operated

Insert a new definition as follows:

3.4.xx
mean value time

the time when 50% of the net heat energy is released from the slow heat release appliance.

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3.46
nominal heat output
total heat output of the appliance quoted by the manufacturer and achieved under defined test conditions when burning the specified test fuel

Insert a new definition as follows:
nominal heat release rate
heat release rate of the appliance quoted by the manufacturer and achieved under defined test conditions when burning the specified test fuel

3.47
open fire
appliance which is built as an inset and designed to be connected to the building and surrounded by non combustible materials

3.48
operating tool
device supplied with the appliance for handling movable and/or hot components

3.49
primary air
combustion air which passes through the fuel bed

3.50
recommended fuel
fuel of commercial quality, listed in the appliance manufacturer's instructions, and shown to achieve the claimed performance when tested in accordance with this European Standard

3.51
recovery capability
ability of the fire to re-ignite existing or newly charged fuel after a defined burning period without external assistance

3.52
reduced combustion capability
ability of an intermittent burning appliance to continue burning for a minimum period, dependent on appliance type and fuel burned, without any input of fuel and without any external interference with the combustion process, in such a manner that at the end of this period, the firebed can be recovered

3.53
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

3.54
residue
ashes, including combustibles, which collect in the ashpit

3.55

roomheater
appliance having a fully enclosed firebox with firedoor(s) which are normally closed, that distributes heat by radiation and/or convection and also provides hot water when fitted with a boiler

3.56
safety heat exchanger
device which allows excess heat to be released from an appliance

3.57
slow **combustion capability**
ability of an appliance to continue operating at a low burning rate for a specified minimum period without any input of fuel and without any interference with the combustion process, in such a manner that the basic firebed can be recovered at the end of this period

Insert a new definition as follows:

Slow heat release roomheater

intermittent burning appliance having a fully enclosed firebox with firedoor(s) which are normally closed, that distributes heat by radiation and/or convection and also provides hot water when fitted with a boiler, having long flue ways to accumulate heat into its mass and providing useful heat for at least x hours after the fire has gone out.

3.58
solid fuel
naturally occurring or manufactured solid mineral fuels, natural or manufactured wood logs and peat briquettes

3.59
solid mineral fuel
coal, lignite, coke and fuels derived from these

3.60
space heating output
heat output provided as convection and radiation to the room

3.61
steady-state condition
stage at which values to be measured in successive equal periods of time do not exhibit significant change

3.62
surround
outside components or assembly enclosing the appliance or parts of it

3.63
test fuel
fuel of commercial quality being characteristic of its type to be used for testing appliances

3.64
thermal discharge control

mechanical device controlled by the water flow temperature which opens a drain in the water circuit of a safety heat exchanger when a specified flow temperature is attained

3.65
thermostat
temperature sensitive device which automatically changes the air inlet cross-sectional area

3.66
water heating output
heat output to water, averaged during the test period

3.67
working surfaces
all surfaces of an appliance designed to transmit heat to the surrounding atmosphere

NOTE: All external surfaces of a roomheater including the flue gas connector in accordance with this standard are classified as working surfaces because they are designed to transmit heat into the room in which they are installed.

4 **Materials, design and construction**

4.1 Production documentation

To identify the appliance, the manufacturer shall have available documents and/or scaled assembly drawings 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 nominal heat output in kW using fuels recommended by the manufacturer;

If the appliance is fitted with a boiler then the following additional details shall also 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 bar;
- the type test pressure in bar;
- the water heating output in kW.

4.2 Construction

4.2.1 **General construction**

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 standard 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. Non-combustible materials 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.

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

Component parts which require periodic replacement and/or removal shall be either so designed or marked for identification to ensure correct fitting.

NOTE 1: Because the entire heat dissipating surfaces of the appliance including the flue spigot/socket and the flue gas connector are working surfaces, there is no requirement for limiting the surface temperature of the appliance.

NOTE 2: It is essential that all operations which the user carries out, including loading and emptying of the appliance, adjusting controls and de-ashing should be easy, safe and effective.

4.2.2 **Integral boiler**

The boiler shell shall be constructed from cast iron and/or steel and shall be capable of operating at the maximum operating pressure declared by the manufacturer. The integral boiler shall meet the requirements of A.4.7.

The materials and dimensions for the integral boiler construction shall be in accordance with the specifications given in Tables 2 to 7. If alternative materials are used, a certificate giving evidence of similar performance is required.

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 firebox or the flueways shall be gastight. Where a seal is made with fire-cement, cement shall be well supported by adjacent metal surfaces.

4.2.2.1 Boilers constructed of steel

4.2.2.1.1 Welding and welding materials

The materials used shall be suitable for welding.

NOTE: The materials listed in table 3, are suitable and do not require any additional heat treatment after welding.

4.2.2.1.2 Nominal minimum wall thicknesses (steel)

Boilers constructed of mild steel shall have the appropriate wall thicknesses set out in table 2.

Table 2: Steel - Nominal minimum wall thicknesses

Application	Non-alloy steels mm	Stainless and corrosion resistant steels mm
Walls of the firebox which are in contact with tire and/or water	5	3
Walls of convection heating surfaces outside combustion chamber (except circular tubes)	4	2
Circular tubes used in convection part of heat exchanger	3,2	1,5
Water cooled grate tubes	4	3
Surfaces not in contact with burning fuel or products of combustion	3	2

NOTES:

1. The nominal minimum wall thicknesses of Table 2 apply to pressure loaded sheets and tubes (other than immersion coils, safety heat-exchangers).
2. Thinner wall thicknesses are only permissible with proof of equivalent corrosion resistance, heat resistance and strength.
3. The nominal minimum wall thicknesses listed in Table 2 have been specified taking into consideration:
   - the maximum water operating pressure (4 bar),
   - the material properties,
   - the heat transfer location.

Table 3: Steel material types

European Standard References	Material Type	Material number in accordance with EN 10027-2
EN 10111	DD 11	1.0332
	DD 12	1.0398
	DD 13	1.0335
	DD 14	1.0389
EN10025	S235JR	1.0037
	S235JRG2	1.0038
	S235JO	1.0114
	S235J2G3	1.0116
	S275JR	1.0044
	S275JO	1.0143
	S275J2G3	1.0144
	S355JR	1.0045
	S355JO	1.0553
	S355J2G3	1.0570
	S355K2G3	1.0595
EN 10028-2	P235GH	1.0345
	P265GH	1.0425
	P295GH	1.0481
	P355GH	1.0473
	16Mo3	1.5415
	13CrMo4-5	1.7335
	10CrMo9-10	1.7380
	10CrMo9-10	1.7383
EN 10120	P245NB	1.0111
	P265NB	1.0423
	P3 IONB	1.0437
	P355NB	1.0557
EN 10088-2	X5CrNi 18-10	1.4301
	X6CrNi 17-12-2	1.4401
	X6CrNiTil8-10	1.4541
	X6CrNiNb 18-10	1.4550
	X6CrNiMo Ti 17-12 -2	1.4571
	X6CrNiMoNb 17-12 -2	1.4580
	X3CrNiMo 17-3-3	1.4436
NOTE : 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 4.2.2.1.2 for the particular application/usage.		

4.2.2.2 **Boilers constructed of cast iron**

4.2.2.2.1 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 (In accordance with EN 1561)	
- Tensile strength R_m	> 150 N/mm^2
- Brine11 hardness	160-220 HB
Spheroidal graphite iron (In accordance with EN 1563)	
- Tensile strength R_m	> 400 N/mm^2
- Elongation	18 % A_3

4.2.2.2.2 **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 kW	**Grey cast iron** mm	**Spheroidal graphite cast iron** mm
< 30	3,5	3,0
≥ 30 and < 50	4,0	3,5

4.2.2.3 **Boiler shell tappings**

The threads of boiler she11 tappings, 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, Parts 1 and 2. Where parallel threads are used, they shall be in accordance with IS0 228 Parts 1 and 2. The design and position of flow tappings shall be such that air will not be retained within the boiler shell.

Table 6 : Minimum thread size designation of flow and return tappings

Nominal heat output kW	**Gravity circulation thread size designation** [1)]	**Pumped circulation thread size designation** [1)]
≤ 22	1	½
> 22 ≤ 35	1¼	1
> 35 < 50	1%	1

[1] Designation in accordance with IS0 7: Parts 1 and 2 or IS0 228: Parts 1 and 2

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 [1]	**Minimum depth or length of thread** mm
½ to 1¼	16
1%	19
[1] Designation in accordance with IS0 7: Parts 1 and 2 or ISO 228: Parts 1 and 2	

Where a drain socket is provided in the boiler shell, it shall be a minimum thread size designation of ½ and shall be in accordance with IS0 7 or IS0 228.

4.2.2.4 **Boiler waterways**

4.2.2.4.1 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. To minimize the build up of sediment, designed sharp or wedge-shaped waterways with a taper towards the bottom shall be avoided.

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

4.2.2.4.2 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.

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

4.2.2.4.3 **Design requirements for all appliances with boilers**

The design of the boiler shall ensure a free flow of water through all parts such that under normal operation in accordance with the manufacturer's instructions, no undue boiling noises shall occur. 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 be a minimum of 70 x 40 mm or have a minimum diameter of 70 mm and be sealed with a gasket and cap.

4.2.2.4.4 **Boilers used with indirect water systems**

The minimum internal width of waterways in boilers designed for indirect water systems shall be 20 mm.
Where waterways have to be locally reduced to facilitate manufacture or are in areas not in direct contact with burning fuel, the width of the waterways shall not be less than 15 mm.

4.2.2.4.5 **Additional requirements for boilers used with direct water systems**

The minimum internal dimensions of waterways in boilers designed for direct water systems shall be not less than 25 mm.

4.2.3 **Cleaning of heating surfaces**

All heating surfaces shall be accessible from the flue gas side for inspection and cleaning with brushes, scrapers or chemical agents by means of sufficient cleaning openings. Where cleaning and servicing of the boiler and its components require the use of special tools (e.g. special brushes), these shall be supplied by the appliance manufacturer.

4.2.4 Flue spigot or socket

For horizontal flue connection, the flue spigot/socket shall be designed to allow fitting, internal or external, over a length of at least 40 mm, of a flue gas connector.

For vertical flue connection, the fitting shall overlap by at least 25 mm.

> NOTE: For inset appliances (made for fireplace recesses) with a vertical chimney flue connection and where the manufacturer's installation instructions specify, in addition to the flue gas connector, that an insulating mortar infill should be added around the connector to seal the appliance to the chimney flue, then in this case it is permissible for the flue spigot/socket overlap to be reduced to a minimum of 6 mm.

4.2.5 **Flueways**

The size of the flueway in its minimum dimension shall be not less than 30 mm except it shall be permissible to reduce to not less than 15 mm for appliances designed only to bum 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 by the appliance manufacturer.

4.2.6 **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 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.

NOTE: The ashpan should 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;
c) it can be shovel shaped.

4.2.7 **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 fuelbed.

NOTE 1: The preferred design with the firedoor(s) and ashpit door(s) closed should allow de-ashing to be carried out. The de-ashing should be possible without undue effort.

NOTE 2: If it is necessary to remove the ashpit door to de-ash the fire, the appliance should be designed to minimise ash or fuel spillage during the de-ashing operation.

4.2.8 Combustion air supply

4.2.8.1 Primary air inlet control

The appliance shall be fitted with either a thermostatically controlled primary air inlet control or a manual primary air inlet control. For appliances with a boiler, a manual primary air inlet control shall only be allowed for boiler outputs up to 7.5 kW. The adjusting control shall be clearly visible or shall be 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 'cold' setting of the air inlet control shall be clearly marked and the method of adjustment shall be described in the user instructions.

The thermostat shall have a variable temperature range and be of the immersion or dry pocket type. The pocket shall be positioned so that the thermostat senses the temperature of the flow water from the appliance.

4.2.8.2 Secondary air inlet control

Where a secondary air inlet control is provided, the position of air entry shall be so designed that the passage of air is not restricted when the firebox is filled to the manufacturer's recommended capacity.

4.2.9 Control of flue gas

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 cm^2 or 3 % of the cross-sectional area of the blade if this is greater.

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

If a draught regulator is fitted the minimum cross sectional area requirement shall not be applicable but the device shall be easily accessible for cleaning.

4.2.10 Firedoors **and** charging **doors**

When the appliance is equipped with a charging door, that door shall be large enough to allow the appliance to be filled with the commercial fuels recommended by the manufacturer. Firedoors and charging doors shall be designed to prevent accidental opening and to facilitate positive closure.

4.2.11 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.

4.2.12 Front firebars and/or deepening plate

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 roomheater during normal operations, particularly during refuelling or de-ashing.

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

4.2.13 Solid mineral fuel and peat briquettes burning appliances

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

5 Safety requirements

5.1 Natural draught

Where the appliance manufacturer claims that a continuous burning appliance can be connected to a chimney serving more than one appliance, and can be operated with solid mineral fuel and peat briquettes as suitable fuels, then when tested in accordance with A.4.9.3, 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 period of 10h period the emitted quantity of carbon monoxide, calculated to NTP as detailed in A.4.9.3, shall not be greater than 250 dm^3. Such an appliance shall be clearly labelled to indicate whether or not it can be installed into a shared flue (see 7.2).

5.2 **Operation with open Wredoors**

The operation of an appliance with an open firebox shall only be permitted when:
- any escape of harmful combustion gases, and
- any loss of the firebed from the appliance,

does not occur under the test conditions described in section A.4.9.1.

5.3 Strength and leaktightness of 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.4.9.4 and during the nominal heat output test described in A.4.7.

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

When tested in accordance with A.4.7 and A.4.9, the temperatures measured in the fuel storage container 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 manufacturer shall indicate in the instructions the need to use an operating tool. This tool shall be supplied with the appliance.

NOTE : *A* suitable glove is regarded as a tool.

5.6 **Temperature of adjacent combustible materials**

When tested in accordance with A.4.7 and A.4.9, and when the appliance is installed according to the manufacturer's installation instructions, the temperature of the trihedron hearth and walls or other structure surounding the appliance e.g. ceiling comprising combustible material shall not exceed the ambient room temperature by more than 65 K.

If the temperature of the surrounding walls and/or of the floor exceeds the ambient temperature by more than 65 K, the manufacturer shall provide the necessary information for insulating the walls and/or floor or indicate the clearance distance required.

5.7 Thermal discharge control

For appliances fitted with a boiler designed to operate on a sealed system and where a thermal discharge control is fitted as part of the appliance, when tested in accordance with A.4.9.5, the control shall operate when the water flow temperature exceeds either 105°C or the manufacturer's declared operating temperature, whichever is the lower.

6 Performance requirements

6.1 Flue gas temperature

When tested in accordance with A.4.7, the flue gas temperature shall be measured and the mean calculated and recorded in the installation instructions.

6.2 Carbon monoxide emission

When tested in accordance with A.4.7, the mean carbon monoxide contents of the dry combustion gases shall be less than one of the values specified in table 8, these values being related to 13 % oxygen content in the flue gases.

Table 8: Carbon monoxide emission classes

Class	Requirements on appliances with closed doors
	CO emission class limits (at 13% O_2) %
Class 1	≤ 0,3
Class 2	> 0,3 ≤ 1,0

NOTE: In some countries national laws also require limits for particulate and organic compound emissions, emissions under slow combustion conditions and for weighed values for emissions to be used. In some countries clean air legislation is based on the use of authorised fuels.

6.3 Efficiency at nominal heat output

When tested in accordance with A.4.7, the average thermal efficiency calculated from the mean of at least two separate test results at nominal heat output shall meet the limit values for the appropriate efficiency class for the appliance as given in table 9.

Table 9: Efficiency at nominal heat output

Class	Requirements on appliances with closed doors
	Efficiency class limits %
Class 1	≥ 70
Class 2	≥ 60 < 70
Class 3	≥ 50 <60

NOTE: In some countries national laws require limits for minimum efficiency under slow combustion conditions and for weighted values for efficiency to be used.

6.4 Flue draught

The flue draught values, related to the appliance's nominal heat output, given in figure 1 shall be taken as the values for the static pressure to be applied in the measurement section when undertaking the nominal heat output test in accordance with A.4.7, the slow combustion and reduced combustion test in accordance with A.4.8, and the safety test in accordance with A.4.9.

Where the flue draught values given in figure 1 need to be exceeded in order to obtain the manufacturer's declared nominal output, the required flue draught shall be clearly stated in the appliance's installation instructions.

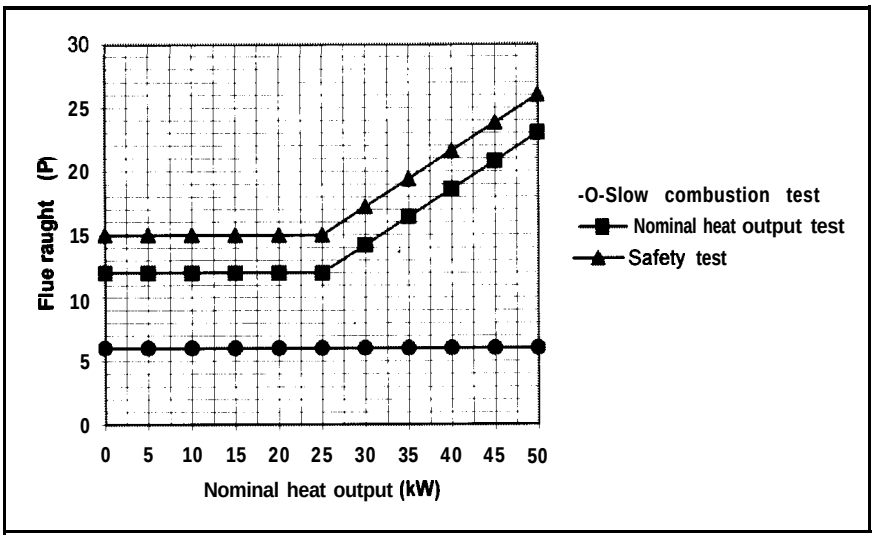

Figure 1: Flue draught values

When undertaking the nominal heat output test in accordance with A.4.7 the flue static pressure shall be kept within ± 2 Pa of the specified value. For the slow combustion or reduced combustion test in accordance with A.4.8 the static pressure shall be kept within ± 1 Pa of the specified value. For the temperature safety test in accordance with A.4.9 the appliance shall be tested at a flue draught 3 Pa greater than that used during the nominal heat output test and the static pressure shall be kept within $^{+2}_{0}$ Pa of this specified value.

6.5 **Recovery**

At the conclusion of the slow combustion or reduced combustion test periods described in A.4.8, 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.4.8.4 within a time of 20 minutes.

6.6 **Refuelling intervals**

When tested in accordance with A.4, and when the appliances is operated with closed doors, the minimum times for maintenance of combustion with one added test load of fuel shall be not less than the values given in Table 10 as appropriate to the appliance type and/or the test fuel used.

Table 10: Minimum refuelling intervals

Continuous burning appliances		
Combustion conditions	**Test fuel type (as detailed in Table B.l)**	**Minimum refuelling interval** hours
nominal	Solid mineral fuel	4
nominal	Wood logs or peat briquettes	1,5
slow combustion	Solid mineral fuel	12
slow combustion	Wood logs or peat briquettes	10
Intermittent burning appliances		
Combustion conditions	**Test fuel type (as detailed in Table B.l)**	**Minimum refuelling interval** hours
nominal	Solid mineral fuel	1
nominal	Wood logs or peat briquettes	***specified by the manufacture***
reduced combustion	Solid mineral fuel	No requirement
reduced combustion	Wood logs or peat briquettes	No requirement

Where the refuelling interval declared by the manufacturer is greater than the minimum refuelling interval given in Table 10 then the manufacturer's declared value shall be verified when tested during the tests in accordance with A.4.7 and A.4.8.

The nominal, slow and reduced test loads shall be the same and are calculated from the refuelling interval, the minimum efficiencies and the calorific values of the fuels. The slope formed by the test fuel load shall not obstruct, even partially, any flue.

6.7 **Space heating output**

The space heating output declared by the manufacturer shall not exceed the space heating output measured in accordance with A.4.7.

6.8 **Water heating output**

The water heating output declared by the manufacturer shall not exceed that measured under the conditions described in A.4.7.

7 **Appliance instructions**

7.1 General

Instructions written in the language of the country of intended destination shall accompany the appliance and shall describe the installation, operation, maintenance and, if assembled on site, the assembly of the appliance. The instructions shall not be in contradiction to the requirements or test results in accordance with this standard.

7.2 **Installation instructions**

The installation instructions shall contain at least the following information:

- the national building regulations and any relevant rules and codes of practice; the instructions shall **contain** the following words: “any national or local regulations must be complied with”,
- the type (model or number) of the appliance,
-the nominal heat output(s) in kW or W,
- ***the heat release rate vs. time in k W or W***
  -the mean value time in hours
- the space heating output in kW or W,
- the water heating output in kW or W,
-the maximum operating water pressure in bar, where applicable,
- the safety clearances against combustible materials, and the other protective measures that must be taken to protect the building construction,
- the requirements for the supply of combustion air, for the simultaneous operation with other appliances and for the operation of exhaust air devices,

NOTE: Extractor fans when operating in the same room or space as the appliance, may cause problems.

- the need of any air inlet grilles to be so positioned that they are not liable to blockage;
- the mass of the appliance in kg,
- the minimum flue draught for nominal heat output, (where applicable, with open and closed firedoors),
-the flue gas mass flow in g/s (where applicable, with open and closed firedoors),
- whether the appliance is suitable for installation in a shared flue system;
- the flue gas temperature directly downstream of the flue spigot/socket in °C, (with closed tiredoors), under nominal heat output conditions,
- the inset of roomheaters: in all cases the minimum dimensions of the required builder’s opening and/or firefront opening in the surround,
- the floors: the appliance must be installed on floors with an adequate load-bearing capacity. If an existing construction doesn’t meet this prerequisite, suitable measures (e.g. load distributing plate) must be taken to achieve it,
- the assembly of the appliance on-site, if applicable,
- advice on the need to provide access for cleaning the appliance, the flue gas connector and the chimney flue,
- the installation of the damper device, if applicable.
- the water content and instructions for fitting a drain-cock in the lowest part of the system (where applicable);
- the setting of temperature controller and method of adjusting the “cold” setting distance;
- advice on a means of dissipating excess heat from the boiler, such as using a “heat leak” radiator;

7.3 **User operating instructions**

Each appliance shall be accompanied by instructions in the language of the country in which it is to be operated, containing all important details regarding the operation for the concerned appliance.

The operating instructions shall contain at least the following information:
- national and local requirements on appliance operation and fuel (permissible fuels) to be met when operating the appliance in the specific country of destination,
- a list of the recommended fuels including type and size in accordance with this standard;
- detail the method of refuelling and de-ashing the appliance and the maximum filling height in the firebox and give typical refuelling intervals at nominal heat output for various recommended fuels,
- a description of the correct instructions for safe and efficient operation of the appliance including the ignition procedure,
- advice against the use of the appliance as an incinerator and the use of unsuitable and non recommended fuels, including advice against the use of liquid fuels,
- the operation of all adjusting devices, dampers and controls,
- ventilation requirements for simultaneous operation with other heating appliances (where applicable);

- the correct operations for seasonal use and under adverse flue draught or adverse weather conditions,
- advice on the need for regular maintenance by a competent engineer;
- instructions on how to achieve slow combustion;
- a warning that the firebox and ashpit cover shall be kept closed except during ignition, refuelling and removal of residue material to prevent fume spillage, unless the appliance is intended to be operated with open firebox,
- operation with open firebox, where applicable,
- operation of the thermal discharge control, where applicable,
- the regular cleaning of the appliance, of the flue gas connector and the chimney flue and highlight the need to check for blockage prior to re-lighting after a prolonged shut down period,
- advice on the adequate provision of combustion and ventilation air and on keeping air intake grilles, supplying combustion air, free from blockage;
- provide instructions on simple fault finding and the procedure for the safe shut down of the appliance in event of malfunction e.g. overheating;
- warning that parts of the appliance, especially the external surfaces, will be hot to touch when in operation and due care will need to be taken;
- the protection against risk of tire in and outside the heat radiation area;
- warning against any unauthorised modification of the appliance;
- use of only replacement parts recommended by the manufacturer;
- advice about the actions to be taken in the event of a chimney fire;
- whether the appliance is suitable for installation in a shared flue system;
- advise whether the appliance is capable of continuous or intermittent operation and give instructions on how this is achieved.

8 Marking

Each appliance shall be permanently and legibly marked, with the minimum following information, in a place where it is accessible so that the information can be read when the appliance is in its final location:

-the manufacturer's name or registered trade mark;
-the type or the model;
-the nominal output in kW or W, or range (if more than one fuel) of heat outputs listed in the form: 'from . . . (lowest) kW to . . . (highest) kW';
-the space heating output in kW or W;
- rate of heat release in k W or W vs. time (a curve)
the water heating output in kW or W;
-the standard number: EN XXX;
-the classification of the appliance (tables 8 and 9);
-the maximum water operating pressure (if applicable), in bar;
-the instruction "follow the user's instructions";
-the minimum clearance distances from combustible materials, in mm, as appropriate;
-whether or not the appliance can be used in a shared flue;
-use only recommended fuels;
-whether the appliance is capable of continuous or intermittent operation.

If a label is used it shall be durable and abrasion proof. Under normal operating conditions, the label shall not discolour, thus making the information difficult to read. Self-adhesive labels shall not become detached as a result of moisture or temperature.

Annex A (normative) Test methods

A.1 Test environment

A.l.l Ambient room temperature

The ambient room temperature of the test laboratory shall be measured at a point lying on a circumference of a circle with a radius of $(1,2 \pm 0.1)$ m traced from the side of the appliance, at a height of $(0,50 \pm 0,01)$ m above the platform scale and away from any direct radiation.

For measurement of the ambient room temperature, a thermocouple or other temperature measuring device shall be placed, protected from radiation by an open ended cylindrical metal screen, with open ends and made of polished aluminium or material of equivalent reflectivity, nominal 40 mm in diameter and 150 mm long. The thermocouple or other temperature measuring device shall meet the uncertainty of measurement requirements specified in A.3.

A.1.2 Cross-draught

Cross-draught in the vicinity of the test appliance and its surroundings shall not be greater than 0.5 m/s measured at the location in accordance with A. 1.1.

A.1.3 External sources

The test assembly shall be protected from direct influence of other heat sources, e.g. adjacent test assemblies and sunlight.

A.2 Test assembly

A.2.1 General

The test assembly shall consist of the test appliance installed in accordance with the appliance manufacturer's installation instructions in a trihedron as specified in A.2.2, mounted on a platform scale that enables the fuel consumption to be measured such that the accuracy requirements specified in A.3 are met.

> NOTE: The appliance should be installed either directly into the trihedron in the case of a free standing appliance, or in an arrangement simulating the construction specified by the appliance manufacturer in the case of inset appliances.

The appliance shall be positioned so that the sides facing the trihedron walls are at the manufacturer's minimum declared distance from combustible material.

A measurement section constructed in accordance with A.2.3 shall be provided with means for determining the flue gas temperature in accordance with A.2.3.2, the flue gas composition in accordance with A.2.3.3 and the applied flue draught in accordance with A.2.3.4.

The appliance flue spigot/socket shall be connected by means of an un-insulated flue gas connector and an insulated flue gas adaptor to the measurement section in accordance with A.2.4.

The flue gases shall be extracted from the top of the measurement section and a means of adjustment shall be provided to enable a constant flue draught pressure as specified in the relevant test procedures to be maintained in the measurement section (e.g. by an extraction fan).

NOTE: Examples of typical installations are given in figures A 1 and A2.

Where the appliance incorporates a boiler, it shall be connected to a water circuit in accordance with A.2.5.

A.2.2 **Trihedron**

The trihedron shall consist of a hearth, a sidewall and a rear wall at right angles to each other.

NOTE: Examples of the general arrangement and construction are given in figures A.3 and A.4.

The trihedron extremities shall extend beyond the appliance external dimensions by at least 150 mm, and by at least 300 mm above the topmost surface of the appliance.

For appliances with a horizontal outlet the rear wall shall have an opening through which the flue gas connector can pass, with a clearance of (150 ± 5) mm around the connector.

The trihedron hearth and walls shall be constructed as illustrated in figure A.5 or a construction of equivalent thermal performance.

If the highest temperature is measured at the periphery of the trihedron then the trihedron floor or walls shall be extended by at least 150 mm beyond the point of highest temperature.

The maximum surface temperatures of the trihedron hearth and walls shall be determined. These temperatures shall be measured using calibrated equipment meeting the accuracy requirements specified in A.3.3. The position of the measurement points shall be as illustrated in figure A.6. The thermocouples shall be secured so that the junction is level with the surface as illustrated in figure A.7.

insert

A.2.2 b Test assembly for determining heat release rate

Because heat release rate, based on surface temperature measurements, is dependent on the space it is measured, test surrounding must be specified. Basic idea is to build walls around the appliance in the distance of for example 3 meters. Same kind of walls are used in every laboratory which ensures that measured heat release rate by radiation (and convection) is the same. What kind of test assembly is needed, is decided in the WG.

A.2.3 **Measurement section**

A.2.3.1 General arrangement

The constructional details and general arrangement of the measurement section shall be as illustrated in figure A.8.

The measurement section shall be provided with means of measuring the temperature and composition of the flue gas and also with means to measure the static pressure as detailed in A.2.3.2 to A.2.3.4.

The measurement section shall be fully lagged with 40 mm thick mineral fibre or similar material in order to provide a thermal conductivity of 0.04 W/m. K at an average temperature of 20" C. The dimensions of the measurement section shall be as detailed in figures A.9 and A.10 and be sized in accordance with the diameter of the flue spigot/socket of the appliance.

A.2.3.2 **Flue gas temperature measurement**

The flue gas temperature shall be measured by a sensing element e.g. a thermocouple located inside a suction pyrometer as shown in figure A.8, with the sealed end touching the opposite wall of the measurement section and with the open outlet end connected to a suction pump. The thermocouple shall be protected by a sheath. A suitable fitting shall be provided to give a gas-tight seal between the suction pyrometer and the wall of the measurement section and between the sensing element and the outlet of the pyrometer.

The suction pyrometer probe shall have 3 sampling holes each between $(2{,}5 \pm 0{,}5)$ mm in diameter, one positioned at the center of the measurement section and the other two positioned either side at one quarter of the flue diameter distance from the side walls of the measurement section. The extremity of the temperature sensing element shall be placed at the position shown in figure A.8.

The inside diameter of the suction pyrometer shall be (5 ± 1) mm and the flow rate shall be adjusted in order to obtain a flow velocity within the range of 20 to 25 m/s.

A.2.3.3 **Flue gas sampling**

The suction pyrometer probe shall be used for flue gas sampling. The outlet of the suction pyrometer probe shall be connected to a flue gas analysis system meeting the uncertainty of measurement specified in A.3. Means of cooling, cleaning and drying the flue gas sample shall be incorporated in the sampling line.

The materials used for the gas sampling line and probe connections shall be resistant to the expected temperature and shall not react with or allow diffusion of flue gases. There shall be no leaks in either the sampling probe connections or the gas sampling line.

A.2.3.4 **Static pressure measurement**

A tube with a nominal internal diameter of 6 mm shall be located into the measurement section as shown in Figure A.8. The end of the tube shall be sealed flush with the inner wall of the measurement section.

A.2.4 **Connection of appliance to measurement section**

The appliance flue spigot/socket shall be connected to the measurement section specified in A.2.3 by an uninsulated flue gas connector and an insulated flue gas adaptor. The flue gas connector shall be made of unpainted mild steel with a thickness of $(1{,}5 \pm 0{,}5)$ mm. Its length shall be (330 ± 10) mm and correspond to the diameter of the flue spigot/socket of the appliance.

The flue gas adaptor shall be connected between the measurement section and the flue gas connector. The flue gas adaptor shall have the same diameter as the measurement section and shall be insulated to the same level as detailed in A.2.3.1.

For appliances with a non-circular outlet or with a diameter different from that of the measurement section, the flue gas connector shall be an adaptor, which accomodates the necessary changes in the shape and/or dimensions to match the measurement section diameter.

For appliances with horizontal outlet, the flue gas adaptor shall have a radius of (225 ± 5) mm at its centre. For appliances with vertical outlet the flue gas adaptor shall be straight and of length (350 ± 10) mm.

NOTE: Some general arrangements are shown in figures A. 1, A.2, A.9 and A. 10.

A.2.5 **Water circuit for appliances with boilers**

The water circuit shall be of a design that maintains a flow of water constant within ± 5 % of the set flow rate. The circuit shall enable a mean outlet temperature of (80 ± 5)° C to be achieved during the test at nominal heat output. The water circuit shall have a means of measuring the water flow, in order to monitor the constancy of the flow rate. The water circuit used shall be either closed or open circuit provided the specified requirements for constancy of water flow rate and outlet temperature are met.

The water circuit shall be connected to the appliance by inlet/outlet pipes in a manner that allows free movement of the appliance for weighing purposes.

The temperature of the inlet and outlet water shall be measured using calibrated equipment inserted into the pipes, and meeting the tolerances specified in A.3.

NOTE: A suitable water circuit is shown in figure A. 11, but other suitable circuits may be used.

A.3 **Measurement equipment**

The measurement equipment used shall be selected to ensure that for each measurement parameter the uncertainty requirements specified in table A.1 are met. The peak value of the parameter to be measured shall be in the range of the measurement equipment used.

Table A.1 - Uncertainty of measurement

Parameter measured		Uncertainty of measurement
Gas analysis		
c o		≤ 6 % of the limit values in table 8
CO_2		≤ 2 %
O_2		≤ 2 %
Temperature		
Flue gas		≤ 5 K
Ambient room		≤1,5 K
Water		≤0,5 K
Surface		≤ 2 K
Touchable Area		≤ 2 K
Water flow		≤ 0,005 m3/h
Cross-draught		IO.1 m/s
Static pressure		≤ 2 Pa
Mass		
Fuel consumption		± 20 g
Residue		± 5 g
Fuel load	≤7,5 kg	± 5 g
	>7,5 kg	± 10 g

A.4 Test procedures

A.4.1 Appliance installation

The appliance shall be installed into the test assembly as specified in A.2.1, in accordance with the appliance manufacturer's installation instructions, and the appliance flue spigot/socket shall be connected to the measurement section as specified in A.2.4.

NOTE: Test assembly shall be used only during safety test, because it prevents the use of surface temperature measurement option in determining heat release rate of the slow heat release appliance.

When measuring heat release rate of slow heat release appliances, test room must be specified to ensure that results from different laboratories are comparable.

If the appliance is supplied in individual parts, the manufacture's specifications as given in the installation instructions shall be followed during assembly.

For appliances with a rear flue outlet, the flue gas connector shall pass through the trihedron wall. The hole around the flue gas connector shall be filled with insulating material (see figure A.4).

Where a flue draught regulator is fitted between the firebed and the flue spigot/socket then, for the performance test at nominal heat output, either the regulator is removed and the opening sealed with a suitably sized solid plate or the regulator itself is sealed e.g. with heat resistant tape so as to avoid the ingress of air through the regulator opening.

delete existing A.4.2

A.4.2 **Calculation of fuel load**

The fuel load for each tiring regime shall be calculated using the formula :

$$B_{fl} = 360\,000 \times P_n \times t_b / (H_u \times \eta) \qquad (1)$$

Where
- B_{fl} is the mass of fuel load, in kg
- H_u is the lower calorific value of the test fuel, on as fired basis, in kJ/kg
- η is the minimum efficiency according to this appliance standard or a higher value declared by the manufacturer, in %
- P_n is the nominal heat output, in kW
- t_b is the minimum refuelling interval, in hours, or duration as declared by the manufacturer

replace it with the following

A.4.2 Fuel load

Appliance manufacture specifies the amount of fuel load for each firing regime so that quoted heat release rate is achieved.

A.4.3 **Fuelling and de-ashing the tire**

Select and prepare the test fuel in accordance with annex B.

Where the test fuels are fuels other than wood logs or peat briquettes load them onto the firebed so as not to pack them artificially.

For wood logs or peat briquettes refuel in accordance with the appliance manufacturer's refuelling instructions and take account of any recommendations regarding general orientation as well as log size in the case of wood logs.

For de-ashing test fuels other than wood logs or peat briquettes, the de-ashing procedure shall be thorough and shall be carried out in accordance with the manufacturer's operating instructions. For appliances with under

grate ash removal observe the residue material falling through the grate bars by opening or removing the ashpit door/cover and continue de-ashing until burning fuel begins to be discharged.

A.4.4 Flue gas losses

A.4.4.1 General

Calculate the flue gas losses from the composition and temperature of the flue gases in accordance with A.6. The composition and temperature of the flue gases and the ambient room temperature shall be measured as specified in A.4.4.2 and A.4.4.3.

A.4.4.2 Composition of the flue gas

Measure the concentration of the products of combustion (CO_2 or O_2, and CO) either continuously or at intervals not exceeding 1 min using calibrated instruments meeting the uncertainty of measurement requirements specified in A.3. Determine the mean values of concentration of the products in the dry flue gas as specified in A.6.

A.4.4.3 Ambient **room and flue gas temperatures**

Measure both the flue gas temperature and ambient room temperature using calibrated instruments that meet the uncertainty of measurement requirements specified in A.3.

Measure and record both the flue gas temperature and the ambient room temperature either continuously or at intervals not exceeding 1 min.

At the end of the test period, calculate and record the mean ambient room temperature and the mean flue gas temperature as specified in A.6.

A.4.5 Water heating output

A.4.5.1 General

For appliances fitted with a boiler, measure the heat given to the water by a constant flow method using the flow circuit described in A.2.5. Measure the water flow rate and temperature rise across the boiler using calibrated equipment that meets the uncertainty of measurement requirements specified in A.3.

A.4.5.2 Procedure

Set the water flow rate at a value determined according to the manufacturer's declared boiler heat output so that the requirements for the mean outlet temperature as specified in A.2.5 are met during the test period. During the test, maintain this set water flow rate to within ± 5 % by reference to the water flowmeter. Do not change the water flow rate to compensate for the short period variation **in flow temperature that** occurs after refuelling.

During the test period, measure and record the inlet and outlet temperatures, either continuously or at intervals not exceeding 1 min., in accordance with A.2.5.

At the end of the test period, calculate the mean rise in water temperature between the boiler inlet and outlet. Also calculate the mean water flow rate, in kg/h.

A.4.6 **Combustible heat losses in the residue**

For appliances with a bottomgrate and where the test fuel is any solid fuel except wood logs, set aside the residue and allow it to cool ***add.' preventing introduction of oxygen to allow further combustion.*** Determine and record the mass of the residue, in kilograms, to the nearest 2 g. Analyse the residue and record its combustible constituents as a percentage of the residue. Calculate the % heat loss in the residue according the formula given in A.6.2.1.4.

If the test fuel is wood logs do not measure the combustible constituents of the residue. The % heat loss in the residue shall be taken as 0,5 % points of efficiency.

A.4.7 **Performance test at nominal heat output**

A.4.7.1 General

The performance test at nominal heat output shall consist of two parts:
- an ignition and pre-test(s) period(s),
- a test period.

The duration of the pre-test period shall be sufficient to ensure that normal working conditions and a basic firebed are established. Observe the static pressure throughout the entire test and if necessary adjust the applied flue draught so that the static pressure is set to the appropriate normal flue draught value ± 2 Pa as detailed in 6.4.

The test period shall be preceded by a pre-test period or periods sufficient to ensure that the mass of the basic firebed plus the ash from the fuel burned at the end of the test period shall not differ in value from that at the end of the previous period by more than 50 g.

Test period requirements are given in table A.2.

Table A.2: Minimum duration, and number of test periods

Appliance	Fuel	Duration	Number
Continuous burning	Wood	1,5 h	2
Continuous burning	Solid mineral fuel	4 h	2
Intermittent burning slow heat release appliance	***Wood***	***specified by the manufacture***	***specified by the manufacture***
Intermittent burning	Solid mineral fuel	1 h	2

A.4.7.2 **Ignition and pre-test period**

Start the flue gas extraction system and adjust the applied draught so that the static pressure in the measurement section is set to the normal draught for the appliance as given in figure 1, or such other value as given in the appliance installation instructions.

Record the initial platform scale reading. Load the appliance with sufficient test fuel to ensure ignition of the fuel in accordance with the appliance manufacturer's instructions. When the fuel is well alight, load the

appliance with a mass of test fuel sufficient to ensure a pre-test period. After refuelling, note the platform scale reading and record the mass of fuel added.

NOTE: with an automatic ignition system, there is already a mass of test fuel present

Adjust the applied flue draught to give the appropriate static pressure in the measurement section. Set the combustion control devices to the required setting in order to achieve the burning condition necessary to give the claimed nominal heat output. For appliances with a boiler, set the water flow rate to ensure the water flow temperature requirement specified in A.2.5 is met.

Operate the appliance during the pre-test period at a burning rate which gives the manufacturer's claimed nominal heat output whilst ensuring at least the mass of basic firebed remains at the end of this period.

End the ignition and pre-test period when the reading on the platform scale shows that the mass of basic firebed plus the ashes from the fuel burned is achieved. Record the reading of the platform scale.

A.4.7.3 **Test period**

When the test fuel is a fuel other than wood logs de-ash the fire, empty and replace the ashpan. Record the total mass of the test installation as measured by the platform scale. ***Load the appliance with the mass of test fuel declared by the manufacture.*** The test period shall start immediately after loading the appliance.

Measure and record the temperature and the composition of flue gas as described in A.4.4. If the appliance is fitted with a boiler, measure and record the inlet and outlet water temperatures and the water flow rate as described in A.4.5.

Measure and record the temperature of the trihedron test hearth and walls either continuously or at regular intervals of not more than 1 min. to ensure that the maximum temperatures achieved are recorded. Measure and record the surface temperatures of any operating knobs intended to be operated without the use of a tool and the temperature in the fuel storage container for the entire test to ensure the maximum temperatures reached by the knobs and storage container are accurately recorded.

End the test period when the reading on the platform scale shows that the mass of the basic firebed plus the ashes from the fuel burned is the same as that recorded at the end of the pre-test period. At the end of the test period, record the reading of the platform scale. If using a solid mineral test fuel, de-ash the fire, and empty and replace the ashpan, retaining the residues for the determination of undergrate combustible loss in accordance with A.4.6. Record the reading of the platform scale. Record in minutes, the duration of the test period.

insert the following new paragraph:

Continue recording the temperature of the trihedron test hearth and walls at least 5 hours after the fire has gone out to ensure that maximum temperatures are achieved.

If, within a tolerance of ± 15 %, the actual test duration were shorter or longer than that specified in, A.4.7.1, determine by way of a comparative calculation whether, at the manufacturer's declared nominal heat output, the required minimum test duration would theoretically have been reached or whether, at the minimum test duration the manufacturer's declared nominal heat output would theoretically have been achieved.

If either the calculated test duration or the calculated nominal heat output does not meet the requirements, the test is invalid (and is designated as a pre-test) and a further test period shall be undertaken.

Delete A.4.8, because slow heat release appliances are intermittent burning type

A.4.8 **Slow combustion, reduced combustion and recovery test**

A.4.8.1 **General**

The slow and reduced combustion tests may start from cold or may follow the nominal heat output test, provided the fire has been de-ashed in accordance with A.4.3 at the termination of the test.

If the test is started from cold then the slow and reduced combustion pre-test periods of A.4.8.2 shall be preceded by an ignition and pre-test period at nominal heat output in the same manner as that described in A.4.7.2 In either case the appliance is then operated for further pre-test period(s) at reduced output as described in A.4.8.2 before commencing the slow combustion and reduced combustion test periods of A.4.8.3.

The pre-test period at nominal heat output and the further pre-test at low output may not be necessary for wood. For wood, if started from cold, the test period may begin when the basic firebed is reached after a minimum of one hour ignition period.

Tests are required for all the appliances in accordance with 6.6.

A.4.8.2 **Pre-test period**

At the end of the period at nominal heat output de-ash the fire if this has not already been done.

Adjust the applied flue draught so that the static pressure in the measurement section is set to (6 ± 1) Pa.

Load the appliance with the appropriated mass of test fuel to ensure a sufficient pre-test period.

Reduce the heat output by reducing the water flow rate (for appliances with boiler only) and/or the setting of the primary air control in stages until the burning rate does not exceed either 33 % of the measured burning rate at nominal heat output for test wood logs or peat briquettes or 25 % of the measured burning rate at nominal heat output for other test fuels, or such lower burning rate level for slow combustion operation as stated in the manufacturers operating instructions.

If the flow temperature exceeds 85°C for appliances with a boiler then adjust the thermostatic primary air control setting and/or the water flow rate to reduce the flow temperature to below 85°C.

Begin the test period when the required burning rate is achieved and stable conditions have been maintained for a period of not less than 15 min.

A.4.8.3 Test period

Record the reading on the platform scale. If necessary refuel the appliance with further test fuel so that the calculated amount of fuel in accordance with A.4.2 or such lesser amount of fuel specified by the manufacturer in the operating instructions is present at the start of the test period.

Allow the appliance to operate, under the test conditions established at the end of the pre-test period, without further attention for the test period duration as specified in 6.6.

End the test either after the test period duration in accordance with 6.6 is achieved, or after such longer duration specified by the manufacturer in the instructions is achieved.

For continuous burning appliances, the mass of the basic firebed must be at least the same as the basic firebed left at the end of the pre-test period.

For intermittent burning appliances with solid mineral fuels, at least a sufficient firebed to allow recovery shall be available.

Measure and record the temperature of the trihedron test hearth and walls either continuously or at regular intervals of not more than 1 min to ensure that the maximum temperatures achieved are recorded.

If a boiler is fitted, measure and record the inlet and outlet water temperature and the water flow rate in accordance with A.4.5.

At the end of the test-period, record the reading of the platform scale and the duration of the test period.

A.4.8.4 **Recovery test period**

At the end of the slow combustion or reduced combustion test period, reset the appliance controls in accordance with the manufacturer's operating instructions to give the nominal heat output. Adjust the applied draught so that the static pressure in the measurement section is set to (10 ± 2) Pa. De-ash the firebed in accordance with A.4.3, and add a refuel charge if necessary as follows:

- for continuous burning appliances, the refuel charge shall be at least 33 % of the nominal heat output test charge;
- for intermittent burning appliances with solid mineral fuels, the refuel charge shall be as indicated by the manufacturer's instructions.

Record whether the tire recovers in accordance with 4.5.10 and record the time taken.

A.4.9 **Safety tests**

delete the whole A.4.9.1 Slow heat release appliances are type la only.

A.4.9.1 Operation with open firebox for the type 2a) (see table 1)

After completion of each of the following tests: A.4.7 and A.4.8, the flue draught pressure shall be set to a value of (6 ± 1) Pa. Load the appliance with the fuel load B_{fl} of A.4.2 and open the firedoor(

During the first hour after introduction of the fuel load, it shall be observed whether combustion gas escapes from the firebox.

In addition it shall be determined by smoke cartridges or other suitable facilities whether, at the upper edge of the firebox opening, a suction effect occurs into the firebox or combustion gas escapes from the firebox.

Furthermore, it shall be observed during the tests with an open firebox whether burning fuel from the firebed drops out of the firebox.

A.4.9.2 Temperature safety tests

delete the whole A.4.9.2.1, because Slow heat release appliances use wood or mineral fuels.

A.4.9.2.1 Temperature safety test for appliances burning solid mineral fuel only

A.4.9.2.1.1 General

This test shall consist of two parts:
- an ignition and pre-test period,
- a test period.

All controls except those used only for start-up purposes, shall be set in a position that allows the highest heat output to be achieved.

The test fuel shall be that fuel which gave the highest trihedron surface temperatures during the nominal heat output test conducted in accordance with A.4.7.

The appliance shall be refuelled and operated over successive test periods until the temperatures of trihedron and fuel storage container reach a steady state.

A.4.9.2.1.2 Ignition

Start the flue gas extraction system and adjust the applied draught to give a static pressure within $^{+2}_{0}$ Pa of the flue draught shown in figure 1. Record the initial platform scale reading resulting from the mass of the test installation (appliance and test hearth, etc.).

Load the appliance with sufficient test fuel to ensure ignition of the fuel in accordance with the appliance manufacturer's instructions. When the fuel is well alight, begin the test period.

A.4.9.2.1.3 Test period

De-ash the fire. Empty and replace the ashpan. Record the total mass of the test installation as measured by the platform scale.

Load the appliance with the calculated mass of test fuel as detailed in A.4.2. Adjust the applied flue draught to give a static pressure within $^{+2}_{0}$ Pa of the flue draught pressure given in figure 1.

Observe the static pressure and adjust the applied flue draught, if necessary, to keep the static pressure within $^{+2}_{0}$ Pa of the appropriate test value.

Measure and record the following parameters :
- the temperatures on the test hearth and the walls of the trihedron,
- the temperature in the fuel storage container, either continuously or at regular intervals of not more than 1 minute.

End the test period when the basic firebed is reached. Record the reading of the platform scale.

Refuel the appliance with the test load and repeat the test. If the peak temperatures during the previous period are exceeded in the subsequent period, continue further refuelling until the maximum temperatures are reached. Record the maximum temperatures achieved.

A.4.9.2.2 **Temperature safety test for woodburning and multifuel appliances**

A.4.9.2.2.1 General

This test shall be performed when the appliance is declared by the manufacturer to burn either wood only or both wood and solid mineral fuels.

All controls, except those used only for start-up purposes, shall be in position allowing for the highest heat output to be achieved.

The test fuel shall be fir timber with a moisture content of (15 ± 3) % ; the cross sectional sizes of the timber shall be 4 x 6 cm or 5 x 5 cm. The length of the timber must be at least two thirds of the width of the firebox or two thirds of the depth of the firebox. If a grate is installed in the appliance, the length and width of the profiles shall exceed the length and width of the grate so that the grate is entirely covered with test fuel.

These special section timber pieces shall be put crosswise in a lattice formation so that the space between the timber pieces shall be not less than 1 cm.

The test load shall be calculated as follows:

$$B_{fl} = c \times S_c / H_u \qquad (2)$$

where

B_{fl} = Mass of fuel load, in kg
SC = Surface of the firebox floor, in m2
H_u = Lower calorific value of the fuel as fired, in MJ/kg
c = 400 MJ/m^2

The test shall be conducted with doors closed.

Total test periods is limited to be 5.

A.4.9.2.2.2 Ignition and test period

Load the appliance with sufficient test fuel to ensure ignition of the fuel in accordance with the manufacturer's operating instructions. When the fuel is well alight, load the appliance with the calculated test load.

Adjust the applied flue draught to obtain a static pressure within $^{+2}_{0}$ Pa of the flue draught pressure shown in figure 1. Set the combustion air controls at the maximum operating positions and adjust the secondary air controls to the normal setting for wood.

Observe the static pressure at approximately 15 min intervals throughout the entire test and adjust the applied flue draught, if necessary to keep the static pressure within $^{+2}_{0}$ Pa of the required test value.

When the basic firebed is achieved, a further load of test fuel is added. Maintain the combustion air controls at their previously set positions to allow the highest heat output to be achieved.

Measure and record :

the temperatures on the trihedron test hearth and walls;
the temperature in the fuel storage container, either continuously or at regular intervals of no more than 1 min.

End the test period when the basic firebed is reached ***after 5 loads.*** Record the reading of the platform scale.

delete following paragraph

Refuel the appliance with a further test load and repeat the test. If the peak temperatures, during the previous test period are exceeded in the subsequent period, continue further refuelling until the maximum temperatures are reached.

Record the maximum temperatures achieved.

delete A.4.9.3 because slow heat release appliances are intermittent burning appliances

A.4.9.3 **Natural draught safety test**

A.4.9.3.1 **General**

This test only applies to a continuously burning appliance and where it is claimed that it can be connected to a chimney serving more than one appliance.

The test assembly shall consist of the test appliance installed on a platform scale meeting uncertainty of measurement requirements specified in A.3.

The appliance flue spigot/socket shall be connected to the natural draught measurement section illustrated in figure A.12 by means of a flue gas connector and an insulated flue gas adapter in accordance with A.2.4 and operated with natural draught.

The measurement section shall be provided with means for determining the flue gas temperature in accordance with A.2.3.2, the flue gas composition in accordance with A.2.3.3 and the applied flue draught in accordance with A.2.3.4.

This test is carried out with the tiredoors closed, and with each of the test fuels used for the performance test at nominal heat output as described in A.4.7.

The test shall consist of:
- an ignition and pre-test period,
- a test period.

If the appliance is equipped with a thermostat, the test shall be carried out with the thermostat in operation and set for the appropriate test as instructed in A.4.9.3.2 and A.4.9.3.3.

Where the appliance incorporates a boiler, it shall be connected to a water circuit in accordance with A.2.5.

A.4.9.3.2 **Ignition and pre-test period**

Record the initial platform scale reading resulting from the mass of the test installation (appliance and test hearth, etc.) and counterbalanced so that the uncertainty of measurement given in table A. 1 can be achieved.

Load the appliance with sufficient test fuel to ensure ignition of the fuel in accordance with the manufacturer's operating instructions. When the fuel is well alight, load the appliance with a sufficient quantity of test fuel to ensure that an appropriate pre-test period is achieved.

The pretest shall be carried out at a burning rate of (33 ± 5 %) for wood logs and peat briquettes or (25 ± 5 %) for other test fuels of the consumption at nominal heat output over a minimum period of two hours and continued at this burning rate until the reading on the platform scale shows that the mass of basic firebed and ashes is achieved. Record the reading of the platform scale.

If the flow temperature exceeds 85°C for appliances with boiler then adjust the thermostatic primary air control setting and/or the water flow rate to reduce the flow temperature below 85°C.

A.4.9.3.3 **Test period**

De-ash the tire. Empty and replace the ashpan. Set the primary air controls at the minimum position and the secondary air control to that required for the test fuel being used in accordance with the manufacturer's operating instructions.

Record the total mass of the test installation as measured by the platform scale. The test period starts immediately after recording the platform scale reading.

Load the appliance with the calculated mass of test fuel in accordance with A.4.9.2.2.1. Measure and record the temperature and the composition of flue gas in accordance with A.4.4 and the static pressure in the measurement section. If the appliance is fitted with a boiler, measure and record the inlet and outlet water temperatures and the water flow rate as described in A.4.5.

Allow the appliance to operate with the air control settings at their previously set positions.

The test ends when, either the basic firebed is reached, or the draught falls below 3 Pa.

If 12 h after the start of the test period, the basic firebed has not been reached and the flue draught has not fallen below 3 Pa, de-ash the tire and allow the fire to continue burning until the basic firebed is reached.

The requirement of 5.1 is met if the flue draught is greater than 3 Pa throughout the test period.

If the tire has gone out before the basic firebed has been reached the test is invalid. Repeat the test using different combustion air settings to ensure the fire continues to bum until the basic firebed has been reached and the draught is greater than 3 Pa.

If the basic firebed has not been reached and the flue draught has fallen below 3 Pa the test is met, if within the next 10 hours the emitted volume of CO is not greater than 250 dm^3 regarding normal conditions when calculated as detailed in A.6.2.8

Record the position of the settings used for inclusion in the user instructions.

A.4.9.4 **Type pressure test for boilers**

Connect the boiler's inlet or outlet water tappings to an hydraulic test rig capable of applying a test pressure of at least twice the maximum operating pressure declared by the manufacturer. Seal any unused boiler water tappings and apply a sustained test pressure of twice the manufacturer's declared maximum water operating

pressure for a period of at least 10 min. Record whether or not the boiler shell or its water carrying components either leaked or became permanently deformed as a result of applying the test pressure.

A.4.9.5 Test for operation of thermal discharge control

A.4.9.5.1 General

This test shall be performed only on an appliance, which is fitted with a boiler designed to operate on a sealed system and where a thermal discharge control is fitted as part of the appliance.

This test shall consist of two parts:
- an ignition and pre-test period,
- a test period.

The boiler shall be connected to a water circuit as specified in A.2.5.

The test shall be carried out with the firedoor(s) closed, and with each of the test fuels used for the nominal heat output test as described in A.4.7.

The cold water used for dissipating the excess heat shall have a temperature between 10 °C and 15 °C and a pressure of (2 ± 0,1) bar.

A.4.9.5.2. Ignition and pre-test period

Start the flue gas extraction system and adjust the applied draught so that the static pressure in the measurement section is within $^{+2}_{0}$ Pa of the flue draught value that was used in the temperature safety test as specified in A.4.9.2.

Record the initial platform scale reading resulting from the mass of the test installation (appliance and test hearth, etc.).

Load the appliance with sufficient test fuel to ensure ignition of the fuel in accordance with the appliance manufacturer's instructions. When the fuel is well alight, load the appliance with the calculated mass of test fuel to ensure a pre-test period. After refuelling, note the platform scale reading and record the mass of fuel added.

Adjust the applied flue draught to give the appropriate static pressure in the measurement section. Set the combustion control devices to the required setting in order to achieve the burning condition necessary to give the claimed nominal heat output. Set the water flow rate through the boiler to a minimum flow rate which ensures that the requirement for the mean water flow temperature specified in A.2.5 can be met.

Operate the appliance during the pre-test period at a burning rate which gives the manufacturer's claimed nominal heat output and with both the water temperature thermostat and the thermal discharge control in operation. Ensure that at least the mass of basic firebed remains at the end of this period. The thermal discharge control shall not operate during this pre-test period.

End the ignition and pre-test period when the reading on the platform scale shows that the mass of basic firebed plus the ash from the fuel burned is achieved. Record the reading of the platform scale.

A.4.9.5.3 Test period

De-ash the fire. If necessary, empty and replace the ashpan. Record the total mass of the test installation as measured by the platform scale.

Load the appliance with the calculated mass of test fuel as detailed in A.4.2. Adjust the applied flue draught within $^{+2}_{0}$ Pa of the required test value.

Put the water temperature thermostat out of function and set all other controls, except those used only for start-up purposes, to the position that allows the highest water heating output to be achieved. Maintain the function of the thermal discharge control. Maintain the water flow at the same rate as that used during the pre-test period.

Allow the appliance to continue operating in this mode whilst recording the temperature of the water flow from the boiler.

End the test when either the thermal discharge control operates or if the thermal discharge control does not operate when the flow temperature exceeds 105 “C. Record whether or not the thermal discharge control operated. If the thermal discharge control operated record the temperature of the flow water from the boiler when the thermal discharge control operated.

A.5 **Test results**

For each test fuel used, record the results of the analysis parameters specified in annex B.

Calculate and record from at least two tests results, in accordance with A.6, the following parameters at nominal heat output:

- the mean total efficiency

delete the following sentence:

- the mean nominal heat output

insert the following new sentence to replace deleted paragraph

the heat release rate vs. time; (using surface temperature method)
mean value time

- the mean nominal heat to water (if a boiler is fitted);
- the mean nominal heat to space;
- the mean CO emission at 13 % O_2;
- the mean flue gas temperature.

The mean value for the nominal ***heat release rate*** calculated from at least two separate valid tests shall be not less than the manufacturer's claimed value. For each separate test result to be valid, it shall not differ from the mean value by more than ± IO %.

Record also the test values of the individual measurements used in the calculations and the flue draught used for each test.

delete the following paragraph:

Record the total heat output, and the actual test duration measured during the test at nominal heat output. If, within a tolerance off 15 %, the test duration was shorter or longer than that specified in A.4.7, determine by way of a comparative calculation whether, at the manufacturer's declared nominal heat output, the required minimum test duration would theoretically have been reached or whether at the required minimum test duration the manufacturer's declared output would theoretically have been achieved. Record either the revised test duration or the recalculated nominal heat output.

Record the maximum surface temperature achieved on every operating knob intended to be operated without the use of a tool. Record the maximum temperatures of the trihedron walls and test hearth. Also record the maximum temperature achieved in any integral fuel store, if fitted.

Record the readings of surface temperature measurement points during 24 hours starting from ignition of the fuel.

delete the following paragraph:

Record whether it was possible to maintain slow combustion for the minimum periods specified in 6.6, and whether recovery of the tire was possible. Record the time taken for the tire to recover.

delete the following paragraph:

Record whether or not the requirements for the natural draught safety test specified in 5.1 were met.

Record whether or not the boiler shell or its water carrying components either leaked or became permanently deformed during the type pressure test and the nominal heat output test.

Record whether or not the thermal discharge control, if fitted, met the requirements specified in 5.7.

Record whether the materials, design and constructional requirements specified in clause 4 were met. Record whether the manufacturer's instructions for the appliance meet the requirements specified in clause 7 and whether the marking and labelling of the appliance meet the requirements specified in clause 8.

NOTE: Actual measured values of dimensions, thickness etc. together with supporting certificates and documentation should also be recorded.

A.6 **Calculation methods**

A.6.1 Notations and units used

The notations and units used in the calculations are given in table A.3.

Table A.3: Notations and units used in calculations

Notation	Definition	Unit
B	Mass of the test fuel hourly (as fired basis)	kg / h
b	Combustible constituents in residues referred to mass of residues	% of mass
C	Carbon content of test fuel (as fired basis)	% of mass
CO	Carbon monoxide content of the dry flue gases	% of volume
CO_2	Carbon dioxide content of the dry flue gases	% of volume
C_p	Specific heat of water	kJ / K. m^3
C_r	Carbon content of the residue, referred to the quantity of test fuel fired. (Approximation : $C_r = R \times b / 100$)	% of mass
C_{pmd}	Specific heat of dry flue gases in standard conditions, depending on temperature and composition of the gases	kJ / K. m^3
C_{pmH2O}	Specific heat of water vapour in flue gases in standard conditions, depending on temperature.	kJ / K. m^3
F	Mass of test fuel burned in ten hour test period (dry, ash free basis) but without correction for combustible constituents in the residue	kg
H	Hydrogen content of the test fuel (as fired basis)	% of mass
H_u	Lower calorific value of the test fuel (as fired basis)	kJ / kg
M_w	Water flow rate	kg/h
N	Boiler water temperature rise	K
m	Flue gas mass flow	g / s
η	Efficiency	%
P	Total heat output	kW
P_{SH}	Space heat output	kW
P_W	Water heat output	kW
P_n	Nominal heat output	kW
P_s	Slow combustion heat output	kW
?	**Rate of heat release**	**kW**
Q_a	Thermal heat losses in the flue gases, referred to the unit of mass of the test fuel	kJ/kg
Q_b	Chemical heat losses in the flue gases, referred to the unit of mass of the test fuel	kJ/kg
Q_r	Heat losses through combustible constituents in the residue referred to the unit of mass of the test fuel (as fired basis)	kJ/kg
q_a	Proportion of losses through specific heat in the flue gases Qa, referred to the calorific value in the test fuel (as fired basis)	%
q_b	Proportion of losses through latent heat in the flue gases Qb, referred to the caloritic value in the test fuel (as fired basis)	%
q_r	Proportion of heat losses through combustible constituents in the residues Qr, referred to the caloritic value of the test fuel	%
R	Residue passing through the grate, referred to the mass of the fired test fuel	% of mass
T_b	Minimum refuelling interval or manufacturer's declared duration	h
t_a	Flue gas temperature	°C
t_r	Room temperature	°C
t_s	**Mean surface temperature**	**°C**
V_{con}	Volume, at NTP, of carbon monoxide	dm^3
W	Water content of the test fuel (as fired basis)	% of mass

A.6.2 **Formulae**

A.6.2.1 Heat losses and efficiency

Note: heat losses and efficiency are determined by similar way as in case of other roomheaters

A.6.2.1.1 General

The heat losses are determined from the mean values of flue gas and room temperatures, the flue gas composition and the combustible constituents in the residue.

The efficiency is determined from these losses using the formula:

$$\eta = 100 - (q_a + q_b + q_r) \quad (3)$$

A.6.2.1.2 Thermal heat losses in the flue gas

$$Q_a = (t_a - t_r) \times [[(C_{pmd} \times (C - C_r)) / (0{,}536 \times (CO + CO_2))] + [C_{pmH2O} \times 1{,}92 \times (9H + W) / 100]] \quad (4)$$

$$q_a = 100 \times Q_a / H_u \quad (5)$$

A.6.2.1.3 Chemical heat losses in the flue gas

$$Q_b = 12\,644 \times CO \times (C - C_r) / [\, 0{,}536 \times (CO_2 + CO) \times 100 \,] \quad (6)$$

$$q_b = 100 \times Q_b / H_u \quad (7)$$

A.6.2.1.4 Heat losses due to combustible constituents in the residue

$$Q_r = 335 \times b \times R / 100 \quad (8)$$

$$q_r = 100 \times Q_r / H_u \quad (9)$$

delete A. 6.2.2 and replace it with
A.6.2.2 Rate of heat release

A.6.2.2 Total heat output

delete the following paragraph and formula (10)

The heat output is calculated from the mass of fuel consumed each hour, the calorific value of the test fuel and the efficiency, using the formula :

$$P = (\eta \times B \times H_u) / (100 \times 3600) \quad (10)$$

The rate of heat release is calculated from measured mean surface temperature, using the formulas :

HEAT RELEASE RATE AS CONVECTION

Heat release rate as convection is calculated using following formulas:

$$h = [9.51 - 0.006(t_r + t_s)][(t_s - t_r)/(t_r + 273.15)]^{0.36} L^{0.08}$$

***h* is over-all heat transfer coefficient ($W\,m^{-2}K^{-1}$),**
***L* is height of the appliance (m)**
***t_s* is mean temperature of the appliance's surface (^oC) and**
***t_r* is room temperature (^oC)**

Total heat release rate as convection is then

$$q_c = hA_s(t_s - t_r)$$

***A*, is surface area of the appliance (m^2)**

HEAT RELEASE RATE AS RADIATION

Heat release rate as radiation is calculated using following formulas:

$$q_r = A_s F \sigma (T_s^4 - T_w^4)$$

***T_s* is the temperature of surrounding walls absorbing radiation (K)**
***T_w* is the temperature of surrounding walls absorbing radiation (K)**
ε_s is emissivity of the surface of the appliance
ε_w is emissivity of the surface of surrounding walls

$$F = \frac{1}{\frac{1}{\varepsilon_s} + \frac{A_s}{A_w}\left(\frac{1}{\varepsilon_w} - 1\right)}$$ **is view factor**

$\sigma = 5.67 \times 10^{-8}\,W\,m^{-2}K^{-4}$ **is Stefan-Bolzmann constant**

where

A_w **is surface area of surrounding walls of the test environment that absorbs and emits radiation**

Total heat release rate is the sum of q_c and q_r,

$$q_{tot} = q_c + q_r$$

NOTE: ***The space where measurement of surface temperature dependent heat release rate is done reflects on heat transfer by radiation. That is why it must be specified in the standard.***

A.6.2.xxx Mean value time, t_{50}

Mean value time is determined mathematically from the heat input, efficiency and heat release rate vs time curve using numerical integration. Mean value time is the time when 50% of the net energy is releasedfrom the appliance.

A.6.2.3 Water heating output

The water heating output is calculated from the water flow rate, the water temperature rise and the specific heat of water, using the formula:

$$P_w = (C_p \times M_w \times N) / 3600 \qquad (11)$$

A.6.2.4 Space heating output

The space heating output is calculated as the difference between the heat release rate and the water heat output, using the formula:

$$P_{SH} = P - P_w \qquad (12)$$

A.6.2.5 Flue gas mass flow

The flue gas mass flow is determined as an approximate value from the CO_2 content of the flue gases and the fuel-specific data, using the formula :

$$m = [\ B \times (1{,}3) \times (C\text{-}C_r) / (\ (0{,}536) \times (\ CO_2 + CO\ )) + (\ 9H + W\ ) / 100\ ] / 3{,}6 \qquad (13)$$

A.6.2.6 CO content

The mean values of the flue gas components such as oxygen, carbon dioxide and carbon monoxide over the test period can be calculated as an allowable approximation of the data received from the instrument readings.

With this calculation method though, the mean values of the components are not weighted over the test period, as the flue gas flow is assumed to be constant and the calculation errors are assumed to be small.

The CO content shall be calculated as follows :

a) The mean carbon monoxide value $CO_{,,}$, shall be calculated as the mean value of all CO data acquired from the instrument readings over the test period.

b) The CO_{avg} value has to be converted to the CO content value based on a standard oxygen content in the flue gas according to one of the following equations:

$$CO \text{ content} = CO_{avg} \times \frac{21 - O_{2\,standardized}}{21 - O_{2\,avg}} \quad (14)$$

$$CO \text{ content} = CO_{avg} \times \frac{CO_{2max}}{CO_{2\,avg}} \times \frac{21 - O_{2\,standardized}}{21} \quad (15)$$

The standardised oxygen content ($O_{2\,standardized}$)in the flue gas shall be taken as 13 %.

NOTE: Where the CO is measured on a volume basis (vol % or parts per million) and the CO-concentration needs to be given by mass concentration (mg/m^3_n) the mean value CO_{avg} should be changed using the following equations:

a) if CO is measured as parts per million (ppm) :

$$CO_{avg}\,(mg/m^3_n) = CO_{avg}\,(ppm) \times d_{co} \quad (16)$$

b) if CO is measured as percentage (vol %) :

$$CO_{avg}\,(mg/m^3_n) = CO_{avg}\,(\text{vol }\%) \times d_{co} \times 10\,000 \quad (17)$$

Where d_{co} is the density of carbon monoxide at standard condition $[d_{CO} = 1{,}25\ kg/m^3_n]$

A.6.2.7 Specific heat value of the combustion products

A.6.2.7.1 Specific heat of dry flue gases in standard conditions (C_{pmd})

The specific heat of the dry flue gases in standard conditions (C_{pmd}) is calculated using the formula:

$$C_{pmd} = 3{,}6 \times \left[0{,}361 + 0{,}008 \times \left[\frac{t_a}{1\,000°C}\right] + 0{,}034 \times \left[\frac{t_a}{1\,000°C}\right]^2\right] + \left[0{,}085 + 0{,}19 \times \left[\frac{t_a}{1\,000°C}\right] - 0{,}14 \times \left[\frac{t_a}{1\,000°C}\right]^2\right] \times \left[\frac{CO_2}{100\,\%}\right] + \left[0{,}3 \times \left[\frac{t_a}{1\,000°C}\right] - 0{,}2 \times \left[\frac{t_a}{1\,000°C}\right]^2\right] \times \left[\frac{CO_2}{100\,\%}\right]^2 \quad (18)$$

A.6.2.7.2 Specific heat of water vapour (C_{pmH20})

The specific heat of the water vapour (C_{pmH20}) in the combustion products is calculated using the formula:

$$C_{pmH20} = 3{,}6 \times \left[0{,}414 + 0{,}038 \times \left[\frac{t_a}{\quad}\right] + 0{,}034 \times \left[\frac{t_a}{\quad}\right]^2\right]$$

1 000°C 1 000°C

(19)

A.6.2.8 **Volume, at** NTP, **of carbon monoxide** (V_{COn})

The volume, at NTP, of the carbon monoxide (V_{COn}) during the 10 hour period of the natural draught safety test is calculated in dm^3 according to the following formula:

$$V_{COn} = \frac{C \times F}{0{,}536 \times (CO_2 + CO)} \times CO \times 10 \quad (20)$$

A.7 Test report

The test report shall specify the results of the testwork and any other additional information and shall contain at least the following details concerning the testwork undertaken on the appliance:

a) the name and address of the appliance manufacturer;

b) the name, serial number and description of the appliance ;

c) a statement describing whether the materials, design and construction requirements specified in clause 4 are met or failed, supported by actual measured values of dimensions, thicknesses, etc. together with certificates as appropriate;

d) a statement describing whether the safety requirements specified in clause 5 and performance requirements specified in clause 6 are met or failed, supported by detailed test results as specified in A.5;

e) a statement describing whether the installation and operating instructions comply with the requirements specified in clause 7;

f) a copy of the marking information given on the appliance, and a statement whether the marking information complies with the requirements specified in clause 8;

g) the name and address of the test laboratory;

h) an unique serial number for the report;

j) each page of the report to be numbered consecutively;

k) the date of issue of the report;

1) signature and legible name of the person taking responsibility for the content of the report.

m) m) the analysis and specifications of the test fuels used during the testwork.