BRITISH STANDARD

BS EN
15035:2006

Heating boilers — Special requirements for oil fired room sealed units up to 70 kW

The European Standard EN 15035:2006 has the status of a British Standard

ICS 97.100.40

BSI
British Standards

National foreword

This British Standard was published by BSI. It is the UK implementation of EN 15035:2006.

The UK participation in its preparation was entrusted to Technical Committee RHE/10, Heating boilers.

A list of organizations represented on RHE/10 can be obtained on request to its secretary.

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 January 2007

ISBN 978 0 580 49906 7

Amendments issued since publication

Amd. No.	Date	Comments

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 15035

December 2006

ICS 97.100.40

English Version

Heating boilers - Special requirements for oil fired room sealed units up to 70 kW

Chaudières de chauffage - Système de circuit de combustion étanche des chaudières au fioul

Heizkessel - Besondere Anforderungen an ölbefeuerte Units für den raumluftunabhängigen Betrieb bis einschließlich 70 kW

This European Standard was approved by CEN on 4 November 2006.

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Ref. No. EN 15035:2006: E

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Foreword

This document (EN 15035:2006) has been prepared by Technical Committee CEN/TC 57 “Central heating boilers”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2007, and conflicting national standards shall be withdrawn at the latest by June 2007.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

1 Scope

This European Standard applies to type C_{X3} central heating boilers as specified in 4.1, equipped with atomizing oil burners:

— type C_{13}, type C_{33}, and type C_{53} boilers, including their combustion air supply and combustion products evacuation ducts and their terminals;

— type C_{43} boilers including their connection ducts but without the chimney which is erected as a shared duct system and which is part of the building;

— type C_{63} boilers, including the connecting piece as specified in 3.7, if not integrated into the boiler;

— type C_{83} boilers, including their connection ducts but without the chimney which is part of the building;

— that have a nominal useful heat output below or equal to 70 kW;

— where the temperature of the water does not exceed 100 °C during normal operation;

— where the maximum water-side operating pressure does not exceed 8 bar.

This European Standard is intended to establish specific requirements and test methods for type C atomizing oil burning central heating boilers with respect to construction, safety, fitness for purpose, rational use of energy, classification and marking.

This European Standard covers only standard tests.

For boilers that produce domestic hot water by a drum or a heat exchanger, integrated or juxtaposed, (by accumulation of instant production), this standard only applies to hot water reheating system components that are not subject to operating conditions applicable to the boiler heating system.

This European Standard covers units consisting of boilers equipped with burners that meet the requirements of EN 267, with the following exceptions:

— maximum NO_x and CO emission values, estimated for boilers according to the classes defined in EN 303-2;

— air factor value, defined by the manufacturer and stated in the boiler's technical specifications;

— marking and/or burner data plate which may provide information for the boiler data plate;

— installation recommendations for installing the burner on the boiler included in the boiler operating instructions.

This European Standard modifies EN 303-1, EN 303-2, EN 304 and specifies supplementary requirements only for room sealed operations.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 267, *Forced draught oil burners — Definitions, requirements, testing, marking*

EN 303-1, *Heating boilers — Part 1: Heating boilers with forced draught burners — Terminology, general requirements, testing and marking*

EN 303-2:1998, *Heating boilers — Part 2: Heating boilers with forced draught burners — Special requirements for boilers with atomizing oil burners*

EN 303-4, *Heating boilers — Part 4: Heating boilers with forced draught burners — Special requirements for boilers with forced draught oil burners with outputs up to 70 kW and a maximum operating pressure of 3 bar — Terminology, special requirements, testing and marking*

EN 304:1992, *Heating boilers — Test code for heating boilers for atomizing oil burners*

EN 1443, *Chimneys — General requirements*

EN 1457, *Chimneys — Clay/Ceramic Flue Liners - Requirements and test methods*

EN 1856-1, *Chimneys — Requirements for metal chimneys — Part 1: System chimney products*

EN 1856-2*, Chimneys — Requirements for metal chimneys — Part 2: Metal liners and connecting flue pipes*

EN 13063-1, *Chimneys — System chimneys with clay/ceramic flue liners — Part 1: Requirements and test methods for sootfire resistance*

EN 13063-2, *Chimneys — System chimneys with clay/ceramic flue liners — Part 2: Requirements and test methods under wet conditions*

EN 13216-1, *Chimneys — Test methods for system chimneys — Part 1: General test methods*

EN 14471, *Chimneys — System chimneys with plastic flue liners — Requirements and test methods*

EN 15034, *Heating boilers — Condensing heating boilers for fuel oil*

3 Terms and definitions

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

3.1
required draught
difference in pressure between the static pressure of the air in the area where the boiler is installed and the static pressure of combustion products leaving the boiler (combustion products measuring hole), required to ensure good working order

3.2
room-sealed boiler
boiler in which the combustion circuit is sealed off from the area where the boiler is installed

3.3
combustion circuit
circuit including the air supply duct, burner, combustion chamber, heat exchanger, combustion products evacuation duct and either the connection piece or terminal connection (where applicable)

3.4
air supply and combustion products evacuation ducts
means for transporting combustion air to the burner and combustion products to the terminal or connection piece.

It is necessary to distinguish between:

— completely surrounded ducts: combustion products evacuation duct is surrounded by combustion air throughout its length;

— separate ducts: combustion products evacuation duct and the combustion air supply duct are neither concentric nor completely surrounded ducts

3.5
terminal
device fitted to the outside of a building, to which are connected:

— air supply and combustion products evacuation ducts for type C_{13} and type C_{33} boilers (one device);

— air supply duct and the combustion products evacuation duct for type C_{53} boilers (two devices);

— air supply duct for type C_{83} boilers (no device)

3.6
terminal guard
device that protects the terminal from mechanical damage from outside influences

3.7
connection piece
device which allows the fitting of a sealed boiler to any system for combustion air supply and combustion products boiler classification

4 Boiler classification

4.1 General

A type C boiler is a boiler in which the combustion circuit is sealed from the area of the building where the boiler is installed.

The air supply and combustion products evacuation ducts and the terminal or the fitting piece which is used to connect the boiler to a chimney or duct system may or may not be part of the unit as stated in 4.2. They admit fresh air from outside the building to the burner as well as discharge the combustion products to the outside.

Boilers are classified into several types according to the combustion products mode of evacuation and supply of combustion air (see examples attached in Annex A).

The types are defined by two subscripts:[1)]

— first subscript number is based on the possible boiler installation with respect to the mode of air supply and evacuation of the combustion products (see 4.2);

— second subscript number is based upon the presence and position of an integral fan in the boiler (see 4.2.8).

4.2 Type of boiler installation

4.2.1 General

Types of installation given below are in line with CR 1749.

4.2.2 Type C_1

A type C boiler connected via its ducts to a horizontally installed terminal at the wall or on the roof. The orifices of the ducts are either concentric or close enough to come under similar wind conditions.

4.2.3 Type C_3

A type C boiler which is connected via its ducts to a vertically installed terminal. The orifices of the ducts are either concentric or close enough to come under similar wind conditions.

4.2.4 Type C_4

A type C boiler which is fitted via its ducts possibly by means of a fitting piece to a shared duct system consisting of a duct for the supply of the combustion air and a duct for the discharge of the combustion products. The orifices of this shared duct system are either concentric or close enough to come under similar wind conditions.

4.2.5 Type C_5

A type C boiler which is connected via its separate ducts to two terminals that may terminate in zones of different pressure.

4.2.6 Type C_6

A type C boiler connected to a separately approved and marketed system for the supply of combustion air and discharge of the combustion products.

4.2.7 Type C_8

A type C boiler which is connected via its ducts by means of a fitting piece to an air supply terminal and fitted to an individual or shared chimney.

4.2.8 Presence and position of a fan

— Type C boiler that does not incorporate a fan is identified by the second subscript number “1” (e.g. C_{11}).

[1)] Boilers in which the combustion circuit is under positive pressure and surrounded by the combustion air circuit may require identification by an additional subscript in accordance with national regulations, if they are intended to be installed in non-ventilated areas.

— Type C boiler that does incorporate a fan downstream of the combustion chamber/ heat exchanger is identified by the second subscript number “2” (e.g. C_{12}).

— Type C boiler that does incorporate a fan upstream of the combustion chamber/ heat exchanger is identified by the second subscript number “3” (e.g. C_{13}).

For heating boilers equipped with atomising oil burners only C_{X3} appliances exist.

5 Construction and materials

5.1 General

Boilers covered by this European Standard shall meet the requirements of 5.2 to 5.6, in addition to the materials and construction requirements in EN 303-1or EN 303-4 or for condensing boilers in prEN 15034.

5.2 Combustion products evacuation and air supply ducts

The quality of materials and the shape and size of the components (ducts, seals) shall ensure that when appropriately assembled, in the conditions specified by the manufacturer with respect to maintenance, and taking into account the relevant thermal, chemical and mechanical constraints, the ducts are reliable and function satisfactorily for an acceptable length of time.

CE marked products in accordance with appropriate harmonised European specifications are presumed to perform as stated, although this does not replace the manufacturer responsibility to ensure that the liner, connecting flue pipe and fitting product (products according EN 13063-1 and EN 13063-2, EN 1856-1 and EN 1856-2 and EN 14471) as a whole are correctly designed and that component products have the necessary performance values.

The flue gas carrying parts shall be designated as P1 and W2 (V2); for appliances using kerosene, P1 and W1 are also suitable.

5.3 Condensate discharge

5.3.1 General

For non-condensing appliances where condensation is continuously formed during normal operation, the condensate shall drain to the boiler and 5.3.2 to 5.4.2.3 shall apply.

5.3.2 Removal of condensate

Condensation produced during boiler operation, including condensation formed in the flue and its connecting pipes, shall be removed by a discharge pipe (or pipes).

The internal diameter of the outside connection of the condensate discharge system shall be at least 13 mm.

The disposal system, forming part of the boiler or supplied with the boiler, shall be such that:

— it can be easily inspected and cleaned in accordance with the manufacturer's instructions;

— it cannot transmit combustion products into the room where the boiler is installed; this requirement is satisfied if the disposal system incorporates a water trap;

— water trap has a seal of at least 25 mm at maximum pressure in the combustion chamber at the maximum flue length specified by the manufacturer.

Surfaces in contact with condensation (except purpose provided drains, water traps and siphons) shall be designed to prevent condensate retention.

5.4 Soundness

5.4.1 Soundness of the combustion circuit

Parts which have to be removed during routine service and affect the soundness of the boiler and/or its ducts, shall be sealed mechanically, excluding pastes, liquids and tapes. Replacing the seals, following a cleaning or servicing operation as stated by the manufacturer, is permitted.

The service instructions shall clearly show how to replace parts which may affect the soundness of the combustion circuit.

If parts of the casing that forms part of the combustion circuit is removed by the user, then clear instructions and appropriate warnings in the user instruction manual shall be provided.

A warning label on the inside of such a panel may be used.

After correct reassembly of the parts in accordance with these instructions, maximum leakage rates contained in this European Standard shall not be exceeded.

When the boiler case forms part of the combustion circuit and it can be removed without the use of tools:

— either the appliance shall not operate, or

— there shall be no leakage higher than the values given in Table 1 when the case is correctly replaced as described in the manufacturers manual.

The ducts, bends, if any, and the terminal or adapter shall fit together correctly and shall form a stable assembly. Parts intended to be dismantled for periodic servicing shall be designed and arranged so that soundness is unaffected after re-assembly.

Any adapter shall allow a sound connection to be made to the system intended for the evacuation of combustion products and supply of air.

5.4.2 Supply of combustion air and evacuation of the combustion products

5.4.2.1 General

All boilers shall be designed so that there is an adequate supply of combustion air during ignition and over the whole range of possible heat inputs stated by the manufacturer.

5.4.2.2 Air supply and combustion products evacuation ducts

Assembly of the various parts during installation shall be such that no work is necessary other than adjusting the length of the air supply and combustion products evacuation ducts. Adjusting the length of the ducts shall not involve cutting, unless specifically recommended by the manufacturer. In this case, cutting shall be carried out under the specific conditions recommended by the manufacturer to ensure soundness.

In all cases, such adaptations shall not impair the correct operation of the boiler.

It shall be possible, if necessary, to connect the boiler, air supply and combustion products evacuation ducts and the terminal or fitting piece using ordinary tools. All necessary accessories and the fitting instructions shall be supplied by the manufacturer.

5.4.2.3 Boiler outlet socket

If the combustion products evacuation ducts are not supplied as part of the unit and dedicated to that unit, then the connecting piece of the combustion products duct shall always be constructed as a socket (female connector), so that the flow of condensate works only in the direction of the appliance.

The manufacturer shall define the requirements for the connecting piece for combustion air duct combustion products duct by:

— naming a certain product type for the connecting piece, or

— giving measurements and acceptable tolerances for the connecting piece.

5.4.2.4 Terminal

Any horizontal terminal shall be designed so that any condensation is correctly discharged.

The manufacturer shall indicate the slope of the terminal in the installation instructions to ensure the correct evacuation of condensates.

5.4.2.5 Terminal guard

The dimensions of the terminal guard, when installed in accordance with the manufacturer's instructions, shall be such that the distance between any part of the guard and the terminal, except the wall plate, exceeds 50 mm. The terminal guard shall have no sharp edges that are likely to cause injury. It shall be submitted to a test laboratory for boiler tests.

5.5 Checking the state of operation

It shall be possible, perhaps after opening a door, to check at any time that the boiler is operating, either by visual observation of the flame or by some other indirect means (e.g. an indicator light).

5.6 Maximum component temperatures

The maximum temperature of the components shall not exceed the maximum ambient temperature stated by the component manufacturer under all normal operating conditions of the unit and at the maximum specified air inlet temperature.

6 Operational requirements

6.1 Soundness of the combustion circuit

Boilers and, if relevant according to the classification, the ducts for combustion products evacuation and/or combustion air supply belonging to the system, shall be sound in accordance with the requirements of Table 1.

Soundness is verified before and after all the tests detailed in this European Standard. Ducts according to EN 1457, EN 1856-1 and EN 14471 shall be designated P1; ducts for air supply shall be designated N2.

Table 1 — Soundness requirements

Test sample	Design [a]	Maximum leakage rate	Test procedure	Test pressure	Boiler type					
					C1	C3	C4	C5	C6	C8
Boiler [b]	Completely surrounded	3 m^3/h	7.5.2	50 Pa	X	X	X	X	X	X
	Not completely surrounded	0,6 m^3/h	7.5.2	(50 + x) Pa	X	X	X	X	X	X
Boiler + ducts [c]	Completely surrounded	5 m^3/h	7.5.2	50 Pa	X	X	X	X	—	X
	Not completely surrounded	1 m^3/h	7.5.2	(50 + x) Pa	X	X	X	X	—	X
Combustion products evacuation duct	Not completely surrounded	0,006 $dm^3/s\ m^{2\ d}$	7.5.3	200 Pa	X	X	X	X	—	X
Air supply duct	/	0,5 $dm^3/s\ m^2$	7.5.3	200 Pa	X	X	X	X	—	X

[a] Completely surrounded means that all parts of the system which carry combustion products are completely surrounded by an enclosure/duct carrying air.

[b] The boiler shall be tested with the joints that ensure soundness between the combustion air duct and the boiler and between the boiler and the combustion products evacuation duct.

[c] The length of ducts that are installed are the maximum available with correct operation of the boiler.

[d] m^2 is related to the external duct area.

X = mandatory

6.2 Safety of operation

6.2.1 Limiting temperatures

6.2.1.1 External temperature of the ducts

The temperature of the ducts in contact with, or passing through the walls of the dwelling shall not exceed the surface temperature by more than 85 °C for an ambient temperature of 20 °C under the test conditions of 7.6.1.1.

However, when this temperature rise exceeds 65 °C, the manufacturer shall give the distance in mm for combustible materials for which the temperature on the combustible material does not exceed 85 °C according to the test in EN 13216-1.

When the ducts and terminal are not supplied by the manufacturer of the unit and not dedicated to it, then the manufacturer shall declare the flue gas temperature for the nominal working temperature of the heating appliance so that products, according to EN 13063-1 to EN 13063-2, EN 1856-1 and EN 14471 with given distances to combustibles can be used to choose the temperature class according to EN 1443, see Table 2.

Table 2 — Temperature classes

Temperature class	nominal working temperature °C	test temperature °C
T 080	≤ 80	100
T 100	≤ 100	120
T 120	≤ 120	150
T 140	≤ 140	170
T 160	≤ 160	190
T 200	≤ 200	250
T 250	≤ 250	300
T 300	≤ 300	350
T 400	≤ 400	500
T 450	≤ 450	550
T 600	≤ 600	700

6.2.1.2 Combustion products discharge temperature

For type C_{43}, type C_{63} and type C_{83} boilers, the manufacturer shall indicate the nominal working temperature so that adequate flues can be chosen.

6.2.1.3 Limiting temperatures of the side wall, the front and the top and the floor

When measured under the test conditions of 7.6.1.2, the requirements of EN 303-1 shall be met.

6.2.2 Ignition

The boiler shall be turned on and correctly ignited, i.e. once the safety time has lapsed, as defined in EN 267. Stable operation of the burner shall be noted:

— under normal conditions, as defined in 7.6.2.2, in a calm atmosphere;

— under special conditions, as defined in 7.6.2.3, under wind.

6.3 Performance requirements

6.3.1 Efficiency

Under the test conditions defined in 7.7, useful efficiency, expressed as a percentage, for a load that corresponds to the useful maximum nominal output, and for a load that corresponds to 30 % of the maximum nominal useful output, shall be no less than the values shown in Table 3.

Table 3 — Boiler output requirements

Boiler type	Efficiency at nominal output		Efficiency at 30 % part load	
	Average temperature of water in the boiler	Efficiency requirement	Average temperature of water in the boiler	Efficiency requirement
	°C	%	°C	%
Standard boilers	70	$\geq 84 + 2 \cdot \times \log P_n$	≥50	$\geq 80 + 3 \times \log P_n$
Low temperature and condensation boilers	70	$\geq 87{,}5 + 1{,}5 \times \log P_n$	40	$\geq 87{,}5 + 1{,}5 \times \log P_n$

6.3.2 Required draught for type C_{83} boilers

The draught requirements of EN 303-2 apply.

The draught shall be determined under the test conditions defined in 7.7.

If the draught value exceeds the requirements of this standard, it shall be stated in the technical documentation.

The manufacturer shall indicate in the installation instructions the characteristics of the chimney to which the boiler can be connected.

6.3.3 Limiting values for emissions

6.3.3.1 Normal conditions

The smoke number shall be less than or equal to 1 during testing at nominal heat-output under the conditions defined in 7.8.2.

The amount of unburned hydrocarbons in the combustion products shall not exceed 10×10^{-6} (10 ppm), with the exception of the first 20 s following initial fuel injection.

A flame ionisation detector (FID) is used to measure this content.

Combustion shall create little pollution. This requirement shall be met if the values in Table A.1 of EN 303-2:1998 are not exceeded at nominal output, taking into account the weighting of pollutant emissions.

Emissions values are measured for fuel that meets the characteristics defined in 7.3.

6.3.3.2 Special conditions

6.3.3.2.1 Carbon monoxide

CO content shall not exceed 0,20 % under the test conditions defined in 7.8.3.

6.3.3.2.2 Smoke number

The smoke number shall be ≤ 1 under the test conditions defined in 7.8.3. For units according to EN 303-4, the smoke number shall be ≤ 2.

7 Test methods

7.1 General

The following clauses are generally applicable except where otherwise specified in particular clauses.

7.2 Boiler installation

The boiler is installed in accordance with the technical instructions in a well-ventilated, draught-free room (air speed less than 0,5 m/s), which has an ambient temperature of about (20 ± 5) °C. The boiler is protected from direct solar radiation.

Depending on the type of boiler, the manufacturer shall supply the boiler, fitted with all the accessories necessary for installation (including its ducts), accompanied by the mounting instructions.

Wall-mounted boilers shall be installed on a vertical test panel of plywood or of a material with the same thermal characteristics in accordance with the information in the manufacturer's instructions. The plywood panel shall be (25 ± 1) mm thick and painted matt black; the panel dimensions are at least 50 mm greater than the corresponding dimensions of the boiler.

Except where otherwise stated, the boiler is connected to the shortest ducts with the smallest pressure loss stated by the manufacturer in his or her installation instructions. If necessary, an external telescopic duct may be sealed in accordance with the manufacturer's instructions. The terminal guard is not fitted.

Depending on the type of boiler, the manufacturer shall provide all terminals and/or fitting pieces with the boiler for testing.

Type C_{13}, type C_{33} and type C_{53} boilers shall be tested with their terminals and ducts fitted. Type C_{13} boilers shall be tested with their accessories suitable for a wall with a thickness of 300 mm.

Type C_{83} boilers shall be tested while fitted to a test duct as defined in EN 304 under normal conditions but are not fitted to a test duct during testing under special conditions.

Thermal tests defined in this standard shall be carried out with an atomizing oil burner that complies with EN 267, under conditions and with the measuring equipment described in EN 304 and EN 267.

Burner adjustments such as heat input required to obtain nominal useful output and excess air, shall comply with the specifications indicated by the manufacturer in the boiler operating and installation instructions.

7.3 Fuel

7.3.1 General

Tests requiring the boiler to be in operation shall be carried out using each fuel type or types specified by the manufacturer.

7.3.2 Quantities

Fuel is weighed or measured volumetrically.

7.3.3 Determination of heating value

7.3.3.1 Heating gas oil

a) If the heat value is not measured calorimetrically and in the absence of a basic analysis, the following net (lower) calorific value may be used, allowing approximation.

H_i = 42,689 MJ/kg

with the assumption that:

carbon content c = 0,86 kg/kg;

hydrogen content h = 0,136 kg/kg;

sulphur content s = 0,002 kg/kg;

and volumetric mass of the fuel at 15 °C: 0,85 kg/dm^3.

b) If the volumetric mass and sulphur content are known (e.g. by basic analysis), the net (lower) calorific value may be calculated as follows:

$$H_i = 52{,}92 - (11{,}93 \times \rho_{15}) - (0{,}3 \times s) \text{ in MJ/kg} \quad (1)$$

where

ρ_{15} is the volumetric mass of the fuel at 15 °C: 0,85 kg/dm^3;

s is the sulphur content in kg/kg.

7.3.3.2 Kerosene

a) If the calorific value is not determined calorimetrically and in the absence of a complete analysis, the value for kerosene can, with sufficient accuracy, be assumed as follows:

H_i = 43,300 MJ/kg

with the assumption that:

Carbon content c = 0,85 kg/kg;

Hydrogen content h = 0,141 kg/kg;

Sulphur content s = 0,004 kg/kg;

density at 15 °C: 0,79 kg/dm³.

b) If the density and sulphur content is known (e.g. by analysis) the calorific value can be calculated in accordance with 7.3.2.1 b).

7.4 Determining the composition of combustion products

To prevent measuring errors, the appliance shall be installed in an area where the temperature is as constant as possible and shall be put into operation long before tests begin (see EN 304).

The combustion products sample is taken perpendicular to the direction of combustion products discharge at a distance L, from the end of the combustion products duct (see examples in Figure 1 and Figure 2):

— for circular ducts: $L = D_i$;

— for rectangular ducts: $L = \frac{4S}{C}$

where

D_i is the internal diameter of the combustion products evacuation duct, in mm;

S is the surface of the duct, in mm^2;

C is the circumference of the duct, in mm.

The sampling probe is positioned so as to obtain a representative sample.

7.5 Soundness of the combustion circuit

7.5.1 General

The test shall check all the joints declared by the manufacturer, between:

— boiler and its ducts;

— interconnecting ducts;

— ducts and any bends and

— ducts and any fitting piece or terminal.

If leakage occurs along the length of the ducts, the tests shall be carried out with the maximum length of ducts.

In accordance with the technical instructions the wall connections, the joint with the terminal or the joint with the fitting piece with another system of combustion products evacuation may be made sound.

7.5.2 Air supply and combustion products circuit

Depending on the manufacturer's choice, the test shall be carried out on the boiler body and on the ducts either separately, or on the boiler assembled with its ducts.

The combustion circuit of the test object in accordance with Table 1 shall be connected to a pressure source on one side and blocked on the other side.

The test pressure shall be 50 Pa for boilers with completely surrounded ducts.

For boilers with separate ducts, this test pressure shall be raised by the highest pressure difference between:

— either the combustion chamber when the soundness test is carried out on the boiler connected to its ducts, or

— on the one hand, the combustion chamber and, on the other hand, the air supply and combustion products evacuation ducts, when the soundness test is carried out separately on the boiler and its ducts.

The pressure shall be measured when the boiler is at thermal equilibrium at nominal heat input, equipped with the longest ducts indicated by the manufacturer.

The pressure of the completely surrounded combustion products circuit shall not be taken into account.

It shall be checked that the requirements of 6.1 are met.

7.5.3 Separate combustion products evacuation duct

When tested in accordance with 7.5.2, but with a test pressure of 200 Pa, the requirements of 6.1 shall be met.

7.5.4 Separate and concentric air supply duct

When tested in accordance with 7.5.2, the requirements of 6.1 shall be met.

7.6 Safety of operation

7.6.1 Limiting temperatures

7.6.1.1 Nominal and maximum temperature of the ducts

7.6.1.1.1 Nominal flue gas temperature

The boiler shall be installed as indicated in 7.2 and supplied with test fuel at nominal heat input, with the adjustable thermostat positioned to show the maximum temperature.

The limiting temperatures shall be measured when thermal equilibrium is reached.

The temperature of the duct shall be measured after the boiler has been operating for 30 min.

It shall be checked that the requirements of 6.2.1.1 are met and the temperature class is verified.

7.6.1.1.2 Maximum flue gas temperature

The thermostat shall be set out of operation by reduced water flow so that the safety temperature limiter will switch off the boiler. The maximum temperature shall not exceed the test temperature of the temperature class according to 6.2.1.1.

7.6.1.2 Temperatures of the side walls, the front and the top

The temperatures of the hottest places on the side walls, front and top shall be measured by means of temperature sensors with the sensing elements applied against the external surface of these parts of the boiler.

It shall be checked that the requirements of 6.2.1.3 are met.

7.6.2 Ignition and combustion quality

7.6.2.1 General

The burner fitted with appropriate injector(s) shall be supplied with test fuel having the characteristics indicated in 7.3.

Tests shall be carried out both when the boiler is cold and when it has reached thermal equilibrium under the test conditions defined in 7.2.

7.6.2.2 Normal conditions

7.6.2.2.1 Test n° 1

The test shall be carried out in calm air without altering the adjustment of the burner, as stated in 7.6.2.1.

In the event that the boiler operates within an output range, the ignition test shall be carried out at the minimum and maximum values in the range indicated by the manufacturer.

It shall be checked that the requirements of 6.2.2 are met.

7.6.2.2.2 Test n° 2

The test shall be carried out in calm air without altering the adjustment of the burner, as stated in 7.6.2.1.

In the event that the boiler operates within an output range, the ignition test shall be carried out at the minimum and maximum values in the range indicated by the manufacturer.

It shall be checked that ignition of the burner takes place correctly with a voltage equal to 85 % of the nominal voltage.

It shall be checked that the requirements of 6.2.2 are met.

7.6.2.2.3 Type C_{43} and type C_{63} boilers

The boiler shall be installed with the longest ducts or operated with the highest resistance as specified by the manufacturer. It shall be checked that the requirements of 6.3.3 are met.

7.6.2.3 Special conditions

7.6.2.3.1 General

The tests shall be carried out with the shortest and longest air supply and combustion products evacuation ducts, or with corresponding pressure losses, as specified by the manufacturer.

The tests shall be carried out in wind without altering the adjustment of the burner, as stated in 7.6.2.1.

The boiler shall have reached thermal equilibrium.

7.6.2.3.2 Type C_{13} and type C_{33} boilers

The boiler shall be installed in accordance with the information in the technical instructions, with accessories supplied by the manufacturer, on the applicable test apparatus of Figures 3a or Figure 3b for type C_{13} and Figure 3c or Figure 3d for type C_{33} boilers.

7.6.2.3.2.1 First test series

The boiler shall have reached thermal equilibrium.

The terminal shall be subjected successively to winds of three different speeds (1 m/s, 2,5 m/s and 12,5 m/s) and with directions in three planes as given in Figures 3a and 3d, depending on the boiler type and the situation:

— horizontal plane with a measuring points every 15° on an arc of 180°;

— planes at +30 °C and -30 °C with measuring points every 15° on an arc of 180°.

For each of the three planes of incidence, the CO and CO_2 concentrations, combustion products temperatures and blackening index shall be measured noting:

— three combinations of wind speed and the angle of incidence giving the lowest CO_2 concentration;

— three combinations for which the highest CO concentration are measured in the dry air-free combustion products.

7.6.2.3.2.2 Second test series

Tests shall be carried out both when the boiler is cold and when it has reached thermal equilibrium under the test conditions defined in 7.2.

For each of the two combinations for which the lowest CO_2 concentration and the highest CO concentration are measured in the dry air-free combustion products, measured during the first test series, it shall be checked that the requirements of 6.2.2 are met.

7.6.2.3.2.3 Third test series

If the manufacturer makes provision for a terminal guard, this shall be fitted in accordance with the instructions, and the nine combinations in the first series that have the highest CO concentrations in the dry air-free combustion products shall be repeated. The measured values are noted to be used for the calculation in 7.8.3.1.

7.6.2.3.2.4 Stable operation with flue gas re circulation for type C_{43} and type C_{63} boilers

For the test 10 % of the flue gas volume shall be re circulated and mixed with the combustion air. It shall be checked whether the requirements of 6.3.3.2.1 are met.

7.6.2.3.3 Type C_{43} and type C_{63} boilers

The boiler shall be installed with the shortest duct or operated with the lowest resistance as specified by the manufacturer. A suction of 50 Pa shall be applied to the orifice of the combustion products evacuation duct as indicated in Figure 4.

It shall be checked that the requirements of 6.3.3 are met.

7.6.2.3.4 Type C_{53} and type C_{83} boilers

The boiler shall be installed with the shortest ducts specified by the manufacturer. A suction of 200 Pa shall be applied to the orifice of the combustion products evacuation duct as indicated in Figure 4.

It shall be checked that the requirements of 6.3.3.2 are met or the boiler enters the lock-out mode.

7.7 Useful efficiency

7.7.1 General

The boiler shall be installed as stated in 7.2. Tests shall be carried out without altering the adjustment of the burner, as stated in 7.6.2.1.

7.7.2 Standard boilers

7.7.2.1 Useful efficiency at the nominal maximum heat output

The test used to determine the useful efficiency at nominal useful boiler output shall be carried out as defined in EN 304, without considering the air supply and combustion evacuation ducts. It shall be checked that the requirements of 6.3.1 are met.

7.7.2.2 Efficiency at 30 % part load

The test used to determine the efficiency at 30 % part load of the nominal useful boiler output shall be carried out as defined in EN 304.

It shall be checked that the requirements of 6.3.1 are met.

7.7.3 Low temperature and condensation boilers

To determine the useful efficiency at 30 % part load for low temperature and condensation boilers, the test methods described in this standard and in EN 304 may be used, provided the average temperature of the boiler water is modified as follows (direct method):

— method No.1 (see 5.8.1.1 of EN 304:1992: (37 ± 1) °C;

— method No.2 (see 5.8.1.2 of EN 304:1992: 40 °C.

It shall be checked that the requirements of 6.3.1 are met.

7.8 Limiting emissions values

7.8.1 General

The boiler shall be installed as stated in 7.2 and when it has reached thermal equilibrium.

Tests shall be carried out without altering the adjustment of the burner, as stated in 7.6.2.1.

7.8.2 Normal conditions

The boiler shall be adjusted to its nominal heat input for an initial water temperature corresponding to the type of boiler tested (Table 2). Water flow rate shall be kept constant.

The values of the unburned hydrocarbons, NO_x and CO shall be determined using the methods and measuring equipment described in EN 304 and EN 267, and under the test conditions defined in 7.7.

It shall be checked that the requirements of 6.3.3.1 are met.

7.8.3 Special conditions

7.8.3.1 Type C_{13} and type C_{33} boilers

The test shall be carried out as indicated where applicable in the first and third test series defined in 7.6.2.3.2.

For each of the test series, the value of the arithmetic average of CO concentrations shall be determined for the nine combinations of wind speed and angle of incidence (see Figures 3a to 3d), giving the highest CO concentration in the dry air-free combustion products is calculated. It shall be checked that the requirements of 6.4.3.1 are met.

For the two combinations chosen during the second series of tests defined in 7.6.2.3.2, with the boiler in thermal equilibrium, it shall be checked that the requirements of 6.4.3.2.2 are met.

7.8.3.2 Type C_{53} and type C_{83} boilers

Under the test conditions defined in 7.6.2.3.4, it shall be checked that the requirements of 6.3.3.2 are met.

8 Marking and instructions

8.1 Boiler marking

8.1.1 Data plate

Each appliance shall carry an indelible data plate which is visible on installation, possibly after the removal of part of the case, which is solidly fixed and durable, carrying at least the following information, written in the language of the country in which the boiler is intended to be installed:

a) name and address of the manufacturer and, where applicable, its logo;

b) trade name and model under which the boiler is sold;

c) serial number and year of manufacture (the manufacturer may choose to use a code);

d) nominal output or output range in kW, or fuel input (minimum to maximum) in kg/h;

e) maximum water pressure (in bar) at which the appliance can be used;

f) authorised operating temperature in °C;

g) appliance type(s). The appliance type shall be stated according to 4.1;

h) electrical supply:

— type given by the symbol “~” or “=”;

— nominal voltage of the electrical supply in Volts given by the numerical value followed by the unit “V”;

— power consumption in Watts given by the numerical value followed by the unit “W”;

i) required draught in the case of type C_{83} boilers (mbar);

j) EC marking where required;

k) flue gas temperature at the nominal working temperature.

8.1.2 Data plate requirements

The plate shall be made from durable material with indelible print. The print shall be friction-resistant and the plate shall not change colour through normal use to the extent that the data becomes difficult to read.

Adhesive plates shall not peel when exposed to humidity and heat.

8.1.3 Packaging

The packaging shall carry information concerning the type of appliance and warnings according to 8.1.4.

8.1.4 Warnings on the boiler and the packaging

One or more labels shall give at least the following warnings, such that they are visible and readable, and enable the user to:

— read the technical instructions before installing the boiler;

— read the user's instructions before lighting the boiler.

8.1.5 Other information

No other information shall be carried on the appliance or the packaging if it is likely to create confusion in relation to the actual state of adjustment of the appliance, the corresponding category(ies) and the direct country(ies) of destination.

8.2 Instructions

8.2.1 Technical instructions

Each appliance shall be accompanied by technical instructions intended for the installer.

These instructions shall at least include the following instructions stated in 8.2.1.1, 8.2.1.2 and 8.2.1.3:

8.2.1.1 General

a) information on the data plate, with the exception of the serial number and the year of manufacture (see 8.1.1);

b) meaning of the symbols used on the appliance and its packaging, in accordance with 8.1.1;

c) reference to certain standards and/or particular regulations if these prove to be necessary for the correct installation and use of the appliance;

d) information, if necessary (see 6.2.1):

— about the minimum distance to be met from combustible materials;

— walls temperature sensitive to heat, for example wood, shall be protected by suitable insulation;

— clearance between the wall on which the boiler is installed and the hot parts on the outside of the boiler are observed;

e) information about required fuel quality (e. g. normal light fuel oil or sulphur reduced fuel oil);

f) general description of the appliance, with an illustration of the principal parts (sub-assemblies) which shall be removed to rectify operational faults;

g) for electrical installation:

— obligation to earth appliances incorporating mains-supplied electrical equipment;

— circuit diagram with terminals (including those for external control);

h) recommended method for cleaning the appliance;

i) servicing necessary and the recommended service interval;

j) indication that, following installation of the boiler, the installer shall instruct the user in the operation of the boiler and the safety devices and shall give at least the user's instructions to the user;

k) manufacturer gives information to local national requirements.

8.2.1.2 For installation of the central heating circuit

a) information about the maximum water temperature in °C;

b) indication of the controls that may be used;

c) precautions to be taken to limit the level of operating noise of the installation;

d) for sealed systems, instructions concerning the installation of a pressurised expansion vessel when the boiler is not originally fitted with such a device;

e) information on:

— either the characteristic curve of the water pressure head available at the boiler outlet connection if the boiler has an integral pump, or

— curve of the table for pressure loss as a function of the water rate for a boiler supplied without a pump.

8.2.1.3 For installation of the combustion circuit

a) information about the type of installation for which the boiler is approved;

b) instruction that the boiler has to be installed with the necessary accessories (e.g. ducts, terminal, fitting piece) supplied with the boiler or the specifications for the necessary accessories that shall be fitted;

c) instruction for the installation of parts intended to be fitted to the boiler;

d) maximum pressure loss or the maximum number of bends to be used and the maximum length and, if necessary, the minimum length of the air supply and combustion products evacuation ducts;

e) particular characteristics of the terminal guard, where provision for this is made, and information on its installation relative to the terminal;

f) specific conditions for adapting the length by cutting ducts or using spool pieces;

The installation specifications shall provide the following information:

g) for type C_{13} boilers:

— information on if and how the terminal shall be placed on the wall and/or the roof (see 7.6.2.3.2);

— instruction that the terminal outlets from separated ducts shall fit inside a square of 500 mm;

h) for type C_{33} boilers:

— instruction that the terminal outlets from separated ducts shall fit inside a square of 500 mm;

i) for type C_{53} boilers:

— instruction that the terminals for the supply of combustion air and for the evacuation of combustion products shall not be installed on opposite walls of the building;

j) for type C_{83} boilers:

— characteristics of the chimney to which the boiler can be connected;

k) distance between supporting elements of flues and the maximum angle and length of an offset which shall be given by the manufacturer. For external installation the height about the last support shall not be larger then 1,5 m.

8.2.2 User's instructions

Each appliance shall be accompanied by instructions intended for the user. They shall include the necessary information on using and maintaining the appliance and incorporate at least the following:

a) point out that a qualified professional or competent person should be called on to install, convert and adjust the boiler where appropriate;

b) specify the operation to start up, turn off and shut down the boiler;

c) specify that it is necessary to abide by the warnings;

d) explain the operations necessary for normal operation, cleaning and day-to-day maintenance of the boiler;

e) explain any precautions to be taken against frost;

f) warn against incorrect use;

g) forcibly warn against any interference with a sealed component;

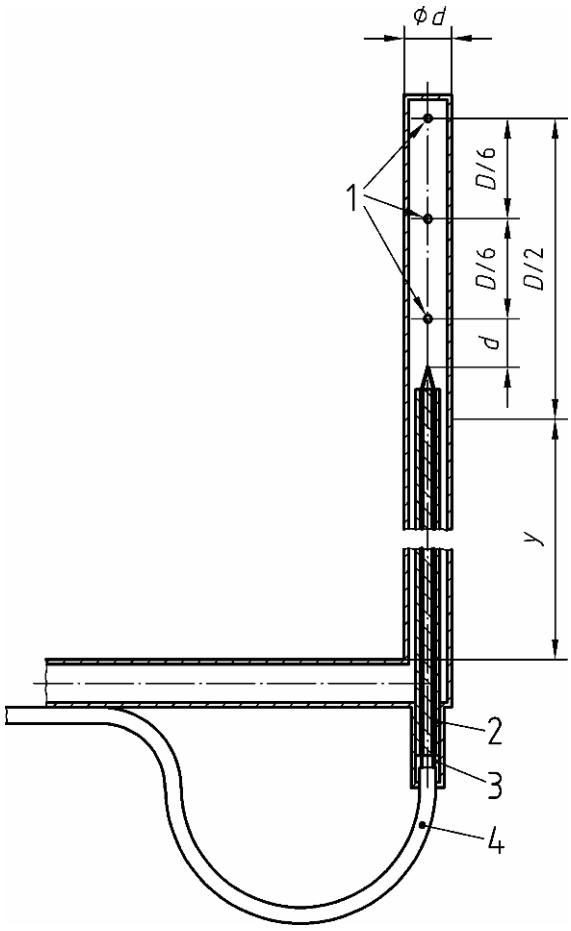
h) point out that the boiler should be checked and maintained periodically by a qualified professional or competent person;

i) if necessary, draw the user's attention to the risks of burning if in direct contact with the viewing window or its immediate surroundings;

j) existing national regulation for condensate discharge, if applicable…".

8.2.3 Presentation

All the information of 8.1 and 8.2 shall be given in the language(s) and in accordance with the practice of the countries in which the boiler is intended to be installed.



Key

1	sampling holes (×3)	3	ceramic tube with two ducts
2	chrome/alumel thermocouple wires	4	insulation cement

NOTE 1 The dimensions of a 6 mm diameter probe (suitable for a combustion products evacuation duct with a diameter greater than 75 mm) are as follows:

—	external probe diameter (d)	6 mm;
—	wall thickness	0,6 mm;
—	diameter of sampling holes (x)	1,0 mm;
—	ceramic tube with two ducts	3,0 mm with ducts of 0,5 mm diameter;
—	thermocouple wire	0,2 mm diameter.

The dimensions (*d*) and (*x*) of a probe suitable for a combustion products duct of diameter less than 75 mm shall be such that:

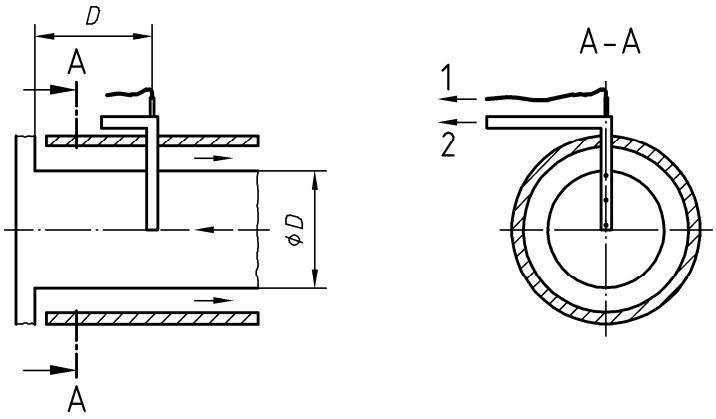
a) cross-section of the probe shall be less than 5 % of the cross-section of the duct;

b) total surface area of the three sampling holes is less than three quarters of the cross-section of the probe.

NOTE 2 The dimension Y is chosen depending on the diameter of the air supply duct and its insulation.

Material: stainless steel.

Figure 1 — Example of probe for measuring the temperature of the combustion products



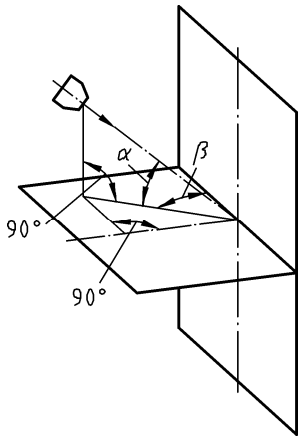
Key

1 to the temperature reader

2 to the sampling pump

D combustion products duct inner diameter, in mm

Figure 2 — Position of sample probe for type C boilers



Key

α = 0° (horizontal winds), +30° and –30°

β = 0° (glancing winds), 15°, 30°, 45°, 60°, 75°, 90° (perpendicular to the test wall)

For appliances fitted with a non-symmetrical terminal, the examination is continued for the following values: 105°, 120°, 135°, 150°, 165° and 180°.

Angle β may be varied either by modification of the position of the wind generator (fixed wall) or by rotation of the test wall about a central vertical wall.

The test wall consists of a strong vertical wall of at least 1,8 m × 1,8 m, with a removable panel at its centre. The device for supplying combustion air and discharging combustion products is mounted so that its geometric centre is at the centre O of the test wall, and its projection from the wall is as recommended by the manufacturer.

The characteristics of the wind generator and the distance from the test wall at which it is placed are chosen such that the following criteria are met at the level of the test wall, after the central panel has been removed:

— wind front is either at least 90 cm square of circular section with a diameter of 60 cm;

— wind speeds of 1 m/s, 2,5 m/s and 12,5 m/s with an accuracy of 10 % can be obtained;

— wind stream is essentially parallel and has no residual movement.

If the central removable panel is not large enough to allow checking of these criteria, they are checked without the wall and measured at a distance corresponding to the distance existing in practice between the test wall and the wind generator discharge nozzle.

Figure 3a — Test rig for type C boilers fitted with a horizontal terminal installed on a vertical wall

Dimensions in millimetres

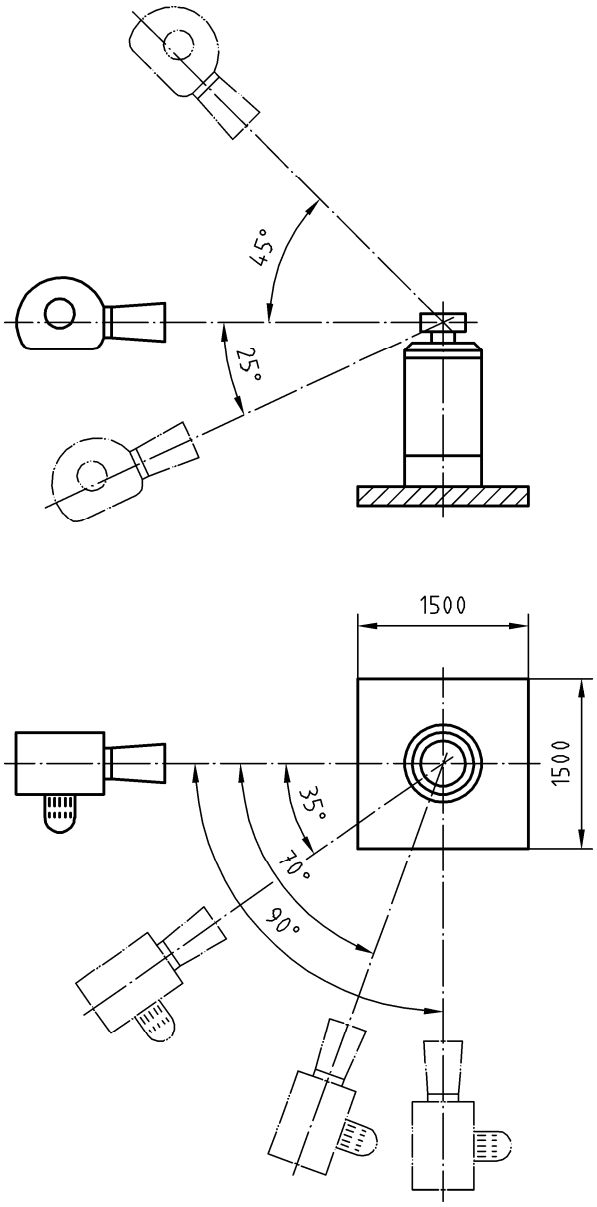


Figure 3b — Test rig for type C boilers fitted with a vertical terminal on a flat roof

Dimensions in millimetres

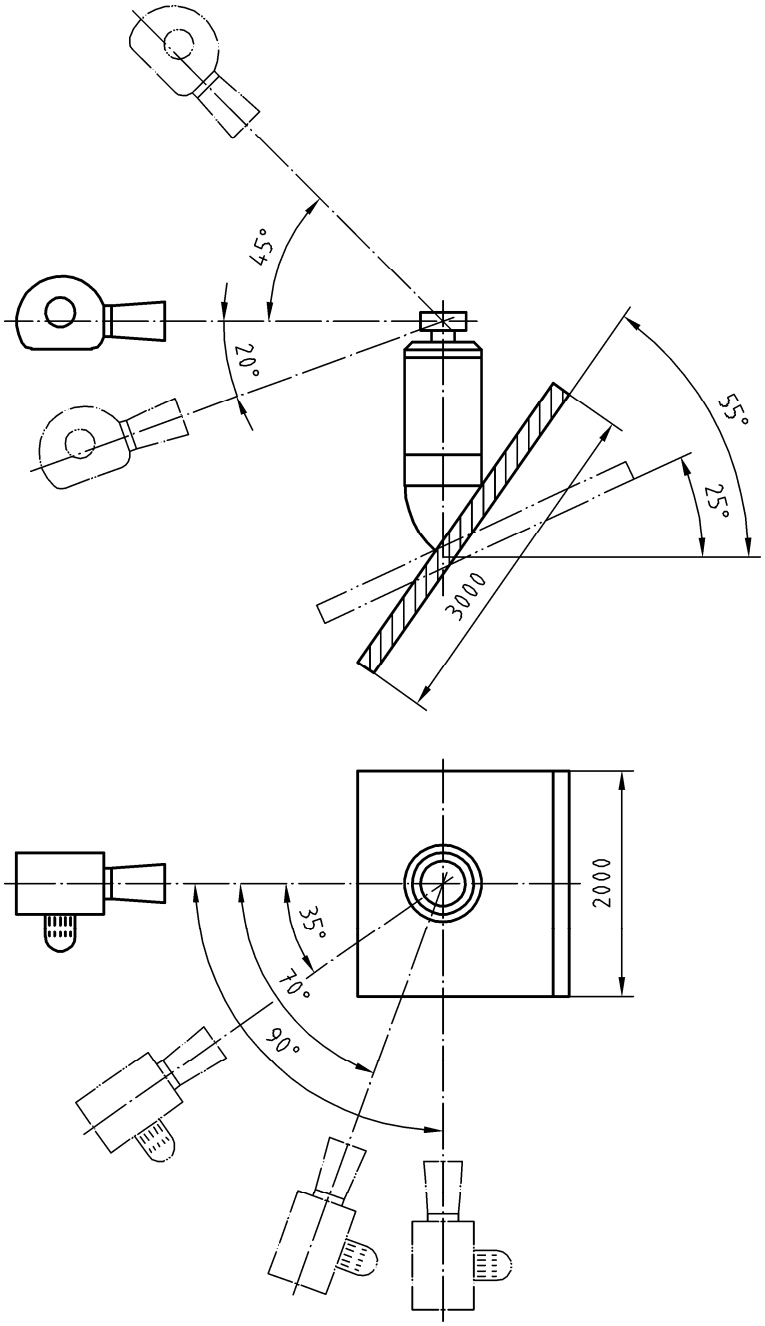


Figure 3c — Test rig for type C boilers fitted with a vertical terminal on a sloping roof

Dimensions in millimetres

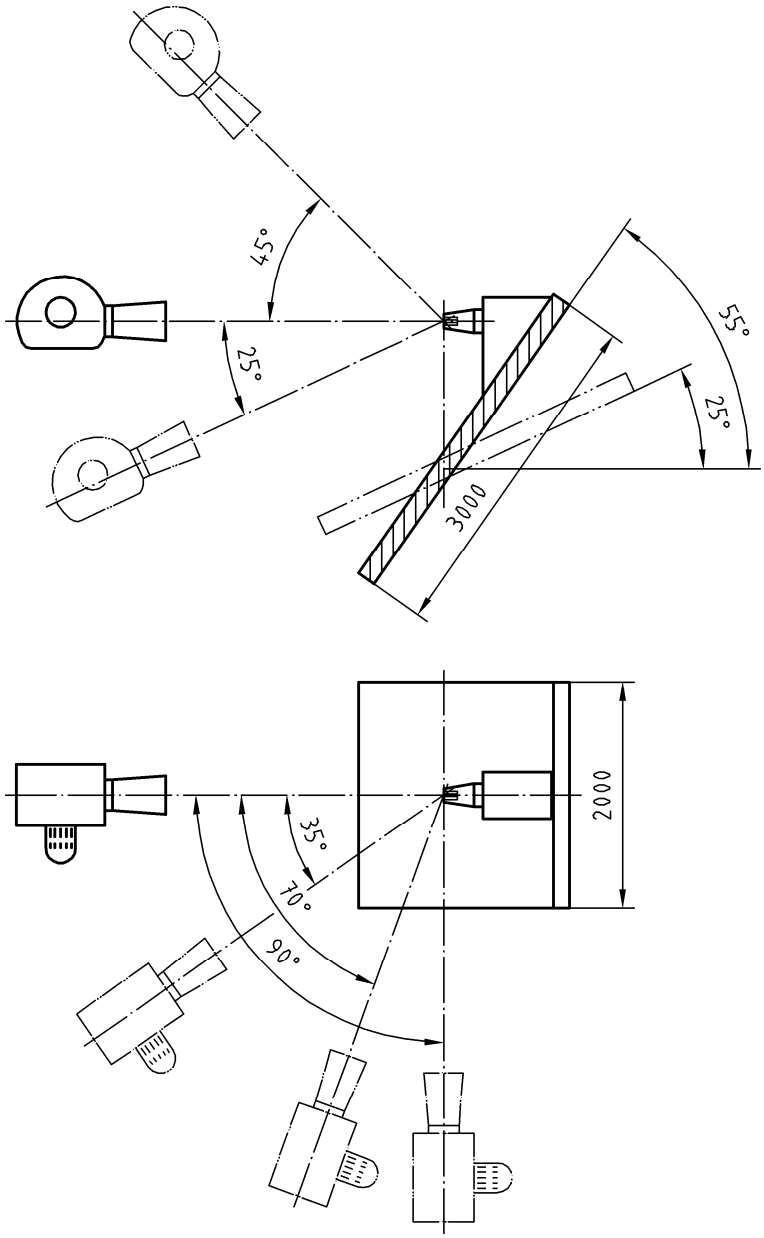
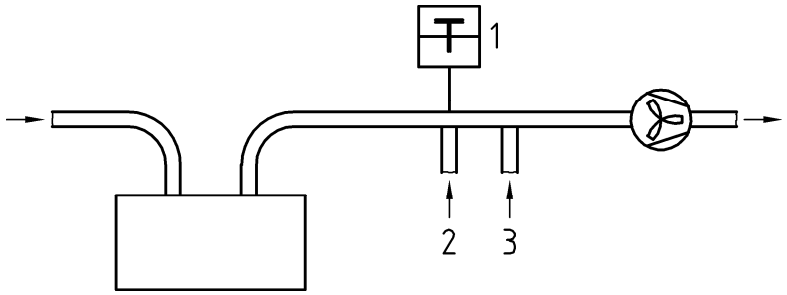


Figure 3d — Test rig for type C boilers fitted with a horizontal terminal on a sloping roof



Key

1 temperature

2 air suction – combustion products

3 CO – CO_2

Figure 4 — Test rig for boiler subject to suction of 200 Pa (see 7.6.2.3.4)

Annex A
(informative)

Classification of type C boilers

The figures in this annex are purely illustrations and are not intended to be technically perfect nor complete in themselves.

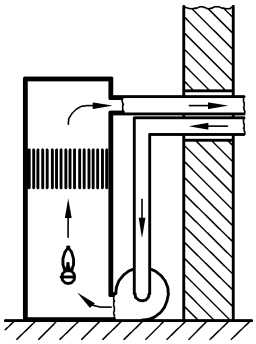


Figure A.1 — Type C_{13}

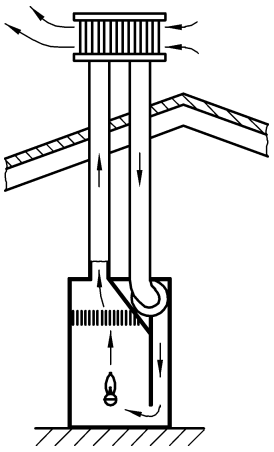


Figure A.2 — Type C_{33}

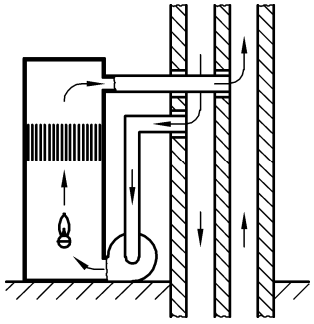


Figure A.3 — Type C_{43}

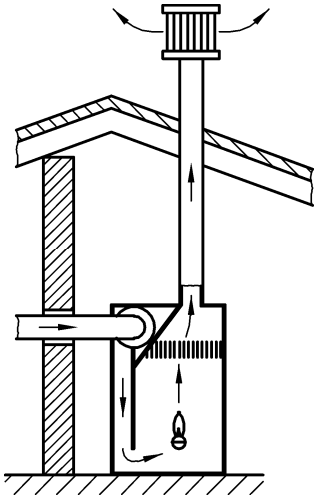


Figure A.4 — Type C_{53}

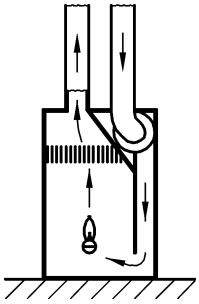


Figure A.5 — Type C_{63}

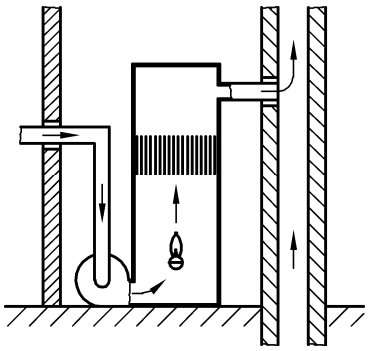


Table A.6 — Type C_{83}

Annex B
(informative)

Steel grades

This annex presents several stainless steel grades approved for completely surrounded or separate combustion products evacuation ducts outside the boiler and upstream from the nozzle.

These materials are approved on the date of publication of this European Standard.

(non-exhaustive list, dated 20/11/97)

— X2CrNiMo 17-22-2, N°1.1104 (AISI 316L)

— X1CrNiMoCu 25-20-5, N°1.4539 (AISI 904L)

— X2CrMoTi 29-4, N°1.4592 (F29 M Cu)

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 92/42/EEC on efficiency requirements for new hot-water boilers fired with liquid or gaseous fuels

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 92/42/EEC on efficiency requirements for new hot-water boilers fired with liquid or gaseous fuels.

Once this standard is cited in the Official Journal of the European Communities under that Directive and has been implemented as a national standard in at least one Member State, compliance with the clauses of this standard given in Table ZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

Table ZA.1 — Correspondence between this European Standard and Directive 92/42/EEC on efficiency requirements for new hot-water boilers fired with liquid or gaseous fuels

Clause(s)/subclause(s) of this EN	Essential Requirements (ERs) of Directive 94/42/EEC	Qualifying remarks/Notes
6.3.1	Clause 5	Efficiency at nominal output and part load

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

Bibliography

[1] CEN/TR 1749, *European Scheme for the classification of gas appliances according to the method of evacuation of the products of combustion (types)*

[2] EN 1857, *Chimneys — Components — Concrete flue liners*

[3] EN 13384-1, *Chimneys — Thermal and fluid dynamic calculation methods — Part 1: Chimneys serving one appliance*

[4] EN 13384-2, *Chimneys — Thermal and fluid dynamic calculation methods — Part 2: Chimneys serving more than one heating appliance*

[5] EN 14241-1, *Chimneys — Elastomeric seals and elastomeric sealants — Material requirements and test methods — Part 1: Seals in flue liners*

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