BS EN 624:2011

BSI Standards Publication

Specification for dedicated LPG appliances — Room sealed LPG space heating equipment for installation in vehicles and boats

bsi.

...making excellence a habit.™

National foreword

This British Standard is the UK implementation of EN 624:2011. It supersedes BS EN 624:2000 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee GSE/24, Dedicated LPG appliances.

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

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

ISBN 978 0 580 67462 4

ICS 43.040.60; 47.020.90; 97.100.20

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 March 2011.

Amendments issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 624

March 2011

ICS 43.040.60; 47.020.90; 97.100.20

Supersedes EN 624:2000

English Version

Specification for dedicated LPG appliances - Room sealed LPG space heating equipment for installation in vehicles and boats

Spécification pour les appareils fonctionnant exclusivement aux GPL - Appareils de chauffage à circuit étanche fonctionnant aux GPL à installer dans les véhicules et bateaux

Festlegungen für flüssiggasbetriebene Geräte - Raumluftunabhängige Flüssiggas-Raumheizgeräte zum Einbau in Fahrzeugen und Booten

This European Standard was approved by CEN on 8 January 2011.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 624:2011: E

Contents

Page

Foreword

This document (EN 624:2011) has been prepared by Technical Committee CEN/TC 181 “Dedicated LPG appliances”, the secretariat of which is held by AFNOR.

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 September 2011, and conflicting national standards shall be withdrawn at the latest by September 2011.

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

This document supersedes EN 624:2000.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

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

NOTE 1 Attention is drawn in particular to EN 1949, *Specification for the installation of LPG systems for habitation purposes in leisure accommodation vehicles and in other road vehicles*, in regard to the harmonization of operating pressures to be used in vehicles.

NOTE 2 Test methods and means of assessment for Clause 5 are given in Clause 6.

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

1 Scope

This European standard specifies the characteristics of safety, construction, performance and efficiency, the test methods and marking, of room sealed space heating equipment of type C (see CEN/TR 1749) with combustion air intake and outlet for the products of combustion in the wall, roof or floor, combined or not. These are referred to in the body of the text as "heaters", burning LPG, for vehicles and boats.

This European standard only covers room sealed heaters also including those which have a combustion air fan, an integral hot air fan or both, only for vehicles and boats which are used for residential, recreational and commercial purposes.

This European standard applies to heaters which are installed either outside or inside the habitable volume, but which have a combustion circuit sealed from the vehicle's interior, and nominal heat input which does not exceed 10 kW (H_s) operated at supply pressure of 30 mbar, 28 mbar, 37 mbar and 50 mbar, using, where appropriate, 12 V or 24 V DC electrical supply.

Room sealed LPG space heating appliances for vehicles and boats are using very often warm air as a heat transfer medium. Annex B specifies additional requirements for appliances using water as a heat transfer medium.

For private cars and vehicles or boats used for the transport of dangerous goods or for commercial personnel transport additional requirements may be necessary.

This European standard does not cover requirements for storage water heaters (boilers) (see EN 15033). For appliances producing additional sanitary hot water (combi-boilers), see relevant clauses of EN 15033.

NOTE If a LPG operated heater is installed in a motorized vehicle being subject to European road traffic legislation, the directives of the Council for the approximation of the laws, regulations and administrative provisions of the member states relating to the heating of the interior of motor vehicles should be applied.

These heaters are also suitable for caravan holiday homes.

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 161:2001, *Automatic shut-off valves for gas burners and gas appliances*

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

EN 437, *Test gases — Test pressures — Appliance categories*

EN 549, *Rubber materials for seals and diaphragms for gas appliances and gas equipment*

EN 1057, *Copper and copper alloys — Seamless, round copper tubes for water and gas in sanitary and heating applications*

EN 10226-1, *Pipe threads where pressure tight joints are made on the threads — Part 1: Taper external threads and parallel internal threads — Dimensions, tolerances and designation*

EN 10226-2, *Pipe threads where pressure tight joints are made on the threads — Part 2: Taper external threads and taper internal threads — Dimensions, tolerances and designation*

EN 60335-1, *Household and similar electrical appliances — Safety — Part 1: General requirements (IEC 60335-1:2001, modified)*

EN 60335-2-21, *Household and similar electrical appliances — Safety — Part 2-21: Particular requirements for storage water heaters (IEC 60335-2-21:2002, modified)*

EN 60335-2-102:2006, *Household and similar electrical appliances — Safety — Part 2-102: Particular requirements for gas, oil and solid-fuel burning appliances having electrical connections (IEC 60335-2-102:2004, modified)*

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

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

EN ISO 3166-1:2006, *Codes for the representation of names of countries and their subdivisions — Part 1: Country codes (ISO 3166-1:2006)*

3 Terms, definitions and symbols

3.1 Terms and definitions

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

3.1.1
caravan
trailer leisure accommodation vehicle that meets the requirements for the construction and use of road vehicles

[EN 13878:2003]

3.1.2
motor caravan
self-propelled leisure accommodation vehicle that meets requirements for construction and use of road vehicles

NOTE 1 It contains at least:

- seats and table,
- sleeping accommodation which can be converted from the seats,
- cooking facilities and
- storage facilities.

NOTE 2 Definition adapted from EN 13878:2003.

3.1.3
boat
craft up to 24 m in length

3.1.4
caravan holiday home
transportable leisure accommodation vehicle that does not meet requirements for construction and use of road vehicles, that retains means for mobility and is for temporary or seasonal occupation

[EN 13878:2003]

3.1.5
space heater
heating equipment installed inside or outside the habitable volume with a sealed combustion circuit

3.1.6
space heater installation box
enclosure that surrounds the heater in such a manner that a minimum distance is always maintained between the space heater and the adjacent walls

3.1.7
liquefied petroleum gas (LPG)
mixture of light hydrocarbons, gaseous under conditions of normal temperature and pressure and maintained in the liquid state by increase of pressure or lowering of temperature

NOTE The principal components are propane, propene, butane and butenes.

3.1.8
liquefied petroleum gas installation
components usually consisting of fuel container(s), pressure regulator(s), piping, hoses and shut-off devices, providing liquefied petroleum gas to appliances

3.1.9
working pressure
pressure at the inlet of the appliance while it is in operation

3.1.10
piping
pipeline of rigid metallic material

3.1.11
pressure regulator
device or system of devices to reduce the inlet pressure and to maintain the pressure required to operate a heater and/or other appliances

3.1.12
room sealed heater
heater that has the combustion circuit isolated from the habitable volume in which the heater is installed

3.1.13
combustion circuit
entire arrangement inside the habitable volume of the vehicle from the combustion air intake to the flue outlet, including the actual space heater and all connecting pipes and other combustion air or exhaust gas conducting parts

3.1.14
combustion air supply
part of the combustion circuit through which the combustion air is supplied from outside

3.1.15
injector
calibrated component that admits the gas into a burner

3.1.16
flue
duct designed to convey the products of combustion to the exterior of a vehicle or boat

3.1.17
flue outlet
cowl
part of the combustion circuit through which the products of combustion are discharged to the outside

3.1.18
wind protection device
cover over the combustion circuit openings on the outside of the vehicle, which protects the circuit from unacceptable effects of the wind (e.g. deflector plates, covering hoods)

3.1.19
space heater cover
part which encloses the sides of the heat exchanger facing the installation area and conducts the air to be heated past the heat exchanger to the outlet openings

3.1.20
combustion air fan
device which assists the flow of the combustion air or of the products of combustion

3.1.21
integral hot air fan
component of the space heater which provides heat dissipation and is essential for the proper function of the heater

3.1.22
hot air distribution devices
devices which do not form a direct part of the heater (e.g. non-integral fan, pipe fittings, blown-air outlets) and which distribute the hot air generated by the heater around the inside of the vehicle or boat

3.1.23
heating water distribution devices
devices, which do not form a direct part of the heater (e.g. pump, pipes, hoses, convectors) and which distribute heating water generated by the heater around the inside of the vehicle or boat

3.1.24
control devices
devices which change or stop the flow of gas by means of actuating mechanisms consisting of a control valve and a valve actuator

3.1.25
tap
device to open or close the gas supply to the various burners and to adjust their rate during use to a predetermined value, called the reduced rate

3.1.26
tap handle
manually operated component used to open, partially open, or close a tap

3.1.27
control valve
device to change or stop the flow of gas by the closure and/or the partial closure of an orifice

3.1.28
valve actuator
device which operates (manually, electrically, hydraulically or pneumatically) a control valve

3.1.29
flame supervision device
device including a sensing element which causes the gas supply to a burner to be opened or closed according to the presence or absence of the flame which activates the sensing element

3.1.30
automatic burner control
device which consists of a flame detector which signals the presence or absence of a flame and of a control box which is actuated by the signals of the flame detector and which starts or shuts down the burner according to an established programme

3.1.31
fail safe device
device which causes, in the event of internal or external faults, either a safe operation or a safety shut-down

3.1.32
spark restoration
automatic process by which, following flame failure, the ignition device is switched on again without interruption of the gas supply

3.1.33
recycling
automatic process by which, after loss of flame during operation, the gas supply is interrupted and the full start procedure is re-initiated automatically (normally after a minimum required waiting time, without a fan or prepurge time, with a fan)

3.1.34
ignition device
device which lights the ignition burner/main burner(s) with the aid of external energy (e.g. a spark)

3.1.35
ignition interlock
device for preventing direct ignition of the main burner at full rate

3.1.36
restart interlock
device which prevents re-opening of the control element during the time when the flame supervision device is open

3.1.37
ignition process
process which may consist of the following individual stages:

— Stage 1: lighting of the gas stream by an ignition source;

— Stage 2: ignition transfer from an ignition burner to the main burner or between several burners (cross-lighting);

— Stage 3: complete ignition of individual burners (if they do not consist of a single flame)

3.1.38
ignition burner
small burner that provides a continuously burning flame to ignite a main burner, when required

NOTE This is sometimes referred to as a pilot.

3.1.39
waiting time
— for thermoelectric flame supervision devices, the time to be kept by the operator between the closing and re-opening of the gas supply;

— for automatic burner control systems in the case of a restart, the time between valve closure on flame loss and valve re-opening

3.1.40
ignition delay time
time between the signal of loss of flame and start of ignition at re-ignition

3.1.41
extinction safety time
— for a thermoelectric flame supervision device, the time that elapses between the disappearance of the supervised flame and the interruption of the gas supply;

— for automatic burner control units, the time between the extinction of the supervised flame and the start of recycling

3.1.42
ignition safety time
— for a thermoelectric flame supervision device, the time between the ignition of the flame and the moment when the closure element is held open by the flame signal;

— for automatic burner control units, the time at a starting procedure between the signals for the opening and closing of the gas supply if no flame is recognised

3.1.43
thermostat
automatic device to maintain a selected sensibly constant temperature

3.1.44
external gas tightness
tightness of gas-carrying parts to the atmosphere

3.1.45
internal gas tightness
tightness of one gas-carrying part to another

3.1.46
soft solder
solder of which the lowest temperature of the melting range, after application, is less than 450 °C

3.1.47
sound mechanical joint
connection device assuring tightness in an assembly made up of several parts, generally of metal

3.1.48
heat input of burner
product of the volume or mass rate and the calorific value of the gas (brought to the same reference conditions) expressed in kilowatts

3.1.49
nominal heat input of a burner
value of the heat input of the burner, as stated on the data plate of the heater

3.1.50
heat output
value of the heat input multiplied by the efficiency factor

3.1.51
volume rate
volume of gas passed in unit time expressed in cubic metres per hour or in litres per hour (cubic decimetres per hour)

3.1.52
mass rate
mass of the gas passed in unit time expressed in kilograms per hour or grams per hour

3.1.53
calorific value
quantity of heat produced by complete combustion at a constant pressure equal to 1 013,25 mbar, of unit volume or mass of the gas, the components of the fuel mixture being at 15 °C, 1 013,25 mbar and the products of combustion being brought to the same conditions

NOTE 1 There are two calorific values:

- the gross calorific value (H_s): the water produced by combustion is assumed to be condensed;

- the net calorific value (H_i): the water produced by combustion is assumed to be retained in the vapour state.

NOTE 2 For the purposes of this standard only the gross calorific value is used.

NOTE 3 The calorific value is expressed in units of energy to the unit volume of dry gas measured under normal reference conditions: 15 °C, 1 013,25 mbar. It is expressed in kilowatthours per cubic metre (kWh/m^3).

3.1.54
wobbe index
ratio of the calorific value of a gas, by unit of volume, and the square root of the relative density of the same gas

NOTE The Wobbe index is called gross when the calorific value considered is the gross calorific value (see 3.1.53). It is usually expressed in megajoules per cubic metre (MJ/m^3).

3.1.55
stability of flames
condition of the flames at the burner ports when the phenomena of flame lift or light back do not occur

3.1.56
light back
phenomenon characterized by the return of the flame inside the body of the burner

3.1.57
flame lift
phenomenon characterised by the partial or total movement of the base of the flame away from the burner port

3.1.58
cold condition
condition of the heater obtained by allowing the unlit heater to attain equilibrium at room temperature

3.1.59
hot condition
condition of the heater obtained by heating to thermal equilibrium at the adjustment pressure, any thermostat remaining fully open

3.1.60
minimum operational rate
— for any burner or section of a burner that is controlled by a thermostat, the bypass rate;

— for any burner that is manually controlled but where it is only possible to obtain certain predetermined fixed settings, the lowest rate obtainable in normal use

3.1.61
central water heater
room sealed LPG space heating appliance using water as a heat transfer medium (heating water)

3.1.62
heating water
water, which may incorporate additives, used as a heat transfer medium

3.1.63
compensator reservoir
container to hold and which allows for the expansion of heating water when heated up

3.1.64
open system
system, open to the atmosphere, for the heating water

3.1.65
closed system
pressurized system for the heating water

3.1.66
heating water circuit
system of central water heater and all the elements necessary to convey the heating water in the vehicle to the convectors/radiators

3.1.67
drain valve
device for draining the heating water

3.1.68
bleed valve
device for the removal of air from the heating water circuit

3.1.69
anti-freeze
liquid added to the heating water to avoid freezing

3.1.70
circulation pump
pump for circulating the heating water in the water circuit

3.1.71
operating pressure
relative pressure in a container

3.2 Symbols

M mass rate

Q heat input of burner

Q_n nominal heat input of a burner

V volume rate

W_s wobbe index

4 Requirements

4.1 Classification of gases

Gases likely to be used are classified in families according to the value of their Wobbe index based on gross calorific value (H_s).

Table 1 — Classification of gases

Category	Wobbe-Index in MJ/m^3; H_s at 15 °C
$I_{3B/P}$, $I_{3+\ (28/30\text{-}37)}$	$72{,}9 \leq W_s \leq 87{,}3$
I_{3P}	$72{,}9 \leq W_s \leq 76{,}8$
I_{3B}	$81{,}8 \leq W_s \leq 87{,}3$

4.2 Classification of heaters

Heaters are classified in categories according to the gases that they are designed to use. However, for each country, only some of the categories defined hereafter are applicable, on account of local gas distribution conditions (types of gas and supply pressures).

Operating pressure for heaters in road vehicles (e.g. caravans and motorcaravans) shall be 30 mbar. Tables A.1 and A.2 show the gas distribution conditions for boats and non road vehicles. Table A.3 show the types of connection applicable to each country.

NOTE Non road vehicles are vehicles which do not comply with the road vehicle regulations, but retains means of mobility.

This specification only covers appliances of the following categories:

a) appliances in category I_{3+} which may be used at a nominal operating pressure of 37 mbar when used on propane and a nominal operating pressure of 28 mbar or 30 mbar when used on butane;

b) appliances in category $I_{3B/P(30)}$ which may be used with propane, butane or mixes of these gases at a nominal operating pressure of 28 mbar or 30 mbar;

c) appliances in category $I_{3B/P(50)}$ which may be used with propane, butane or mixes of these gases at a nominal operating pressure of 50 mbar;

d) appliances in category $I_{3B(28\text{-}30)}$ which may be used with butane only at a nominal operating pressure from 28 mbar to 30 mbar;

e) appliances in Category $I_{3P(30)}$ which may be used with propane only at a nominal operating pressure of 30 mbar;

f) appliances in category $I_{3P(37)}$ which may be used with propane only at a nominal operating pressure of 37 mbar;

g) appliances in category $I_{3P(50)}$ which may be used with propane only at a nominal operating pressure of 50 mbar.

5 Safety, constructional and performance characteristics

5.1 Conversion to different gases

The appliance shall be supplied for a single gas category and for a single operating pressure or pressure couple unless where the test pressure range for that category includes the test pressure range for other categories. If this is the case the subsidiary categories may also be stated on the data plate. For example for category I_{3+} the test pressures for categories $I_{3B/P(30)}$, $I_{3P(37)}$ and I_{3B} are covered.

Conversion to another category or pressure or pressure couple is not permitted.

5.2 Materials

The quality and thickness of materials used in the construction of a heater shall be such that the safety characteristics are not altered in use.

In particular, all parts of the heater including controls shall withstand the mechanical, chemical and thermal conditions to which they may be submitted during their use and at ambient temperatures between −20 °C and +60 °C. In normal conditions of use, of cleaning or of adjustment, the materials shall not be liable to any alterations which might impair their performance. Sheet metal parts not made of corrosion-resistant material shall be vitreous enamelled or be covered with another effective protection against corrosion.

Materials of appliances which are intended to be used in road vehicles of categories M1 and N1 shall comply with European Directive 2000/53/EC.

Materials containing asbestos shall not be used.

Aluminium gas pipes shall not be used.

All accessible components shall have no sharp edges or corners likely to cause injury during use or maintenance. Mountings for glass components shall be such as to avoid stresses on the glass during normal use.

The appliance shall be so designed that it is able to absorb vehicle vibrations and relative movements. All parts of the combustion circuit shall be made of corrosion resistant materials or be provided with a permanent protection against corrosion (by, for example, condensate water). If mild steel protected against corrosion is used for parts in contact with exhaust gas, the minimum thickness shall be 1 mm. For appliances to be used in marine environments additional corrosion protection may be needed.

The seals with which the exhaust gas comes into contact shall not be adversely affected by moisture or heat (see 5.13).

Non metallic materials which are used as seals and lubricants in the gas path shall be resistant to LPG. Diaphragms and seals shall comply with EN 549.

5.3 Accessibility of components

Components which require maintenance or replacement shall be designed or marked in such a manner that they cannot be incorrectly fitted while following the instructions for maintenance and servicing.

If batteries etc. have to be replaced regularly, this replacement shall be easy.

Operating elements, such as handles, levers, etc., shall be accessible, but arranged in such a manner that they cannot be broken off or damaged.

5.4 Strength of assembly

The construction of a heater shall be such that, during normal conditions of transport, installation, use and maintenance, any displacement of parts, distortion or deterioration likely to impair its performance shall not occur.

5.5 Tightness

5.5.1 Tightness of the gas carrying parts

5.5.1.1 Construction

Holes for screws, pins, etc. intended for the assembly of components shall not open into the gas ways and shall leave a minimum wall thickness of 1 mm.

The tightness of assemblies connected to the gas circuit shall be assured, by means of metal-to-metal joints or joints with seals (e.g. washers, O-rings or gaskets).

For parts that are not required to be dismantled during normal maintenance, the use of thread sealing compounds complying with EN 751-1 or EN 751-2 is permitted.

Soft solder shall not be used to ensure the tightness of the connections of the gas circuit within the heater.

Removable components or the threaded parts of the pipe work which are likely to be dismantled during normal maintenance shall remain sound after five disconnections, if necessary after changing a gasket, where the manufacturer's instructions require this.

5.5.1.2 Tightness test

When tested in accordance to 6.5.1.2, the leak detected shall not exceed 40 cm^3/h.

5.5.2 Tightness of combustion circuit

The heaters, including all parts which serve as the combustion air supply and flue shall form a continuous leakproof arrangement. Any necessary extension pieces shall be fitted and all items, including ducts shall be part of the appliance or specified in the installation instructions.

The combustion circuit from the combustion air intake to the entry of the heat exchanger shall not exceed a leakage rate of 1,0 m^3/h when tested as in 6.5.2.2.

The combustion circuit from the entry of the heat exchanger to the flue outlet shall not exceed a leakage rate of 0,2 m^3/h when tested as in 6.5.2.2.

5.6 Gas inlet connection

The gas inlet connection shall be rigid and securely attached to the heater. Types of connection are shown in Table A.3.

5.7 Heater stability and fixing

The heater shall be designed so it is mechanically secure to the vehicle structure.

When the heater is installed as described in the manufacturer's instructions, it shall not be capable of moving from its installed position.

5.8 Taps and controls

5.8.1 General

Taps shall be placed in such a position that they are easy to operate and not subject to damage in normal use. Their operation shall remain easy during and after the tests described in Clause 6. They shall be protected against external clogging. All parts of a control shall be clean.

Taps shall be mounted in such a way that no accidental movement of the tap body relative to the gas supply connection is possible.

Controls placed in the gas circuit shall be arranged that maintenance by a service engineer is easy and that its exchange by a service engineer is possible.

The heater shall not incorporate a pressure regulator.

Heaters having a manually ignited atmospheric burner shall be equipped with an ignition interlock, reignition interlock or an equivalent device, unless when tested as described in 6.19.3 the heater and its flue withstand a maximum energy delayed ignition without danger to the user.

Heaters having a nominal heat input > 3,5 kW shall be equipped with a temperature regulator. The heat input of the space heater can be variable and/or have an "on-off" setting as a function of the room temperature. If the heat input is continuously varied, a turndown ratio of at least 1:3 shall be achieved. Failure of the temperature regulator shall not result in a permanent damage of the heater. If a temperature regulator is not provided in case of heaters with a nominal heat input ≤ 3,5 kW, the gas supply shall be manually variable in a ratio of at least 1:3 by means of the control element.

A plug type tap shall have a compensating device to take up automatically any wear between the plug and the tap body.

Control devices shall be manufactured from non-combustible materials which do not deform in use. This requirement does not apply to:

— external accessories;

— internal seals;

— diaphragms;

— lubricants.

Gas carrying components shall be made from corrosion resistant metallic materials or be protected against corrosion.

Each safety shut-off valve shall be fitted with a filter on its inlet.

Each heater shall have the means whereby the user can turn the heater on or off and check its state.

5.8.2 Automatic shut-off valves

5.8.2.1 For heaters with automatic burner control and a heat input greater than or equal to 7 kW there shall be two automatic shut-off valves in series, both at least complying to EN 161, Class B.

The first valve shall act as the safety shut-off valve and shall interrupt the gas supply to the main and any ignition burner and be operated by the flame supervision device or any other safety devices. The second valve shall act as the burner control valve.

5.8.2.2 Both valves shall be operated by independent outlets of the electrical control unit.

5.8.2.3 For heaters with automatic burner control and a heat input smaller than 7 kW a single automatic shut-off valve may be used to operate both as the safety shut-off valve and as the burner control valve, as long as it is fitted with a stainless steel closing spring in addition to the filter called for in 5.8.1 and complies to EN 161, Class A with a working pressure of 300 mbar. Alternatively, a valve complying with EN 161:2001, Class E can be fitted with a sealing force at least equivalent to a pressure five times the maximum working pressure of the supply piping, but at least to 300 mbar, and equipped with a fatigue proof, stainless steel closing spring.

5.8.2.4 Heaters with one automatic shut-off valve shall withstand the maximum energy delayed ignition test detailed in 6.19.3, i.e. shall show no visible distortion or damage.

5.9 Control handles

The “closed“, “open“ and any reduced rate positions shall be marked in a clear and durable fashion. The closed position shall be indicated by a full disc or a circle of at least 3 mm in diameter.

If control handles operate by turning, the closing direction shall be clockwise.

Any special position of the tap intended for ignition and/or any special button that has to be operated to cause ignition shall be clearly marked (for example a star).

Where more than one tap is provided, it shall be obvious which burner is controlled by each tap.

Tap handles shall be so arranged relative to one another that the movement of one handle does not cause inadvertent movement of an adjacent one.

Tap handles shall be so designed that they cannot move by themselves. The shape of a handle shall be such that its grip makes manipulation easy.

5.10 Injectors

The heat input shall be restricted by an injector. If additional preset devices are provided in the gas path, they shall be factory sealed.

Injectors shall carry an indelible means of identification of their application.

Adjustable injectors shall not be used.

5.11 Ignition devices

5.11.1 The heater shall be provided with an integral igniter which enables the heater to be ignited with the combustion chamber closed and without the cover being detached. For heaters having a nominal heat input > 5 kW, the ignition shall only be possible at a reduced rate position. The positions of all burners relative to one another shall not change under operating conditions.

5.11.2 Electrical/electronic ignition devices shall comply with Clause 8 of EN 60335-2-102:2006.

5.12 Safety devices

5.12.1 General

A flame supervision device shall be fitted to the heater. It shall be so designed that, in the case of a failure of any of the components indispensable to its performance, the supply of the gas to the burner is cut off automatically.

With the exception of devices which are manually operated and require continuous manual operation the heater shall not incorporate any device which allows the flame supervision device or any other safety device to be overridden.

5.12.2 Thermoelectric flame supervision devices

Under the conditions of test described in 6.12.2.2 the ignition safety time shall not exceed 20 s. This safety time does not include any purge time necessary for heaters equipped with a combustion air fan. The extinction safety time shall not exceed 60 s under the conditions specified in 6.12.2.3. Heaters equipped with thermoelectric flame supervision devices shall either:

a) incorporate a restart interlock to prevent manual re-ignition at full rate after loss of flame before the flame supervision device has closed or

b) have a spark restoration device which operates within 1 s of flame loss or

c) have a warning notice on the heater, warning against manual re-ignition within the waiting time of at least 3 min of flame loss (see 7.1.2 c)) or

d) be able to withstand the maximum energy delayed ignition test as detailed in 6.19.3 without damage to the heater or the user.

5.12.3 Automatic burner control system

5.12.3.1 Prepurge time

In the case of heaters which are equipped with an automatic burner control system and with a burner(s) with combustion air fan, the fan shall operate during the prepurge time. The prepurge time during start and recycling shall not be less than 15 s. Only one recycling sequence is permitted.

5.12.3.2 Safety times

The extinction safety time of an automatic burner control system shall not be more than 10 s at cold start and at spark restoration. In case of automatic burner control systems without re-ignition at flame loss the extinction safety time shall be no more than 1 s.

5.12.3.3 Waiting time

In case of heaters which are equipped with an automatic burner control system without fan the waiting time shall be at least 3 min, but less than 10 min.

5.12.3.4 Burner control

Any automatic burner control system for the heater shall comply with EN 298:2003 with the following exceptions:

— 6.1 (excluding last sentence);

— 6.5 (excluding 6.5.2.2.2 and the tests according to EN 60730-1);

— 7.1 to 7.5 (volatile lock-out device only to be tested for manual start);

— 8.7 severity level 3;

— 9 (excluding 9.1.2 b), 9.2.2).

5.12.3.5 Combustion air fan supervision

a) Heaters with an output smaller than or equal to 4 kW shall incorporate supervision of either the combustion air fan motor current or the combustion air fan speed or the combustion air flow, such that the heater will lock out if the supervised parameter is outside the envelope of the appliance.

b) Heaters with an output greater than 4 kW and smaller than or equal to 7 kW shall incorporate supervision of either the combustion air fan speed or the combustion air flow, such that the heater will lock out before the CO content of the dry, undiluted products of combustion exceeds 0,2 % when using reference gas at normal pressure.

c) Heaters with an output greater than 7 kW shall incorporate supervision of the combustion air flow, such that the heater will lock out before the CO content of the dry, undiluted products of combustion exceeds 0,2 % when using reference gas at normal pressure.

d) All heaters shall lock out when the duct for the products of combustion or the combustion air intake duct is completely obstructed.

5.12.3.6 Hot air fan supervision

In case of a heater equipped with an integral hot air fan its function shall be supervised. If the temperature of the hot air exceeds 220 K over ambient temperature at the heater‘s exit the burner shall be switched off and locked automatically. An additional switch-off of the burner operation below this temperature is permitted.

5.12.3.7 Lock-out indication

For automatic burner control systems, an indication of lock-out shall be visible to the user at the control unit.

5.12.3.8 Characteristics at high and low voltage

The flame supervision device shall operate normally under the test conditions in 6.12.3.8.

Automatic burner control systems shall operate as specified in a voltage range from 75 % to 120 % of the nominal voltage. In the event of the voltage dropping below the lower limit, the function shall remain also stable and the automatic flame supervision device shall operate reliably or affect a safety cut-off or stand-by respectively.

The automatic burner control system may switch the heater to standby at a supply voltage between 95 % and 75 % of the nominal voltage to avoid nuisance lock-outs in the event of temporary reductions in voltage. If this facility is provided then the heater shall perform a normal start-up sequence on resumption of normal voltage.

5.12.3.9 Humidity resistance

During the first 30 min after the treatment laid down in 6.12.3.9 the automatic burner control system shall either operate correctly or go to safety shut down or stand by. After 30 min it shall operate correctly as required by 5.12.3.1 and 5.12.3.2.

5.12.3.10 Vibration resistance

After the vibration test as laid down in 6.12.3.10 the automatic burner control system shall operate correctly as required by 5.12.3.1 and 5.12.3.2.

5.12.3.11 Long term performance

During and after the long term test as laid down in 6.12.3.11 the automatic burner control system shall operate correctly as required by 5.12.3.1 and 5.12.3.2.

5.12.3.12 Reversed polarity

When tested as 6.12.3.12 the heater shall not fail to a dangerous state nor suffer damage. It shall either:

a) operate satisfactorily or

b) not operate at all but operate satisfactorily when the polarity is subsequently corrected or

c) blow a fuse or fuses but operate satisfactorily when the polarity is subsequently corrected and the fuse/s replaced.

5.13 Ducts for the products of combustion and cowls

5.13.1 Combustion air supply inlet, flue outlet and wind protection device (cowl)

5.13.1.1 The openings of the combustion air supply and for the products of combustion outlet whether separate or combined shall be protected so that a 16 mm diameter ball cannot be introduced from the outside.

5.13.1.2 The components shall be designed so that no part of any combustion air inlet, products of combustion outlet and wind protection devices protrudes more than 30 mm from the side of a road vehicle.

5.13.1.3 All combustion air supplies, the outlets and wind protection devices shall be designed so that they are resistant to rain water and splashes. Any water which does enter shall not result in unsafe operation of the heater.

5.13.1.4 The cross sectional area of the openings in the cowls shall not be adjustable. A closable cowl which only has the two positions "open" or "closed" is permitted.

5.13.2 Evacuation ducts for the products of combustion

5.13.2.1 Ducts for the products of combustion which are laid inside a combustion air supply duct shall be tested as part of the combustion circuit and comply with 5.5.2 when tested as in 6.5.2.2.

5.13.2.2 The cross sectional area of combustion air supply and evacuation ducts for the products of combustion shall not be adjustable.

5.13.2.3 Ducts for the products of combustion which are not entirely laid inside combustion air supply ducts when tested as in 6.13.2.3 shall have a leak rate of not more than 1 dm^3/h per metre of length and comply with the requirements of 5.13.2.4, 5.13.2.5, 5.13.2.6.

5.13.2.4 When tested as described in 6.13.2.4 the duct for the products of combustion shall not extend by more than 15 % of its original length. The permanent extension shall not be greater than 10 % of the original length.

5.13.2.5 After being subjected to the bending test described in 6.13.2.5 the duct for the products of combustion shall meet the sealing requirements of 5.13.2.3, and the cross sectional area shall not be reduced by more than 10 %.

5.13.2.6 When tested as described in 6.13.2.6 the duct for the products of combustion shall not extend more than 25 % of its original length. After testing and in the cool state the duct shall meet the sealing requirements of 5.13.2.3.

5.14 Verification of the heat input

When tested in accordance with 6.14 each of the burners, supplied separately, shall give the nominal heat input stated by the data plate.

A tolerance of ± 5 % relative to the nominal heat input is permitted for the value obtained in the test.

For injectors of diameter < 0,5 mm a tolerance of ± 10 % relative to the nominal heat input is permitted for the value obtained in the test.

5.15 Temperature of various parts of the heater

When tested in accordance with 6.15 the surface temperature of the various parts of the heater indicated below shall not exceed the specified limits.

The temperature of those parts that are intended to be touched (tap handles, buttons, knobs) shall not exceed the ambient temperature by more than:

— 35 K for metals or equivalent materials;

— 45 K for porcelain or equivalent materials;

— 60 K for plastics or equivalent materials.

The temperature of the front and sides of the heater excluding convected air outlet grilles and surfaces within 25 mm of these shall not exceed the ambient by more than 100 K. The temperature of convected air outlet grills and surfaces within 25 mm of these (working surfaces) shall not exceed 220 K above ambient temperature.

5.16 Temperature of the floor, walls or adjacent surfaces

When tested in accordance with 6.16 the temperature of the floor on which the heater and its ducts are placed, the temperature of the walls situated near the heater and its ducts and, when applicable, the ceilings, shelves or cupboards above the heater and its ducts shall not exceed the ambient temperature by more than 50 K.

5.17 Temperature of taps and components

When tested in accordance with 6.17, the temperature of tap bodies and components, including glass components, shall not exceed the maximum value allowed according to their specifications.

5.18 Temperature of the products of combustion

The temperature of the products of combustion shall not exceed 230 K above ambient temperature when tested in accordance with 6.18.

The temperature of the products of combustion has no lower limit.

5.19 Ignition

5.19.1 General

When tested in accordance with 6.19 ignition shall be from an easily accessible position.

In the case of hand-operated electric igniters at least 8 out of 10 ignition attempts shall result in the flame lighting after purging the supply pipes with gas.

For fully automatic ignition systems, ignition is deemed satisfactory if every ignition sequence results in the flame lighting after purging.

Any ignition burner or control flame shall not go out when the main burner is lit or extinguished.

Any condensation during start-up shall not impair the safe operation of the heater.

Under the test conditions defined in 6.19 and in a still atmosphere, ignition of pilots and burners shall be ensured correctly, i.e. ignition is smooth, flames carry across to all ports or jets, flames do not light back, flames do not leave the confines of the heater and do not cause excessive noise.

A slight tendency to flame lift is permitted at the moment of ignition, but the flame shall be stable under full working conditions.

5.19.2 Ignition performance

5.19.2.1 Cold condition

When the heater is operated according to the manufacturer‘s instructions and tested in accordance with 6.19.2.1, ignition shall be satisfactory.

5.19.2.2 Hot condition

Ignition shall be satisfactory when tested in accordance with the method in 6.19.2.2. Ignition shall also take place at any thermostat setting down to that which will give the minimum operational rate.

5.19.2.3 At low temperature

When tested in accordance with 6.19.2.3, ignition shall be satisfactory.

5.20 Crosslighting

5.20.1 General

When tested in accordance with 6.20 and in a still atmosphere, crosslighting between burners shall be ensured correctly and without excessive noise. The flames shall be stable and quiet. A slight tendency to flame lift is permitted at the moment of ignition, but the flame shall be stable under full working conditions.

5.20.2 Cold condition

When tested in accordance with 6.20.2 the crosslighting of heaters having burners subdivided into sections and between ignition burners and main burners shall be smooth and flames shall carry across to all ports or jets and not light back to the injector.

5.20.3 Hot condition

When tested in accordance with 6.20.3 the crosslighting of heaters having burners subdivided into sections and between ignition burners and main burners shall be smooth and flames shall carry across to all ports or jets and not light back to the injector.

5.20.4 Crosslighting at low temperature

When tested in accordance with 6.20.4 the crosslighting of heaters having burners subdivided into sections and between ignition burners and main burners shall be smooth and flames shall carry across to all ports or jets and not light back to the injector.

5.20.5 Conditions of ignition burner flame shortening

The arrangement of any flame supervision device shall be such that, in the event of ignition burner flame shortening, the valve in the device shall close the supply of gas to the main burner before crosslighting becomes violent.

On a heater that incorporates a permanent ignition burner flame, crosslighting in the cold condition shall take place and shall not be violent when the ignition burner is reduced to two-thirds of its normal rate. In addition, the crosslighting shall be such that the heater is not damaged when the flame is reduced to the point at which it will just remain alight.

5.21 Flame stability

5.21.1 Flame lift

When tested in accordance with 6.21.1 the flames shall not lift or be extinguished.

Burners that are sub-divided into sections under separate control shall also meet this requirement at all control settings.

5.21.2 Light-back

When tested in accordance with 6.21.2 in the hot condition the flames shall not light back.

The heater shall show no deterioration after the test.

5.21.3 Sooting

When tested in accordance with 6.21.3 there shall be no accumulation of soot likely to affect the safe operation of the heater.

5.22 Combustion in still air

When tested in accordance with 6.22 the CO content of the dry, air free, combustion products shall not exceed 0,1 %.

5.23 Resistance to wind

5.23.1 General

Test equipment and installation shall comply with the criteria of 6.23.1.

5.23.2 Flame stability

When tested in accordance with 6.23.2 the flame shall not lift, light back or be extinguished.

5.23.3 Ignition and crosslighting

When tested in accordance with 6.23.2 ignition and crosslighting shall be satisfactory.

5.23.4 Combustion

When tested in accordance with 6.23.2 the quantity of CO in the dry air free products of combustion shall not exceed 0,2 %.

5.24 Efficiency

When tested in accordance with 6.24 the efficiency shall be at least 83 %.

5.25 Ignition and combustion in motion

If the heater is intended to be used whilst the vehicle is in motion, ignition and crosslighting shall be satisfactorily. The CO-content in the dry, air free products of combustion shall not exceed 0,2 % when tested in accordance with 6.25.

5.26 Prolonged performance test

After testing in accordance with the method given in 6.26 the heater shall comply with the following requirements:

a) no part of the heater, especially any non-metallic seal in the exhaust gas system shall have suffered any breakdown or deformation liable to affect the safety of the heater or lead to any reduction in the life of the components;

b) there shall be no deterioration of the heater cover;

c) there shall be no seizure of screws or other changes likely to cause undue difficulty in subsequent maintenance;

d) any tap shall be easy to turn both with the heater hot and when it has cooled down;

e) after cooling down, the heater shall comply with the tightness requirements given in 5.5.1;

f) the heat input shall not have changed by more than 5 % from its initial value;

g) the requirements of 5.22 shall be met;

h) the requirements of 5.19.2.3 shall be met.

5.27 Electromagnetic compatibility

12 V and 24 V electrical systems should meet the requirements of European Directive 2004/104/EC by ISO 7637-2:2004, test level III, class D. During and after these tests the control system shall either operate normally, cause a safety shut-down or go to stand-by.

Additionally, heaters for caravan holiday homes should meet the requirements of European Directive 2004/108/EC.

6 Test methods

6.1 General

6.1.1 Reference and limit gases

The burners are tested with the gases indicated in Table 2.

Table 2 — Test gases corresponding to the categories of appliances

Test gases	$I_{3B\ (28/30)}$ $I_{3+\ (28/30\text{-}37)}$, $I_{3\ B/P\ (30)}$, $I_{3\ B/P\ (50)}$	$I_{3P(30)}$, $I_{3P(37)}$, $I_{3P(50)}$
Reference gas	G 30	G 31
Incomplete combustion limit gas	G 30	G 31
Light-back limit gas	G 32	G 32
Flame lift limit gas	G 31	G 31
Sooting limit gas	G 30 and G 32	G 32

Test gases shall be in compliance with EN 437.

6.1.2 Test pressures

Test pressures, i.e. the pressure supplied at the gas inlet connection of the heater, are given in Table 3.

Table 3 — Test pressures

Category	Test pressures			Working pressure according to data plate mbar
	Normal mbar	**Minimum** mbar	**Maximum** mbar	
$I_{3B/P\ (30)}$, $I_{3P(30)}$	29	25	35	30
$I_{3B/P\ (50)}$, $I_{3P(50)}$	50	42,5	57,5	50
I_{3+}, $I_{3B(28/30)}$	29	20	35	28/30
I_{3+}, $I_{3P(37)}$	37	25	45	37

6.1.3 Special national conditions

The national conditions with regard to gases and supply pressures for boats and non road vehicles are given in Table A.2.

6.1.4 Test installation

The heater shall be installed in accordance with the manufacturer's instructions with the minimum clearances allowed and with the minimum ventilation allowed.

For heaters with ducts the duct shall be the maximum length allowed by the manufacturer unless otherwise indicated.

Unless otherwise stated the heater shall be placed in a room where the ambient temperature is between 15 °C and 25 °C.

For heaters with additional electrical components the operating voltage is the nominal voltage unless otherwise stated (see Table 4).

Precautions shall be taken to prevent thermostats and variable controls from acting to interfere with the gas flow. For example for thermostats it may be necessary to immerse the sensor in iced water for tests at full heat input and hot water for tests at by-pass and reduced heat input. For the temperature tests to verify 5.15 to 5.18, these are performed with the thermostat in full rate position and the sensor in its normal position.

6.2 Materials

Mechanical and visual inspection.

6.3 Accessibility of components

Mechanical and visual inspection.

6.4 Strength of assembly

Mechanical and visual inspection.

6.5 Tightness

6.5.1 Tightness of the gas carrying parts

6.5.1.1 Construction

Mechanical and visual inspection.

6.5.1.2 Tightness test

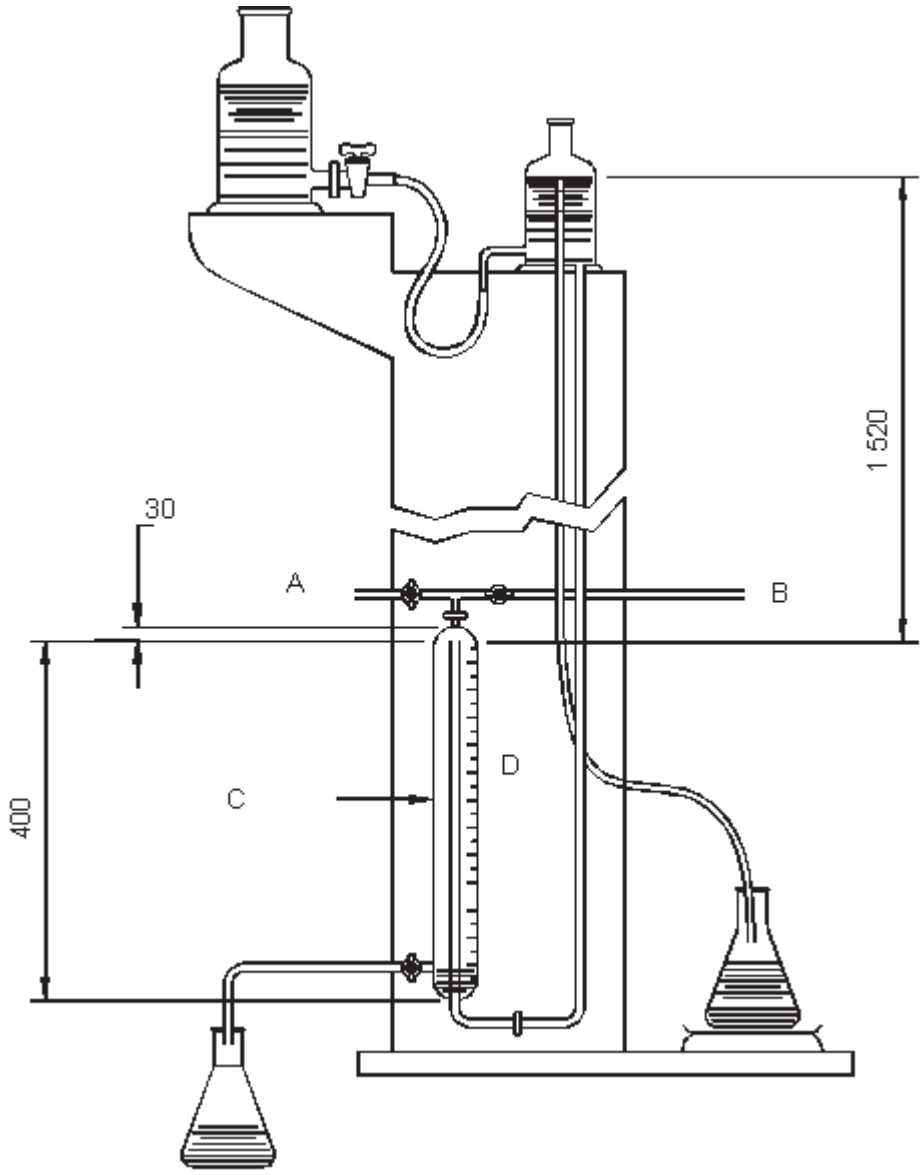
The gas carrying parts are tested successively as follows:

1) with all controls and shut-off devices closed;

2) with all controls in the "on" position, the injectors of burner and ignition burners temporarily blocked and any shut-off devices (for example the valves of safety devices) where present in the “open“ position.

The tests are carried out cold with air. The pressure upstream of the heater is adjusted to 150 mbar. The tests are carried out first on delivery of the heater (controls greased by the manufacturer) and again after all tests with the original components fitted to the heater, i.e. without changing any parts (e.g. injectors, ignition burner). The method used for this test should be such that the measurement error is less than 10 %. The equipment shown in Figure 1 shall be used, but this does not preclude other methods being used.

Dimensions in millimetres



Key

A Compressed Air
B Appliance under test
C Measuring vessel (OD 24)
D Graduated scale (OD 8, wall thickness 1)

The dimensions given are as a guide only.

Figure 1 — Apparatus for testing appliance tightness

6.5.2 Tightness of combustion circuit

6.5.2.1 The tightness test covers the heater body and the parts for connecting the outlet for the products of combustion and the combustion air supply inlet. Any flue and combustion air supply ducts shall be at the maximum length specified in the installation instructions.

6.5.2.2 For appliances with atmospheric burner the heater to be tested is connected to a compressed air source so that during testing there is a pressure of 0,5 mbar.

For fan assisted burner the test pressure shall be 1,5 times the pressure measured inside the heat exchanger near to the outlet with the burner operating at full rate.

The test is performed with an air inlet duct, if separate, and the flue duct of the maximum length as specified in the installation instructions.

6.5.2.3 The tightness test is repeated after the maximum energy delayed ignition test (see 6.19.3).

6.6 Connections

Mechanical and visual inspection.

6.7 Heater stability and fixing

Mechanical and visual inspection.

6.8 Taps and controls

6.8.1 General

Mechanical and visual inspection.

6.8.2 Automatic shut-off valves

6.8.2.1 Mechanical and visual inspection and 7.8 of EN 161:2001.

6.8.2.2 Mechanical and visual inspection.

6.8.2.3 Mechanical, electrical and visual inspection.

6.8.2.4 See 6.19.3.

6.9 Control handles

Mechanical and visual inspection.

6.10 Injectors

Mechanical and visual inspection.

6.11 Ignition devices

6.11.1 Mechanical and visual inspection.

6.11.2 Test as in EN 60335-2-102:2006.

6.12 Safety devices

6.12.1 General

Mechanical, visual and electrical inspection.

6.12.2 Thermoelectric flame supervision devices

6.12.2.1 General

The tests designed to verify the ignition and extinction delay times of the flame supervision devices specified in 5.12 are carried out with the reference gas corresponding to the heater category as in Table 2 (6.1.1), at the normal test pressure.

6.12.2.2 Verification of ignition safety time

The ignition burner flame is lit in accordance with the manufacturer's instructions with the appliance in the cold condition. After the ignition safety time as given in 5.12.2 switch from the "ignite" - setting to the normal operation setting and check if the ignition burner flame and/or burner flame stay alight.

6.12.2.3 Verification of extinction safety time

After 5 min of operation the gas supply to the appliance is closed completely. After the extinction safety time as given in 5.12.2 the gas supply is re-opened and it is checked if the gas supply to the burner and/or ignition burner is closed.

6.12.3 Automatic burner control systems

6.12.3.1 Prepurge time

Mechanical and electrical inspection at nominal voltage and normal pressure using reference gas.

6.12.3.2 Extinction and ignition safety time

Mechanical and electrical inspection at nominal voltage and normal pressure using reference gas.

6.12.3.3 Waiting time

Measure with a timepiece.

6.12.3.4 Burner control

For test methods see EN 298:2003.

6.12.3.5 Combustion air fan supervision

The heater shall be supplied with reference gas at normal pressure in still air and be operated at full rate for 30 min. Then:

a) In case of a heater with a heat output of less than or equal to 4 kW the supervised parameter is altered and it is checked that the heater locks out before the supervised parameter goes outside the operation range specified by the heater manufacturer. Alternatively, tests b) or c) may be performed for heaters with an output less than or equal to 4 kW.

b) In case of a heater with a heat output greater than 4 kW, but less than or equal to 7 kW either the combustion air fan speed or the combustion air flow is progressively reduced and checked that the heater locks out before the CO content of the dry, undiluted products of combustion exceeds 0,2 %.

c) In case of a heater with a heat output greater than 7 kW the combustion air flow is progressively reduced and it is checked that the heater locks out before the CO content of the dry, undiluted products of combustion exceeds 0,2 %. This test shall be performed at nominal voltage.

d) In all cases either the duct for the products of combustion or the duct for the combustion air is completely obstructed and it is checked that the heater locks out.

6.12.3.6 Hot air fan supervision

The outlets of the hot air fan are obstructed until the heater effects a lock-out. If a thermostat is fitted it shall be disabled before the start of the test. The temperature of the hot air stream is measured at a distance of $5D$ from the hot air outlet, D being the diameter of the hot air outlet.

6.12.3.7 Lock-out indication

Visual inspection.

6.12.3.8 Characteristics at high and low voltage

Power supply shall be reduced step by step from 120 % of the nominal voltage and failure of the flame shall be simulated. The flame control unit shall function normally at least down to that voltage at which the gas supply shall be interrupted due to a standby or failure lock-out. The starting characteristics for low-voltage shall be checked accordingly.

6.12.3.9 Humidity resistance

Place the automatic burner control system at 40 °C and a relative humidity of 93 % for 21 days. Immediately on removal from the environmental chamber, check for compliance with 5.12.3.9 at normal test pressure and nominal voltage.

6.12.3.10 Vibration resistance

Subject the automatic burner control system, built into the heater, to sinusoidal vibrations as specified below:

Frequency range for 1 cycle:	10 Hz to 160 Hz to 10 Hz
Acceleration amplitude:	2 *g*
Rate of frequency change:	1 octave per minute
Number of cycles in each direction:	10
Orientation:	3 at 90° to each other

For a frequency below 58 Hz the acceleration amplitude may drop beyond 2 *g* (in accordance with EN 60068-2-6).

6.12.3.11 Long term performance

The automatic burner control system is assembled into the heater and supplied with reference gas at normal pressure and put through 5 000 cycles of:

Switch on – purge (if applicable) – light – recognise flame – interrupt gas supply – attempt reignition – safety lock-out – re-establish gas supply – reset lock-out – switch on.

6.12.3.12 Reversed polarity

The heater shall be connected to its electric supply as specified in the installation instructions, but with reversed polarity. Then it is switched on once.

6.13 Ducts for the products of combustion and cowls

6.13.1 Combustion air supply inlets, products of combustion outlets and wind protection devices

6.13.1.1 A 16 mm diameter ball shall be applied to all openings into the cowl with a force of 5 N.

6.13.1.2 Mechanical inspection.

6.13.1.3 For the water influx test the opening shall be subjected to an influx of water at 45° to the vertical from above to simulate severe rain. The test is regarded as successful when the heater operates satisfactorily after 5 min of water influx.

6.13.1.4 Visual inspection.

6.13.2 Ducts for the products of combustion

6.13.2.1 Visual inspection.

6.13.2.2 Mechanical inspection.

6.13.2.3 Both ends of a sample of the ducts are sealed and the interior is pressurised to 0,5 mbar with air. The test set up shall be such that any leakage in the duct can be detected. A convenient way of sealing the ends is by immersing them in water, the air being supplied to the inside via a dip tube.

6.13.2.4 The test is performed on a sample of duct approximately 1 m long. The original length is measured or marked while the sample is subject to a load of 5 kg. An additional load of 1,6 D^2 kg is added, where D is the internal diameter of the duct in cm, and the extended length is measured. The additional load is then removed and the permanent extension measured under the 5 kg load only.

6.13.2.5 One position along a 1 m sample exhaust duct is bent in the same plane through 5 bend sequences over a cylinder having a diameter of 1,5 D. Each bend sequence being: from the straight, 90° one way and back to straight, then 90° the other way and back to straight.

6.13.2.6 The test for extension under load as described in 6.13.2.4 is repeated with a sample duct at (300 ± 10) °C.

6.14 Verification of the nominal heat input

The nominal heat input is verified by using the reference gas indicated in 6.1.1, Table 2 depending on the category of the heater, at the normal test pressure defined in 6.1.2.

The measurements are made after 15 min of operation (the measurement starts at the end of the 15th minute and ends at the end of the 30th minute).

Any control such as a thermostat shall be at its highest setting, tap handles shall be at the “full open“ position.

Precautions shall be taken to prevent thermostats and variable controls from acting to interfere with the gas flow. For example for thermostats it may be necessary to immerse the sensor in iced water for tests at full heat input and hot water for tests at by-pass and reduced heat input.

The heat input is calculated from the following expressions:

$$Q_{\mathrm{n}} = \frac{M_0 \times H_{\mathrm{S}}}{\rho_{\mathrm{n}}} \qquad (1)$$

where

Q_{n} is the nominal heat input in kW;

M_0 is the nominal mass rate in kg/h under reference test conditions (15 °C, 1 013,25 mbar);

H_S is the gross calorific value of reference gas in kWh/m^3;

ρ_n is the density of the reference gas in kg/m^3, under reference test conditions (15 °C, 1 013,25 mbar).

If the mass is measured by means that are influenced by pressure and temperature (e.g. rotameter) the mass M_0 has to be corrected according to the following equation:

$$M_0 = M \times \sqrt{\frac{1013{,}25 + p}{p_a + p} \times \frac{273{,}15 + t_g}{288{,}15} \times \frac{d_r}{d}} \quad (2)$$

where

M_0 is the mass rate under reference conditions;

M is the mass rate obtained under test conditions;

p_a is the atmospheric pressure in mbar;

p is the gas supply pressure at the inlet of the heater in mbar;

t_g is the temperature of the gas at the inlet of the heater, in °C;

d is the density of dry gas relative to dry air;

d_r is the density of the reference gas relative to dry air.

If a wet meter is used, or if a dry meter is used with a saturated or partially saturated gas, then in the first step of the calculation, (i.e. the flow of reference gas under test conditions) the symbol "d" representing the relative density of dry test gas, should be replaced by the following expression for the relative density of wet test gas:

$$d_{wet} = \frac{d\left(p_a + p - W\right) + 0{,}622 \times W}{p_a + p} \quad (3)$$

where

W is the saturation vapour pressure of water, expressed in millibar, at the point of the test gas, which in the case of a wet meter is equal to t_g °C.

6.15 Temperatures of various parts of the heater

6.15.1 Test conditions

The heater shall be installed as in 6.1.4 in a room where the ambient temperature is between 15 °C and 25 °C.

6.15.2 Test method

The heater is supplied with the reference gas defined in 6.1.1 at normal test pressure (see 6.1.2) and normal voltage. If the heater can be operated without the air distribution fan the test shall be carried out with this fan inoperative.

6.15.3 Measurement of temperature

After operating for 2 h at maximum rate measure the maximum temperature rise of all parts which have to be touched (i.e. buttons, handles), and those of the external surfaces of the heater.

The surface temperatures are measured with contact thermocouples or similar devices.

6.16 Temperatures of the support, walls and adjacent surfaces

6.16.1 Test conditions

The heater is placed in a corner consisting of a horizontal wood panel 25 mm thick, serving as a support, and two vertical panels of wood 25 mm thick. One panel is placed as near as possible to the back of the heater and the other at the distance from one side of the heater equal to that indicated in the manufacturer's instructions. The dimensions of these panels shall be such that they extend at least 50 mm beyond the corresponding dimensions of the heater. For fixed heaters a wooden panel, 25 mm thick, is placed horizontally above the heater, at the minimum distance specified in the installation instructions. The surface of the panels adjacent to the appliance shall be matt black.

The heater is installed in accordance with 6.1.4. Thermocouples are incorporated into each adjacent panel, at the centre of 100 mm squares; these penetrate the panels from the outside so that the junctions are situated 3 mm from the surface facing the heater.

For the tests specified in 6.16.2, the heater shall be placed in a room where the ambient temperature is between 15 °C and 25 °C.

6.16.2 Test methods

The heater is supplied with the reference gas defined in 6.1.1 at normal test pressure (see 6.1.2) and normal voltage. If the heater can be operated without the air distribution fan the test shall be carried out with this fan inoperative.

6.16.3 Measurement of temperature

After operating for 2 h at maximum rate, measure the maximum temperature rise of adjacent surfaces.

6.17 Temperature of taps and components

6.17.1 Test conditions

The heater shall be tested under the conditions described in 6.15.1.

6.17.2 Test methods

The heater is supplied with the reference gas defined in 6.1.1 at normal test pressure (see 6.1.2) and normal voltage. If the heater can be operated without the air distribution fan the test shall be carried out with this fan inoperative.

6.17.3 Measurement of temperature

After operating for 2 h at maximum rate measure the maximum temperature rise of all taps and components.

The temperatures are measured with contact thermocouples or similar devices.

6.18 Temperatures of the products of combustion

With the heater fitted with the shortest pipe length as specified in the installation instructions, the heater is tested as described in 6.17. The temperature of the products of combustion shall be measured at the end of the exhaust pipe outlet.

6.19 Ignition

6.19.1 General

The tests are carried out with the reference gas; light back limit gas and flame lift limit gas at the pressures given in Tables 2 and 3. The tests are carried out in still air at nominal voltage.

For heaters intended for installation in boats the tests are also performed with the heater inclined at 30° from the vertical in four directions at 90° to each other.

6.19.2 Ignition performance

6.19.2.1 Cold condition

Ignite the heater in accordance with the manufacturer's instructions.

6.19.2.2 Hot condition

Heat the heater to the hot condition, turn off the gas and then reignite in accordance with the manufacturer's instructions.

If any delay period between turning off and turning on again is specified in the manufacturer's instructions, this shall be complied with but shall not exceed 10 min.

6.19.2.3 At low temperature

The heater is placed in a room at a temperature of −20 °C. The heater remains in the room for a period of at least 12 h. With the heater still in the room, it is ignited in accordance with the manufacturer's instructions using flame lift gas at normal pressure.

6.19.3 Maximum energy delayed ignition test

Progressively increase the ignition delay until it is judged that the worst condition has been found. On re-ignition take due account of any time specified in the manufacturer's instructions that should be allowed to elapse after turning off the burner and before attempting to re-ignite.

For heaters fitted with a thermoelectric flame supervision device, the maximum ignition delay, i.e. the time between first admitting gas and applying the ignition source, shall be limited to 60 s.

6.20 Crosslighting

6.20.1 General

The tests are carried out with reference gas, light-back limit gas and lift limit gas at pressures according to Tables 2 and 3.

For heaters intended for installation in boats the tests are also performed with the heater inclined at 30° from the vertical in four directions at 90° to each other.

6.20.2 Cold condition

6.20.2.1 The heater is ignited in accordance with the manufacturer's instructions and any section(s) of the burner that are separately controlled are immediately turned off. After 30 s these sections are turned on again.

6.20.2.2 The heater is ignited and operated at the full-on rate and the test repeated with thermostats and controls, if any, at the setting that will give the reduced rate.

6.20.3 Hot condition

6.20.3.1 After heating the heater to the hot condition, the tests given in 6.20.2 are repeated except that any delay before relighting the separately controlled sections shall be as specified in the manufacturer's instructions.

6.20.3.2 The heater is ignited in accordance with the manufacturer's instructions and then sections that are separately controlled turned off. The remaining section(s) are allowed to come to thermal equilibrium and then the separately controlled sections turned on in turn, allowing each to come to thermal equilibrium.

6.20.4 Crosslighting at low temperature

The heater is placed in a room at a temperature of –20 °C. The heater remains there for a period of at least 12 h. With the heater still in the room it is ignited and then any burners under separate control ignited in accordance with the manufacturer's instructions using flame lift limit gas at normal pressure.

6.20.5 Conditions of ignition burner flame shortening

The tests designed to verify the operating characteristics are carried out using the reference gas at the maximum and minimum pressures, the requirement in each case being that the flame failure device does not open or remain open unless the crosslighting to other burners can be or has been effected satisfactorily when the manufacturer's instructions for ignition are followed.

This requirement applies only to heaters whose control incorporates a “pilot only“ position. These tests are carried out by reducing the ignition burner rate using the tap or adjuster or, if no adjuster is fitted, by interrupting the ignition burner supply so that adjustment can be made.

6.21 Flame stability

6.21.1 Flame lift

The test is carried out with the lift limit gas (see Table 2 and 3) at maximum pressure.

From cold operate the burner(s) using lift limit gas at the pressure indicated. After 1 min the appearance of the flames is observed.

The test is repeated using the reference gas at the maximum pressure.

For fan assisted burners the test shall be carried out at minimum pressure.

6.21.2 Light-back

The test is carried out with the light-back limit gas (see Table 2), at the minimum setting, if any, by reducing the pressure to a point where combustion can be maintained, but stopping when the minimum pressure is reached.

When a stable flame has been established at the burner head, the flame is maintained for 15 min. After this the heater is inspected.

For fan assisted burners the test shall be carried out by starting the appliance with normal pressure for 15 min, then reducing to minimum pressure and keep it for 15 min and then raise to maximum pressure for 15 min.

6.21.3 Sooting

The test is carried out for 2 h with sooting limit gas (see Table 2) and at maximum pressure at nominal voltage.

For heaters intended for installation in boats the tests are also performed with the heater inclined at 30° from the vertical in four directions at 90° to each other.

6.22 Combustion in still air

Testing is carried out in the steady state with the maximum duct length with the reference gas at normal test pressure and with the voltage in accordance to Table 4.

Table 4 — Heater performance at voltage limits

Nominal voltage of the heater V	Limit voltage of the heater V	Requirements
12	< 11,4	The heater shall operate normally above 11,4 V or 22,8 V respectively.
24	below 22,8	Below this voltage: a) the heater may switch onto stand by or b) if the voltage drop lasts longer than 5 s, the heater may switch to fail.
12	11,4 to 14	The heater shall operate normally.
24	22,8 to 28	
12	> 14	The heater shall not show any deterioration or switch into a safe position.
24	> 28	

The percentage by volume of carbon dioxide (CO_2) or oxygen (O_2) in the products of combustion shall be determined by a method which allows the percentage by volume carbon dioxide (CO_2) or oxygen (O_2) to be measured to an accuracy of 0,2 % by volume.

The percentage by volume of carbon monoxide (CO) which is determined from the diluted dry products of combustion is converted to the percentage by volume of carbon monoxide (CO) in the undiluted dry products of combustion by the following equation:

$$(CO)_{nd} = \frac{(CO)_m \times (CO_2)_{max}}{(CO_2)_m} \quad (4)$$

where

$(CO_2)_{max}$ is the percentage by volume of carbon dioxide (CO_2) in the non-diluted dry products of combustion;

$(CO_2)_m$ is the measured percentage by volume of carbon dioxide (CO_2) in the diluted dry products of combustion;

$(CO)_{nd}$ is the percentage by volume of carbon monoxide (CO) in the non-diluted dry products of combustion;

$(CO)_m$ is the measured percentage by volume of carbon monoxide (CO) in the diluted dry products of combustion.

(m = measured, nd = non-diluted)

If this ratio is to be determined from the volume percent of oxygen $(O_2)_m$ in the products of combustion, the following equation applies:

$$\frac{(CO)_m}{(CO)_{nd}} = \frac{21-(O_2)_m}{21} \quad (5)$$

where

$(O_2)_m$ is the measured percentage by volume of oxygen (O_2) in the diluted dry products of combustion.

The percentage by volume of carbon monoxide (CO) in the diluted products of combustion shall be determined using a method which allows it to be measured with an accuracy of 0,005 % by volume.

The extraction of combustion products is effected in such a manner that representative samples are obtained for the steady state operation.

The sample is extracted approximately 150 mm before the outlet of the exhaust pipe.

For heaters intended for installation in boats the tests are also performed with the heater inclined at 30° from the vertical in four directions at 90° to each other.

6.23 Resistance to wind

6.23.1 Wind generator and test installation

6.23.1.1 General

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

a) the wind front is either approximately 900 mm square or circular with a minimum diameter of 600 mm;

b) wind speeds of 2,5 m/s and 10 m/s are obtained with an accuracy of ± 10 % over the whole of the wind front;

c) the wind stream is essentially parallel with no residual rotary movement;

d) the wind stream is applied to the air intake and outlet for the products of combustion simultaneously even if these are separate.

6.23.1.2 Test installation for wall terminals

The apparatus for wall terminals wind test is shown at Figure 2.

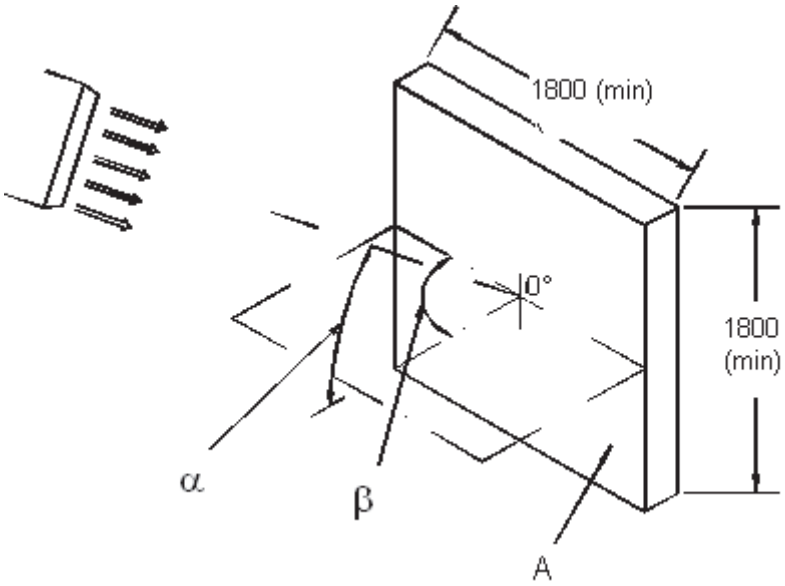
The test wall consists of a vertical wall at least 1,8 m square with a removable panel at its centre. The terminal is mounted on the wall so that its geometric centre is at the centre of the test wall.

The distance between the bottom of the test wall and the floor of the test room shall be 500 mm ± 100 mm.

The direction β of the wind stream is varied by moving the wind generator or rotating the wall.

The elevation α of the wind stream is varied by moving the wind generator nozzle, ensuring that the centre of the wind stream is directed at the centre of the test wall.

Dimensions in millimetres



Key

A Test wall
α Elevation of the wind stream
β Direction of the wind stream

Figure 2 — Apparatus for wall terminal wind test

6.23.1.3 Test installation for roof terminals

The Apparatus for roof terminal wind test is shown at Figure 3.

The test roof is a flat 500 mm diameter disc mounted horizontally with the terminal fitted in the centre. A separate fan may be used for this test with an outlet area at least 30 mm greater in every direction than the projected area of the terminal. Requirements of 6.23.1.1 b) and c) shall be met without the terminal in place.

Dimensions in millimetres

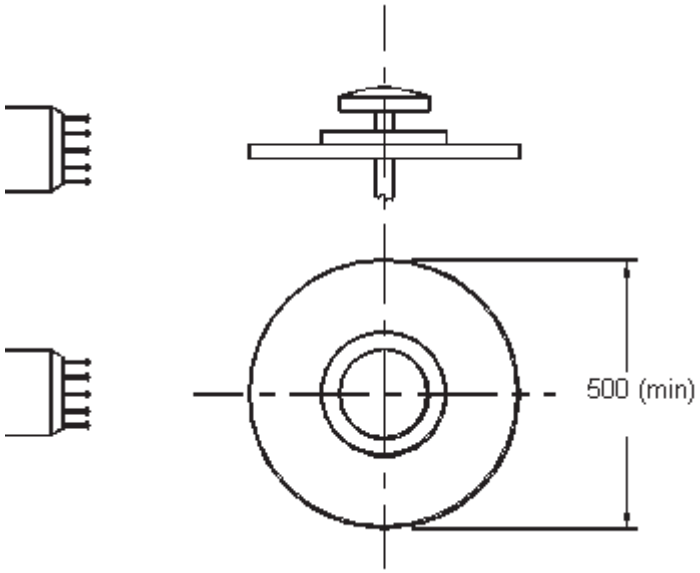


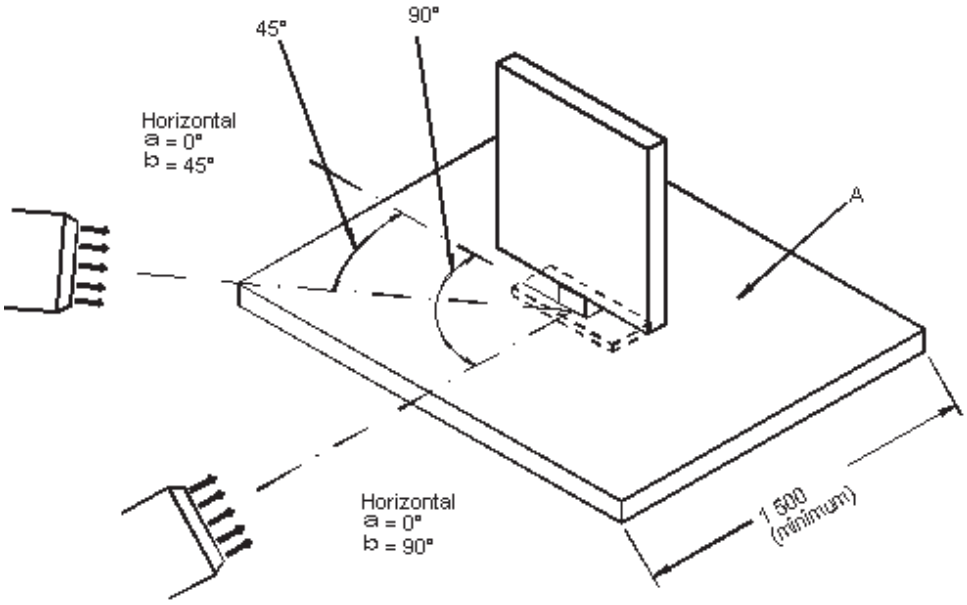
Figure 3 — Apparatus for roof terminal wind test

6.23.1.4 Test installation for floor terminals

The Apparatus for floor terminal wind test is shown at Figure 4.

The test floor is a flat floor at least 1,5 m square mounted horizontally with the terminal of the heater at the geometric centre. A wind generator in accordance with 6.23.1.1 a), b) and c) is used.

Dimensions in millimetres



Key

A Floor

Figure 4 — Apparatus for floor terminal wind test

6.23.2 Test conditions

Heaters are subjected, according to flue and intake configuration to winds at the speeds and directions laid down in Tables 5 to 9.

The heater shall be operated on reference gas at normal test pressure and at nominal voltage.

Table 5 — Wind speeds and directions for testing balanced wall flue and air intakes

Set Up	Elevation α	Angle β		Wind Speed m/s
		Symmetrical terminals	Asymmetrical terminals	
Figure 2	0° Horizontal	0°	0°	2,5 and 10
	0° Horizontal	20°	20°	2,5 and 10
	0° Horizontal	45°	45°	2,5 and 10
	0° Horizontal	90°	90°	2,5 and 10
	0° Horizontal		135°	2,5 and 10
	0° Horizontal		160°	2,5 and 10
	0° Horizontal		180°	2,5 and 10
	20° plunging	0°	0°	2,5 and 10
	20° plunging	20°	20°	2,5 and 10
	20° plunging	45°	45°	2,5 and 10
	20° plunging	90°	90°	2,5 and 10
	20° plunging		135°	2,5 and 10
	20° plunging		160°	2,5 and 10
	20° plunging		180°	2,5 and 10

Table 6 — Wind speeds and directions for testing combined roof flue and air intakes

Set Up	Elevation α	Angle β		Wind Speed m/s
		Symmetrical terminals	Asymmetrical terminals	
Figure 3	0° Horizontal		0°	2,5 and 10
	0° Horizontal		45°	2,5 and 10
	0° Horizontal	90°	90°	2,5 and 10
	0° Horizontal		135°	2,5 and 10
	0° Horizontal		180°	2,5 and 10
	0° Horizontal		225°	2,5 and 10
	0° Horizontal		270°	2,5 and 10
	0° Horizontal		315°	2,5 and 10

Table 7 — Wind speeds and directions for testing combined underfloor flues and air intakes

		Angle β		
Set Up	**Elevation** α	**Symmetrical terminals**	**Asymmetrical terminals**	**Wind Speed** m/s
Figure 4	0° Horizontal		0°	2,5
	0° Horizontal		45°	2,5
	0° Horizontal	90°	90°	2,5
	0° Horizontal		135°	2,5
	0° Horizontal		180°	2,5
	0° Horizontal		225°	2,5
	0° Horizontal		270°	2,5
	0° Horizontal		315°	2,5

Table 8 — Wind speeds and directions for testing roof flues with underfloor air intakes

Set Up	**Elevation** α	Angle β		**Wind Speed** m/s	
		Symmetrical terminals	**Asymmetrical terminals**	**Roof flue**	**air intake**
Figures 3 and 4	0° Horizontal		0°	2,5	0
	0° Horizontal		45°	2,5	0
	0° Horizontal	90°	90°	2,5	0
	0° Horizontal		135°	2,5	0
	0° Horizontal		180°	2,5	0
	0° Horizontal		225°	2,5	0
	0° Horizontal		270°	2,5	0
	0° Horizontal		315°	2,5	0
	0° Horizontal		0°	10	2,5
	0° Horizontal		45°	10	2,5
	0° Horizontal	90°	90°	10	2,5
	0° Horizontal		135°	10	2,5
	0° Horizontal		180°	10	2,5
	0° Horizontal		225°	10	2,5
	0° Horizontal		270°	10	2,5
	0° Horizontal		315°	10	2,5

Table 9 — Wind speeds and directions for testing wall flues with underfloor air intakes

Set Up	Elevation on Wall α	Angle β		Wind Speed m/s	
		Symmetrical Wall Terminal	Asymmetrical Wall Terminal	Wall	Floor with α Horizontal
Figures 2 and 4	0°	0°	0°	2,5	0
	0°	20°	20°	2,5	0
	0°	45°	45°	2,5	0
	0°	90°	90°	2,5	0
	0°		135°	2,5	0
	0°		160°	2,5	0
	0°		180°	2,5	0
	20° plunging	0°	0°	2,5	0
	20° plunging	20°	20°	2,5	0
	20° plunging	45°	45°	2,5	0
	20° plunging	90°	90°	2,5	0
	20° plunging		135°	2,5	0
	20° plunging		160°	2,5	0
	20° plunging		180°	2,5	0
	0°	0°	0°	10	2,5
	0°	20°	20°	10	2,5
	0°	45°	45°	10	2,5
	0°	90°	90°	10	2,5
	0°		135°	10	2,5
	0°		160°	10	2,5
	0°		180°	10	2,5
	20° plunging		0°	10	2,5
	20° plunging		20°	10	2,5
	20° plunging		45°	10	2,5
	20° plunging		90°	10	2,5
	20° plunging		135°	10	2,5
	20° plunging		160°	10	2,5
	20° plunging		180°	10	2,5

6.24 Efficiency

The efficiency test is carried out at nominal heat input at thermal equilibrium using reference gas at normal test pressure in still air, the electrical supply at nominal voltage and at an ambient temperature of (20 ± 5) °C. The test is performed using the longest pipe for the products of combustion and combustion air supply pipe mentioned in the instructions.

In the case of heaters having ducts for the products of combustion which are not laid inside the combustion air supply pipe, the temperature of the combustion air is taken as the ambient temperature. The temperature of

the products of combustion and the CO_2 content in the products of combustion are measured under the test conditions given in the previous paragraphs of this clause.

In the case of heaters having exhaust gas outlets through pipes laid inside a combustion air supply pipe, the intake air temperature is measured 50 mm from the connection to the heater.

The combustion air temperature is measured with a thermocouple fitted in the annular gap in such a way that the tip of the thermocouple is approximately in the centre of the gap and at the same level as the axis of the air supply pipe. The temperature of the products of combustion and the CO_2 content in the products of combustion shall be measured 150 mm before the outlet of the duct. If this distance cannot be achieved, the measurement can be performed at a shorter distance, but it shall be ensured that the mean values of the CO_2 content and the temperature are derived from the same measuring point. A rod type probe consisting of a stainless steel tube and extending over the entire diameter of the duct for the products of combustion is used to sample the products of combustion.

The probe shall be provided with orifices which point in the direction of the flow of the products of combustion. The thermocouple for measuring the temperature of the products of combustion is mounted on the probe and shall be arranged at the geometric centre of the upper cross-sectional half of the duct for the products of combustion.

The efficiency factor based on gross calorific values and test gas G 30 is calculated from the measured values as follows:

$$\frac{\eta}{0{,}926} = 100 - \left[\left(\frac{42{,}4}{(CO_2)_m} + 0{,}8\right) \times \frac{t_{ex} - t_L}{100}\right] \quad (6)$$

where

η is the efficiency factor, expressed in percentage;

$(CO_2)_m$ is the measured CO_2 content in the products of combustion as a percentage in volume;

t_{ex} is the temperature of the products of combustion expressed in degree Celsius;

t_L is the combustion air temperature expressed in degree Celsius.

If the CO_2 content in the products of combustion is to be determined from the measured O_2 content of the products of combustion, the following equation applies:

$$\frac{(CO_2)_{max}}{(CO_2)} = \frac{21}{21 - (O_2)_m} \quad (7)$$

where

$(CO_2)_{max}$ is the percentage by volume of carbon dioxide (CO_2) in the non-diluted dry products of combustion;

$(O_2)_m$ is the measured percentage by volume of oxygen (O_2) in the diluted dry products of combustion.

6.25 Ignition and combustion in motion

The test is carried out with the heater installed in a vehicle in accordance with the appliance manufacturer's instructions with the heater supplied with reference gas at normal test pressure and at nominal voltage at air speeds of 50 km/h and 100 km/h.

6.26 Prolonged performance test

The heater is operated for thirty cycles, each cycle consisting of 16,5 h on, 1,5 h off, 1,5 h on, 1,5 h off, 1,5 h on and finally 1,5 h off. The heater shall be operated using reference gas at normal test pressure.

7 Marking and instruction literature

7.1 Appliance

7.1.1 Data plate

All heaters shall carry, in a position visible to the installer after installation, a durable data plate which gives, in indelible characters, at least the following:

a) name of manufacturer[1)] and/or his identification symbol, completed by the address of the manufacturer or importer;

b) product identification number;

c) trade name or type;

d) serial number;

e) type of gas and operating pressure(s) in mbar;

f) consumption in g/h and nominal heat input in kW;

g) appliance category(ies);

h) type of electrical supply used, if applicable;

i) country(ies) of first destination in accordance with EN ISO 3166-1:2006;

j) suitability for caravans, motorcaravans and/or boats by symbols. Mark for which purpose the appliance is not suitable by crossing the symbol (e.g. see Figure 5 to Figure 7).

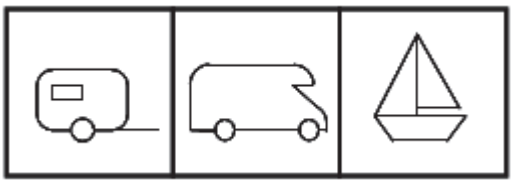


Figure 5 — Symbols suitable for caravan, motorcaravan and boats

1) "Manufacturer" means the organisation or company which assumes responsibility for the product.

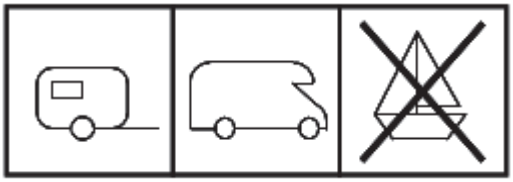


Figure 6 — Symbols suitable for caravan, motorcaravan and not for boats

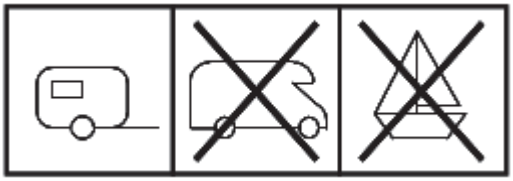


Figure 7 — Symbols suitable for caravan, not for motorcaravan and not for boats

7.1.2 Appliance warning labels

Appliances shall be fitted with the following labels:

a) advice such as: "Read the instructions before operation of this heater.";

b) warning: "Switch off when vehicle or any other appliance is being refuelled.";

c) warning in case of heaters equipped with thermoelectric flame supervision devices: "Always wait for 3 min after flame failure has occurred before attempting re-ignition."

All instructions shall be given in the official language(s) of the first country of destination and following the practices of that country.

7.2 Packaging

The packaging shall be externally marked with the following:

a) type of gas and pressure(s) for which the heater is intended;

b) electrical supply requirements;

c) information about the suitability of the appliance for boats;

d) advice such as: "Read the instructions before installation and operation of this heater."; a graphical icon is considered to be sufficient;

e) suitability for caravans, motorcaravans and/or boats by symbols; mark for which purpose the appliance is not suitable by crossing the symbol (e.g. see Figure 5 to Figure 7).

All instructions shall be given in the official language(s) of the first country of destination and following the practices of that country.

7.3 Instructions for use and user maintenance

The heater shall be accompanied by instructions for use and user maintenance.

The instructions shall give all the information required to use the heater safely and sensibly. In particular, the instructions shall warn the user against incorrect use of the heater.

All instructions shall be given in the official language(s) of the first country of destination and following the practices of that country.

The instructions shall include information on:

a) action to be taken in the event of gas leakage;

b) recommended servicing frequency together with a warning against unauthorised interference;

c) operating procedure;

d) the requirement that the combustion air supply inlet and outlet openings for the products of combustion shall never be obstructed and be checked from time to time and, if necessary, cleaned by the user (e.g. in winter, snow shall be removed from the outlet for the products of combustion and air intake);

NOTE For heaters with underfloor fluing it should be stated that three sides of the underfloor space are to be kept open and not to be obstructed.

e) the need for the heater, its gas supply and ducting for the products of combustion to be inspected in accordance with national regulations or if these do not exist, the manufacturers recommendations, however it is advised that this should be done at least every two years;

f) whether the heater is to be used whilst the vehicle is in motion.

They shall also include a warning that the space heater shall not be operated when refuelling:

— the vehicle,

— the caravan towing vehicle, or

— other appliances, or

— when the vehicle in which the heater is installed is in a confined space such as a garage.

If the space heater uses water as a heat transfer medium, the following additional instructions are applicable:

g) information how to inspect the level of the heating water and how to drain, fill and bleed it;

h) information regarding acceptable anti-freeze;

i) warning that it is dangerous to reset a temperature limiting device before having the appliance checked by a competent person;

j) information about necessary repairs or replacements in case of overheat cut out to be undertaken by a competent person.

7.4 Instructions for installation

Heaters shall be accompanied by instructions for installation. These instructions may be in one document together with those for use and user maintenance, provided that their texts are not combined.

All instructions shall be given in the official language(s) of the first country of destination and following the practices of that country.

The instructions shall include the information given in 7.1, excluding 7.1.1 c). In addition they shall indicate the minimum distance from an adjacent wall, ceiling or shelf at which the heater or its ducts can be placed as well as the length of the ducts of the combustion circuit.

Where the heater is equipped with a class E type valve it shall give advice to the installer to check that any pressure more than five times the working pressure is avoided at the appliance inlet connection by suitable means.

Instructions shall also include:

a) the location of the outlet for the products of combustion to prevent the re-entry of the flue gases into the habitable volume;

b) inspection of the installation and function;

c) inspection of the duct installation for the products of combustion;

d) suitability of the heater for operation whilst the vehicle is in motion.

These instructions shall also contain specific instructions required for connecting the heater and a reference to the installation regulations in force in the first country of destination.

If the space heater uses water as a heat transfer medium, the following additional instructions are applicable:

e) information on the type of central water heater, such as:

   1) open or closed system

   2) maximum operating pressure of the heating water circuit;

f) information regarding the acceptable materials for pipes, hoses, radiators, etc. which are compatible with the material of the heating water container and with anti-freeze liquids;

g) information regarding acceptable anti-freeze liquids;

h) information regarding the installation of:

   1) the circulation pump, if not integral with the central water heater;

   2) the compensator reservoir;

   3) the whole heating water circuit, in order to facilitate system bleeding.

7.5 Servicing instructions

The appliance shall be accompanied by the instructions for servicing to enable the appliance to be maintained in a safe working condition.

Annex A
(normative)

Supply situation in various countries

Table A.1 —Heater categories for boats and non road vehicles in various countries

Category / Country[c]	$I_{3+(28\text{-}30/37)}$	$I_{3B/P(30)}$	$I_{3B/P(50)}$	$I_{3B(28\text{-}30)}$[b]	$I_{3P(30)}$[b]	$I_{3P(37)}$[b]	$I_{3P(50)}$[b]
AT		X	X				X
BE	X	X					
CH	X	X					
CZ	X	X					
DE		X	X				X
DK[a]		X					
ES	X						
FI[a]		X					
FR[a]	X			X		X	
GB	X			X		X	
GR	X	X					
IE	X			X		X	
IS							
IT	X						
LU							
NL		X			X		
NO[a]		X					
PT	X			X		X	
SE[a]		X					
CY		X					
EE		X					
HU		X					
LT							
LV							
MT							
PL		X					
RO		X					
SI	X	X			X	X	
SK							

NOTE The information contained in this table in no way prohibits the manufacture and approval of heaters belonging to other categories intended for sale in other countries.

[a] These countries do not permit by legislation underfloor flue terminals for the products of combustion.

[b] These categories are utilized in some countries for mobile homes and may be used also for this type of appliances.

[c] Country codes are in accordance with EN ISO 3166-1:2006.

Table A.2 —Normal working pressures for heaters in boats and non road vehicles

Appliance Category	$I_{3+(28\text{-}30/37)}$	$I_{3B/P(30)}$	$I_{3B/P(50)}$	$I_{B(28\text{-}30)}$ [a] [a]	$I_{3P(30)}$ [a]	$I_{3P(37)}$ [a]	$I_{3P(50)}$ [a]
Working Pressure	**28-30/37 mbar**	**30 mbar**	**50 mbar**	**28/30 mbar**	**30 mbar**	**37 mbar**	**50 mbar**
Country[b]							
AT		X	X		X		X
BE	X	X		X		X	X
CH	X		X			X	X
CZ	X		X			X	X
DE		X	X		X		X
DK		X					X
ES	X			X		X	X
FI		X					
FR	X	X		X		X	
GB	X	X		X		X	
GR	X	X		X		X	X
IE	X			X		X	
IS							
IT	X	X				X	
LU							
NL		X			X	X	X
NO		X					
PT	X			X		X	
SE		X					
CY	X	X	X	X			
EE		X					
HU		X					
LT							
LV							
MT				X			
PL		X				X	
RO		X			X		
SI	X	X			X	X	
SK	X	X	X			X	X

NOTE The information contained in this table in no way prohibits the manufacture and approval of heaters belonging to other categories intended for sale in other countries.

[a] These categories are utilized in some countries for mobile homes and may be used also for this type of appliances.

[b] Country codes are in accordance with EN ISO 3166-1:2006.

Table A.3 —Types of connection used for heaters in various countries

Country[a]	without thread	threaded complying with:		connection to copper tube complying with EN 1057
		EN 10226-1 or EN 10226-2	EN ISO 228-1	
AT	X			X
BE				
CH				
CZ				
DE	X			X
DK		X	X	X
ES				
FI				
FR			X	
GB	X	X		X
GR				
IE	X	X		X
IS				
IT	X	X	X	X
LU				
NL				
NO				
PT		X	X	X
SE				
CY				
EE				
HU				
LT				
LV				
MT				
PL				
RO				
SI	X	X	X	X
SK				

[a] Country codes are in accordance with EN ISO 3166-1:2006.

Annex B
(normative)

Appliances using water as a heat transfer medium

B.1 General

For appliances using water as a heat transfer additionally the following shall apply.

B.2 Requirements

B.2.1 Mechanical strength

B.2.1.1 Heating water container

NOTE 1 The European Directive 2009/105/EC Pressure Equipment Directive (PED) may be applicable.

The heating water container in an open system shall withstand twice the operating pressure, at least 0,5 bar, whichever is greater.

Closed systems shall withstand 1,43 times the operating pressure, or a minimum pressure of 3 bar whichever is greater.

The container shall not leak, nor be permanently deformed.

NOTE 2 Even in open systems the hydraulic pressure in the system can reach higher values, as there may be parts of the system being positioned at high level.

B.2.1.2 Stability and fixing

The central water heater and its accessories, if part of the appliance or delivered with it, shall be so designed that they can be securely fixed to the structure of the vehicle or boat taking into account the forces produced by the moving of the water content(s) during motion.

B.2.2 Electrical safety

The electrical equipment of the appliance shall fulfil the requirements of EN 60335-1.

Electrical immersion heaters – if any – shall fulfil the requirements of EN 60335-2-21.

B.2.3 Mechanical safety elements

B.2.3.1 Pressure relieve valve

In closed systems a pressure relieve valve shall operate at not more than 1,3 times the operating pressure. The valve may be incorporated in the drain valve. It shall not be possible to override permanently the pressure relieve valve, nor to change its setting by the user.

B.2.3.2 Thermal safety

B.2.3.2.1 Control thermostat

The heater shall have a thermostat which controls the temperature of the heating water.

B.2.3.2.2 Abnormal operation

Appliances shall be constructed so that as a result of abnormal or careless operation, the risk of fire, mechanical damage impairing safety, protection against electric shock or gas leakage is obviated as far as is practicable.

The temperature of the heating water shall be protected by a temperature limiting device, or a thermal cut out. The devices shall not be of the self-resetting type and shall result in a non-volatile lockout. A reset shall only be possible by manual action, e.g. reset button or on/off operation or disconnection of electrical supply. If the heater is in safe condition after the test according to B.3.3.2.2, the requirements of B.2.3.2.2, first sentence, are deemed to be fulfilled.

B.2.4 Materials

All metal parts that may come into contact with water e.g. condensate, ingress of water from the cowl, drainage, etc. shall be made of corrosion proof material, or shall be coated with corrosion protection.

All parts that are in contact with heating water shall be made of corrosion proof material, or shall be coated with corrosion protection. If special anti-freeze liquids are required, these shall be specified by the manufacturer in the instructions for installation use and shall be compatible with the materials used.

B.2.5 Bleed valve

A bleed valve shall either be installed in the central water heater or be referred to in the instructions for installation.

NOTE It may be helpful to advise in the instructions for installation, that more than one bleed valve is necessary in the heating water circuit and how to install them.

B.3 Test methods

B.3.1 Mechanical strength

B.3.1.1 Heating water container

The test pressure for the heating water container is 1,5 times the operating pressure stated in the instructions of the appliance or the values given in B.2.1.1, whichever is greater. The pressure shall be maintained for at least 10 min with the pressure relief valve put out of service.

Then check for permanent deformation or water leaks by visual inspection.

B.3.1.2 Stability and fixing

Mechanical and visual inspection.

B.3.2 Electrical safety

Inspection of electrical safety according to the requirements of B.2.2.

B.3.3 Mechanical safety elements

B.3.3.1 Pressure relief valve

Test by checking the opening pressure and by visual inspection.

B.3.3.2 Thermal safety

B.3.3.2.1 Control thermostat

Test the heater at full rate of gas and electrical at normal conditions if applicable:

— with circulation pump, if applicable;

— with sanitary hot water, if applicable.

The control thermostat shall prevent the water from boiling. It shall operate at a temperature lower than the minimum operating temperature of the temperature limiting device.

B.3.3.2.2 Abnormal operation

Test the heater at full rate (gas and electrically, if applicable) with the thermostat set out of function:

— with liquid (accordance to manufacture specification) in the heating system and with sanitary hot water, if applicable.

— without liquid in the heating system and without sanitary hot water, if applicable.

If the heater is possible to be reset by the user after the test, the heater needs to fulfil the requirement in B.2.3.2.2 first part.

If the heater is not possible to be reset without changing components there shall be clear instructions in the user manual.

B.3.4 Materials

B.3.4.1 General

Visual inspection.

B.3.4.2 Heating water container

Visual inspection and checking the material compatibility certificate.

B.3.5 Circulation pump

Visual inspection and checking the instructions for installation.

B.3.6 Compensator reservoir

Visual inspection and checking the instructions for installation.

B.3.7 Bleed valve

Visual inspection and checking the instructions for installation.

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 2009/142/EC "Gas appliances"

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 2009/142/EC "Gas appliances".

Once this standard is cited in the Official Journal of the European Union 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 2009/142/EC

Essential requirement	Requirement	Clauses in the standard which comply wholly or partly with the essential requirements
1	General conditions	
1.1	Design and construction safety	5
1.2	Instructions	
1.2.1	Installer instructions	
	Type of gas	7.4
	Gas supply pressure	7.4
	Flow of fresh air	
	– for combustion supply	7.4, 7.3
	– danger of unburned gases (3.2.3)	Not applicable
	Dispersal of combustion products	7.4, 7.3
	Forced draft burners	Not applicable
1.2.2	User instructions	
	– instructions for safe use	7.3
	– restrictions on use	7.3
1.2.3	Warning notices with	
	– type of gas	7.1, 7.2, 7.3, 7.4
	– gas supply pressure	7.1, 7.2, 7.3, 7.4
	– restrictions-	7.1, 7.2, 7.3, 7.4
1.3	Fittings Instructions	Not applicable
2	Materials	
2.1	Appropriate for their purpose	5.2, B.2.4
2.2	Properties of the materials	Not applicable (this standard is for type approval only)

Table ZA.1 *(continued)*

3	Design and construction	
3.1	General	
3.1.1	Safety of construction	5.2, 5.4, B.2.1
3.1.2	Condensation	5.19.1
3.1.3	Risk of explosion in event of external fire	5.2, 5.5.1
3.1.4	Water/air penetration in the gas circuit	5.5.2, 5.13.1
3.1.5	Normal fluctuation of auxiliary energy	5.8.1, 5.22, 5.11.2
3.1.6	Abnormal fluctuation or failure of auxiliary energy	5.8.1, 5.22
3.1.7	Hazards of electrical origin	5.11.2, B.2.2
3.1.8	Pressurised parts	B.2.1.1; B.2.3
3.1.9	Failure of devices, – Gas circuit: – automatic shut-off valves: – flame supervision device: – air proving device: – automatic burner control system: – thermostat/overheat protection: – governors: – multifunctional controls:	 5.8.1 5.8.2 5.12 5.12.3.4 5.12.3 5.12.3.5, B.2.3.2.2 5.8.1 5.8.1
3.1.10	Overruling safety devices	5.12.1
3.1.11	Adjustment protection	5.10
3.1.12	Clear marking of devices	5.9
3.2	Unburned gas release	
3.2.1	Risk of gas leakage	5.5.1
3.2.2	Risk of gas accumulation, – during ignition: – during re-ignition: – after extinction:	 5.12.2, 5.12.3 5.12.3.2 5.12.3
3.2.3	– safety device fitted: – rooms with sufficient ventilation:	5.12.1 Not applicable
3.3	Ignition	
	– Ignition: – re-ignition – cross-lighting	5.19 5.19 5.20, 5.23.3
3.4	Combustion	
3.4.1	– flame stability: – unacceptable concentrations of products harmful to health:	5.21 5.22, 5.23, 5.25
3.4.2	No accidental release of combustion products	5.5.2
3.4.3	No release in dangerous quantities	Not applicable
3.4.4	CO concentration	Not applicable
3.5	Rational use of energy	5.24
3.6	Temperatures	
3.6.1	Floor and adjacent walls	5.16
3.6.2	Knobs and levers	5.15
3.6.3	External parts	5.15

Table ZA.1 *(continued)*

3.7	Foodstuffs and water used for sanitary purposes Sanitary water	 Not applicable

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

Bibliography

[1] EN 751-1, *Sealing materials for metallic threaded joints in contact with 1st, 2nd and 3rd family gases and hot water — Part 1: Anaerobic jointing compounds*

[2] EN 751-2, *Sealing materials for metallic threaded joints in contact with 1st, 2nd and 3rd family gases and hot water — Part 2: Non-hardening jointing compounds*

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

[4] EN 1949, *Specification for the installation of LPG systems for habitation purposes in leisure accommodation vehicles and accommodation purposes in other vehicles*

[5] EN 13878:2003, *Leisure accommodation vehicles — Terms and definitions*

[6] EN 15033, *Room sealed storage water heaters for the production of sanitary hot water using LPG for vehicles and boats*

[7] EN 60068-2-6, *Environmental testing — Part 2-6: Tests — Test Fc: Vibration (sinusoidal) (IEC 60068-2-6:2007)*

[8] ISO 7637-2:2004, *Road vehicles — Electrical disturbances from conduction and coupling — Part 2: Electrical transient conduction along supply lines only*

[9] 2000/53/EC, *Directive of the European Parliament and of the Council of 18 September 2000 on end-of life vehicles*

[10] 2001/56/EC, *Directive of the European Parliament and of the Council of 27 September 2001 relating to heating systems for motor vehicles and their trailers, amending Council Directive 70/156/EEC and repealing Council Directive 78/548/EEC*

[11] 2004/104/EC, *Commission Directive of 14 October 2004 adapting to technical progress Council Directive 72/245/EEC relating to the radio interference (electromagnetic compatibility) of vehicles and amending Directive 70/156/EEC on the approximation of the laws of the Member States relating to the type-approval of motor vehicles and their trailers*

[12] 2004/108/EC, *Directive of the European Parliament and of the Council of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC*

[13] 2009/105/EC, *Directive of the European Parliament and of the Council of 16 September 2009 relating to simple pressure vessels*

This page deliberately left blank

British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards -based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

PLUS is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email bsmusales@bsigroup.com.

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

Copyright

Useful Contacts:

Customer Services
Tel: +44 845 086 9001
Email (orders): orders@bsigroup.com
Email (enquiries): cservices@bsigroup.com

Subscriptions
Tel: +44 845 086 9001
Email: subscriptions@bsigroup.com

Knowledge Centre
Tel: +44 20 8996 7004
Email: knowledgecentre@bsigroup.com

Copyright & Licensing
Tel: +44 20 8996 7070
Email: copyright@bsigroup.com

bsi.

...making excellence a habit.™