

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

The European Standard EN 624:2000 has the status of a
British Standard

ICS 43.040.60; 47.020.90; 97.100.20

National foreword

This British Standard is the official English language version of EN 624:2000.
The UK participation in its preparation was entrusted to Technical Committee GSE/24, Dedicated LPG appliances, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled “International Standards Correspondence Index”, or by using the “Find” facility of the BSI Standards Electronic Catalogue.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 55 and a back cover.

The BSI copyright notice displayed in this document indicates when the document was last issued.

This British Standard, having been prepared under the direction of the Engineering Sector Committee, was published under the authority of the Standards Committee and comes into effect on 15 November 2000

© BSI 11-2000

ISBN 0 580 36454 2

Amendments issued since publication

Amd. No.	Date	Comments

ICS 43.040.60; 47.020.90; 97.100.20

English version

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

Spécifications 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 10 April 2000.

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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.



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

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

CONTENT	Page
Foreword	5
1 Scope	6
2 Normative references	6
3 Terms and definitions	7
4 Classification	12
4.1 Classification of gases	12
4.2 Classification of heaters	13
5 Safety, constructional and performance characteristics	13
5.1 Conversion to different gases	13
5.2 Materials	14
5.3 Accessibility of components	14
5.4 Strength of assembly	14
5.5 Soundness	14
5.6 Gas inlet connection	15
5.7 Heater stability and fixing	15
5.8 Taps and controls	15
5.9 Control handles	16
5.10 Injectors	17
5.11 Ignition devices	17
5.12 Safety devices	17
5.13 Ducts for the products of combustion and cowls	19
5.14 Verification of the heat input	20
5.15 Temperature of various parts of the heater	20
5.16 Temperature of the floor, walls or adjacent surfaces	21
5.17 Temperature of taps and components	21
5.18 Temperature of the products of combustion	21
5.19 Ignition	21

5.20	Crosslighting	22
5.21	Flame stability	22
5.22	Combustion in still air	23
5.23	Resistance to wind	23
5.24	Efficiency	23
5.25	Ignition and combustion in motion	23
5.26	Prolonged performance test	23
5.27	Electromagnetic compatibility	24
6	Test methods	24
6.1	General	24
6.2	Materials	25
6.3	Accessibility of components	25
6.4	Strength of assembly	25
6.5	Soundness	25
6.6	Connections	26
6.7	Heater stability and fixing	26
6.8	Taps and controls	26
6.9	Control handles	26
6.10	Injectors	26
6.11	Ignition devices	26
6.12	Safety devices	27
6.13	Ducts for the products of combustion and cowls	29
6.14	Verification of burner heat inputs	29
6.15	Temperatures of various parts of the heater	31
6.16	Temperatures of the support, walls and adjacent surfaces	31
6.17	Temperature of taps and components	32
6.18	Temperatures of the products of combustion	32

6.19	Ignition	32
6.20	Crosslighting	33
6.21	Flame stability	34
6.22	Combustion in still air	34
6.23	Resistance to wind	35
6.24	Efficiency	40
6.25	Ignition and combustion in motion	41
6.26	Prolonged performance test	41
7	Marking and instruction literature	41
7.1	Appliance	41
7.2	Packaging	42
7.3	Instructions for use and user maintenance	42
7.4	Instructions for installation	43
7.5	Servicing instructions	44
Annex A (normative)		
Supply situation in various countries		47
Annex ZA (informative)		
Clauses of this European Standard addressing essential requirements or other provisions of EU Directives		50

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 181 "Dedicated liquefied petroleum gas appliances", the secretariat of which is held by NSAI.

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 March 2001, and conflicting national standards shall be withdrawn at the latest by March 2001.

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

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

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

This standard only covers type testing.

NOTE: Attention is drawn in particular to prEN 1949 "Specification for the installation of LPG systems for habitation purposes in leisure accommodation vehicles and other vehicles" in regard to the harmonization of operating pressures to be used in vehicles.

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 CR 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 road vehicles and boats.

The European standard only covers type testing of room sealed heaters also including those which have a combustion air fan, an integral hot air fan or both, only for road vehicles and boats which are used for residential, recreational and commercial purposes. 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 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, a nominal heat input which does not exceed 15 kW (H_g) operated at supply pressures of 30 mbar, 28 mbar, 37 mbar and 50 mbar, using, where appropriate, 12 V or 24 V DC electrical supply.

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 mobile homes and mobile units.

2 Normative references

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

EN 161:1991	Automatic shut-off valves for gas burners and gas appliances
EN 298:1993	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 751-1	Sealing materials for metallic threaded joints in contact with 1 st , 2 nd and 3 ^d family gases and hot water - Part 1: Anaerobic jointing compounds
EN 751-2	Sealing materials for metallic threaded joints in contact with 1 st , 2 nd and 3 ^d family gases and hot water - Part 2: Non-hardening jointing compounds
prEN 1949	Specification for the installation of LPG-systems for habitation purposes in leisure accomodation vehicles and other vehicles
EN 23166	Codes for the representation of names of countries and their subdivisions -- Part 1: Country codes
EN 50165:1997	Electrical equipment of non-electric appliances for household and similar purposes - Safety requirements

prEN 55025	Limits and methods of measurement of radio disturbance characteristics for the protection of receivers used on board of vehicles
EN 60730-1	Automatic electrical controls for household and similar use - Part 1: General requirements (IEC 60730-1:1993, modified)
CR 1749	European scheme for the classification of gas appliances according to the method of evacuation of products of combustion (types)
ISO 7-1	Pipe threads where pressure-tight joints are made on the threads - Part 1: Designation, dimensions and tolerances
ISO 228-1	Pipe threads where pressure-tight joints are not made on the threads - Part 1: Designation, dimensions and tolerances
ISO 274	Copper tubes of circular section - Dimensions
ISO 7637	Road vehicles - Electrical disturbance by conduction and coupling
IEC 60068-2-6	Environmental testing - Part 2: Tests - Test Fc: Vibration (sinusoidal)

3 Terms and definitions

For the purposes of this standard the following terms and definitions apply:

3.1

caravan

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

3.2

motor caravan

self propelled leisure accommodation vehicle that meets the requirements for the construction and use of road vehicles

3.3

boat

craft up to 24 m in length

3.4

mobile home and mobile unit

transportable leisure accommodation vehicle that does not meet requirements for construction and use of road vehicles

3.5

space heater

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

3.6

space heater installation box

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

3.7

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

3.8

liquefied petroleum gas installation

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

3.9

working pressure

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

3.10

piping

pipeline of rigid metallic material

3.11

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

3.12

room sealed heater

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

3.13

combustion circuit

the 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

3.14

combustion air supply

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

3.15

injector

calibrated component that admits the gas into a burner

3.16

flue

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

3.17

flue outlet; cowl

that part of the combustion circuit through which the products of combustion are discharged to the outside

3.18

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)

3.19

space heater cover

that 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

3.20

combustion air fan

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

3.21

integral hot air fan

component of the space heater which provides heat dissipation and is essential for the proper function of the heater

3.22

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

3.23

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

3.24

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

3.25

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

3.26

tap handle

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

3.27

control valve

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

3.28

valve actuator

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

3.29

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

3.30

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

3.31

fail safe device

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

3.32

spark restoration

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

3.33

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)

3.34

ignition device

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

3.35

ignition interlock

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

3.36

restart interlock

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

3.37

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 a 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)

3.38

Ignition burner

small burner that provides a continuously burning flame to ignite a main burner, when required. This is sometimes referred to as a pilot

3.39

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

3.40

ignition delay time

time between the signal of loss of flame and start of ignition at reignition

3.41

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

3.42

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

3.43

thermostat

automatic device to maintain a selected sensibly constant temperature

3.44

external gas soundness

the soundness of gas-carrying parts to the atmosphere

3.45

internal gas soundness

the soundness of one gas-carrying part to another

3.46

soft solder

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

3.47

sound mechanical joint

connection device assuring soundness in an assembly made up of several parts, generally of metal

3.48

heat input of burner

product of the volume or mass rate and the calorific value of the gas (brought to the same reference conditions). It is expressed in kilowatts

Symbol: Q .

3.49

nominal heat input of a burner

the value of the heat input of the burner, as declared by the manufacturer

Symbol: Q_n .

3.50

heat output

the value of the heat input multiplied by the efficiency factor

3.51

volume rate

the volume of gas passed in unit time. This is expressed in cubic metres per hour or in litres per hour (cubic decimetres per hour)

Symbol: V .

3.52

mass rate

mass of the gas passed in unit time. This is expressed in kilograms per hour or grammes per hour
Symbol: M .

3.53

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

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.

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

The calorific values are expressed in units of energy referred:

- either to the unit volume of dry gas measured under normal reference conditions: 15 °C, 1 013,25 mbar. It is usually expressed in megajoules per cubic metre (MJ/m³);
- or to the unit mass of dry gas. It is then usually expressed in megajoules per kilogramme (MJ/kg)

3.54

Wobbe index

the ratio of the calorific value of a gas, by unit of volume, and the square root of the relative density of the same gas. The Wobbe index is called gross when the calorific value considered is the gross calorific value (see 3.53). It is usually expressed in megajoules per cubic metre (MJ/m³)
Symbol: W_s .

3.55

stability of flames

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

3.56

light back

phenomenon characterized by the return of the flame inside the body of the burner

3.57

flame lift

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

3.58

cold condition

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

3.59

hot condition

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

3.60

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

4 Classification

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_g).

Table 1 - Classification of gases

Category	Wobbe index in MJ/m ³ ; H_g at 15 °C
$I_{3B/P} + I_{3+(28/30-37)}$	between 72,9 and 87,3
I_{3P}	between 72,9 and 76,8
I_{3B}	between 81,8 and 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). For these categories, requirements different from those defined in this standard shall not be specified.

Tables A.1, A.2 and A.3 include the gas distribution conditions and types of connection applicable to each country.

This specification only covers appliances of the following categories:

- 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;
- 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;
- 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;
- appliances in Category $I_{3B(28-30)}$ which may be used with butane only at a nominal operating pressure of 28 mbar or 30 mbar;
- appliances in Category $I_{3P(30)}$ which may be used with propane only at a nominal operating pressure of 30 mbar;
- 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

NOTE: Test methods and means of assessment are given in clause 6.

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 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.

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 manufacturer's instructions.

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 Soundness

5.5.1 Soundness 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 soundness 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 soundness 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 Soundness test

When tested in accordance to 6.5.1.2, the leak detected shall not exceed 40 cm³/h.

5.5.2 Soundness 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 supplied or specified by the heater manufacturer.

The combustion circuit from the combustion air intake to the entry of the heat exchanger shall not exceed a leakage rate of 1,0 m³/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 m³/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 withstands a maximum energy delayed ignition without danger to the user.

Heaters having a nominal input $> 3,5$ kW shall be equipped with a temperature regulator. The input of the space heater can be variable and/or have an "on-off" setting as a function of the room temperature. If the 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 $\leq 3,5$ 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 an input greater than or equal to 7 kW there shall be two automatic shut-off valves in series, both at least complying to Class B as defined in EN 161.

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 an 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 Class A as defined in EN 161 with a working pressure of 300 mbar. Alternatively, a valve complying to 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 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 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 50165:1997.

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 6.12.2.1 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 6.12.2.2. Heaters equipped with thermoelectric flame supervision devices shall either:

- a) incorporate a restart interlock to prevent manual reignition 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 d)); 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 reignition 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 the following clauses of EN 298:1993:

- 6.1;
- 6.2;
- 6.4;
- 6.5 (excluding 6.5.2.2e) 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;
- 8.8;
- 9 (excluding 9.1.2 b), 9.2.2);
- 10.

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 specified by the heater manufacturer.

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 effect 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 dm³/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 be capable of giving the nominal heat input stated by the manufacturer.

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 grilles 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 value recommended by the manufacturer.

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

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.

5.20.1 Cold condition

When tested in accordance with 6.20.1 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.

5.20.2 Hot 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 Crosslighting at low temperature

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 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 flame 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 76 %.

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 soundness 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 shall meet the requirements of prEN 55025 class 1 and ISO 7637 test level I class D. During and after these tests the control system shall either operate normally, cause a safety shut-down or go to stand-by.

6 Test methods

NOTE: This clause describes the methods of test which enable the requirements of clause 5 to be verified.

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

Category	$I_{3B(28/30)}$, $I_{3+(28/30-37)}$, $I_{3B/P(30)}$, $I_{3B/P(50)}$	$I_{3P(30)}$, $I_{3P(37)}$, $I_{3P(50)}$
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

Type of Gas	Test pressures			Working pressure according to data plate
	Normal	Minimum	Maximum	
$I_{3B/P(30)}$, $I_{3P(30)}$	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 special national conditions with regard to gases and supply pressures 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 Soundness

6.5.1 Soundness of the gas carrying parts

6.5.1.1 Construction

Mechanical and visual inspection.

6.5.1.2 Soundness 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 %. In case of dispute equipment shown in figure 1 shall be used.

6.5.2 Soundness of combustion circuit

6.5.2.1 The soundness 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 recommended by the heater manufacturer.

6.5.2.2 The heater to be tested is connected to a compressed air source so that during testing there is a pressure of 0,5 mbar at the inlet to the appliance.

The test is performed with an air inlet duct, if separate, and the flue duct of the maximum length as recommended by the heater manufacturer.

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 4.8 of EN 161:1991.

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 50165.

6.12 Safety devices

6.12.1 General

Mechanical, visual and electrical inspection.

6.12.2 Thermoelectric flame supervision devices

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.

6.12.2.1 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.

6.12.2.2 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.

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 begin 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 stand by 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 <i>g</i>
Rate of frequency change:	1 octave per min
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 IEC 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 given by the manufacturer, 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 6.13.2.3 is repeated with a sample duct at $(300 \pm 10) ^\circ\text{C}$.

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 one of the following expressions depending on whether the gas flow rate is measured by volume or weight.

$$Q_n = \frac{1}{3\,600 \times 10^{-3}} \cdot M_o \cdot H_s$$

or

$$Q_n = \frac{1}{3\,600 \times 10^{-3}} \cdot V_o \cdot H_s$$

where

- Q_n is the nominal heat input, expressed in kilowatts;
- M_o is the nominal mass rate (in kilogramme per hour) under reference test conditions (15 °C, 1 013,25 mbar);
- V_o is the nominal volume rate (in cubic metres per hour) under reference test conditions (15 °C, 1 013,25 mbar);
- H_s is the gross calorific value of reference gas, expressed in megajoules per cubic metre or in megajoules per kilogramme.

M_o and V_o are calculated from the mass or volume rate observed during the test (M or V) using the appropriate equation as follows:

Determination by mass

$$\frac{M_o}{M} = \sqrt{\frac{1\,013,25+p}{p_a+p} \cdot \frac{273,15+t_g}{288,15} \cdot \frac{d_r}{d}}$$

Determination from volume rate

$$\frac{V_o}{V} = \sqrt{\frac{1\,013,25+p}{1\,013,25} \cdot \frac{p_a+p}{1\,013,25} \cdot \frac{288,15}{273,15+t_g} \cdot \frac{d}{d_r}}$$

where:

- M_o is the mass rate under reference conditions;
- M is the mass rate obtained under test conditions;
- V_o is the volume rate under reference conditions;
- V is the volume rate obtained under test conditions;
- p_a is the atmospheric pressure, expressed in millibar;
- p is the gas supply pressure at the inlet of the heater, expressed in millibar;
- t_g is the temperature of the gas at the inlet of the heater, expressed in degree celsius;
- 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:

$$d_{wet} = \frac{d (p_a + p - W) + 0,622 W}{p_a + p}$$

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 by the manufacturer.

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 recommended by the manufacturer, 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

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.

6.20.1 Cold condition

6.20.1.1 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.

6.20.1.2 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.

6.20.2 Hot condition

6.20.2.1 After heating the heater to the hot condition, the tests given in 6.20.1 are repeated except that any delay before relighting the separately controlled sections shall be as specified in the manufacturer's instructions.

6.20.2.2 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.

6.20.3 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.

6.20.4 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.

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.

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. 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.
24	below 22,8	
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 (CO₂) or oxygen (O₂) in the products of combustion shall be determined by a method which allows the percentage by volume carbon dioxide (CO₂) or oxygen (O₂) 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.

$$(CO_{nd}) = \frac{(CO_m) \cdot (CO_2 \text{ max})}{(CO_2 m)}$$

where:

- (CO₂ max) is the percentage by volume of carbon dioxide (CO₂) in the non-diluted dry products of combustion;
- (CO₂ m) is the measured percentage by volume of carbon dioxide (CO₂) 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 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 (O₂ m) in the products of combustion, the following equation applies:

$$\frac{(CO_m)}{(CO_{nd})} = \frac{21 - (O_2 m)}{21}$$

where:

- (O₂ m) is the measured percentage by volume of oxygen (O₂) 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 4 directions at 90° to each other.

6.23 Resistance to wind

6.23.1 Wind generator and test installation

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.

6.23.1.1 Test installation for wall terminals (see 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 $\pm$ 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.

6.23.1.2 Test installation for roof terminals (see 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 b) and c) shall be met without the terminal in place.

6.23.1.3 Test installation for floor terminals (see 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 a), b) and c) is used.

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

Set Up	Elevation α	Angle β		Wind Speed m/s
		Symmetrical terminals	Asymmetrical terminals	
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

		Angle β		Wind Speed m/s	
Set Up	Elevation α	Symmetrical terminals	Asymmetrical terminals		
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 $(20 \pm 5)^\circ\text{C}$. 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:

$$\frac{\eta}{0,926} = 100 - \left[\left(\frac{42,4}{C O_2 m} + 0,8 \right) \cdot \frac{t_{ex} - t_L}{100} \right]$$

where:

η	is the efficiency factor, expressed in percentage;
$C O_2 m$	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:

$$\frac{(C O_2 \text{ max})}{(C O_2)} = \frac{21}{21 - (O_2)}$$

where:

- CO₂ max is the percentage by volume of carbon dioxide (CO₂) in the non-diluted dry products of combustion;
- O₂ m is the measured percentage by volume of oxygen (O₂) 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

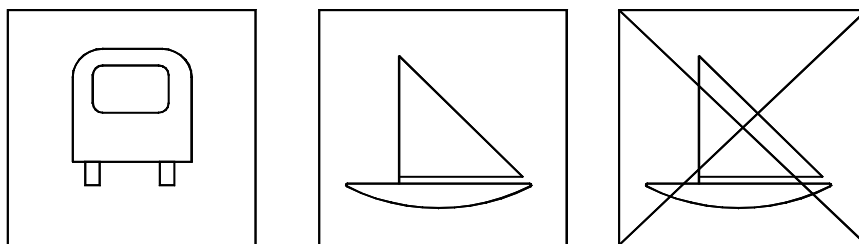
7.1.1 Data plate

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 manufacturer¹ and/or registered trade mark, completed by the address of the manufacturer or importer;
- b) trade name or type;
- c) serial number;
- d) type of gas and operating pressure(s) in mbar;
- e) consumption in g/h and nominal heat input in kW;
- f) appliance category(ies);
- g) type of electrical supply used, if applicable;
- h) country(ies) of first destination in accordance with EN ISO 3166-1;

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

- i) suitable for vehicles and suitable / not suitable for boats as a symbol, e.g.:



7.1.2 Appliance warning labels

Appliances shall be fitted with the following labels:

- a) An advice such as: "Read the instructions before operation of this heater";
- b) if applicable, a warning: "This heater is not suitable for use when the vehicle is in motion.";
- c) a warning: "Switch off when vehicle or any other appliance is being refuelled.";
- d) a warning in case of heaters equipped with thermoelectric flame supervision devices: "Re-ignition shall not be performed before 3 min after flame failure."

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";
- e) advice such as: "This heater requires installation by a competent person".

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 sold with 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.

7.4 Instructions for installation

Heaters shall be sold with 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:

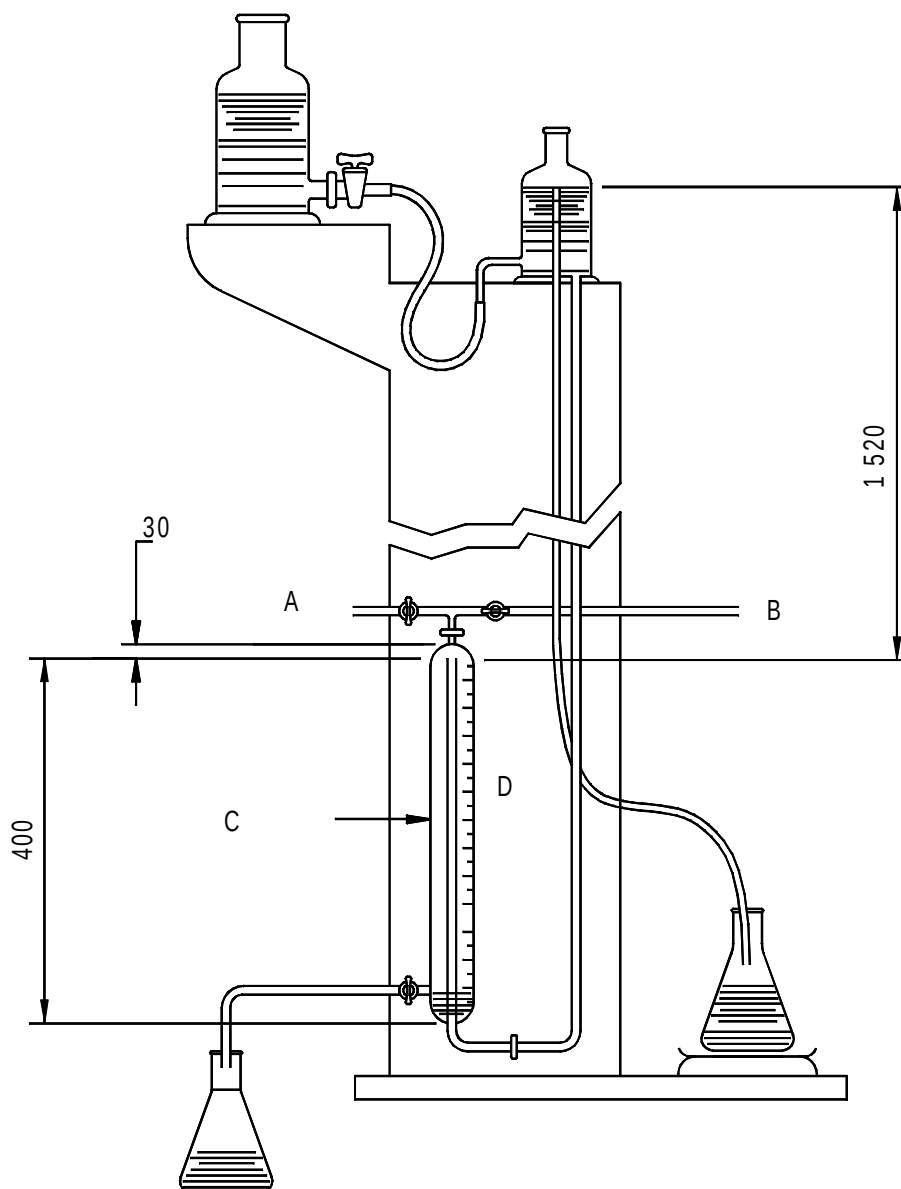
- a) The location of the outlet for the products of combustion to prevent the re-entry of the flue gases into the habitable volume;
- b) inspection of the installation and function;

- 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..

7.5 Servicing instructions

The manufacturer shall make servicing instructions available, on request, to competent persons to enable the heater to be maintained in a safe working condition.

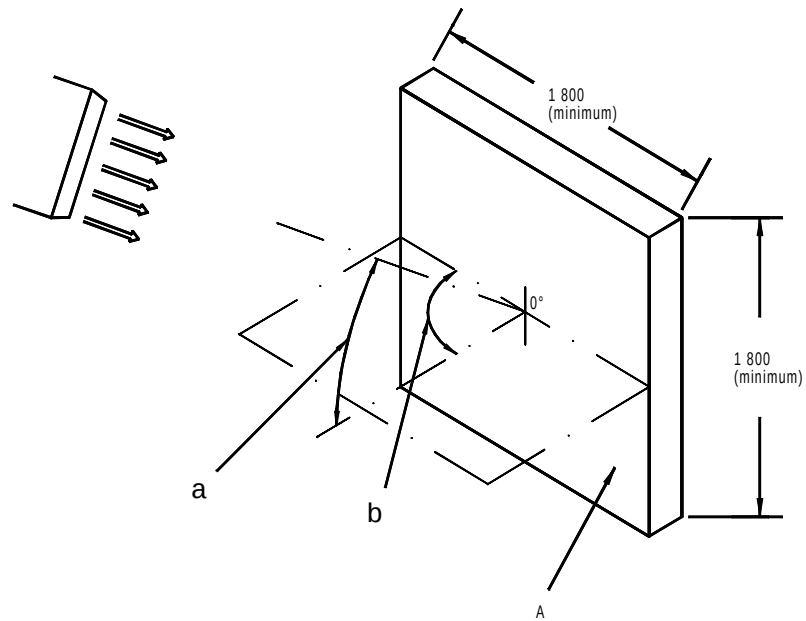


Key

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

The dimensions given (in millimetres) are as a guide only

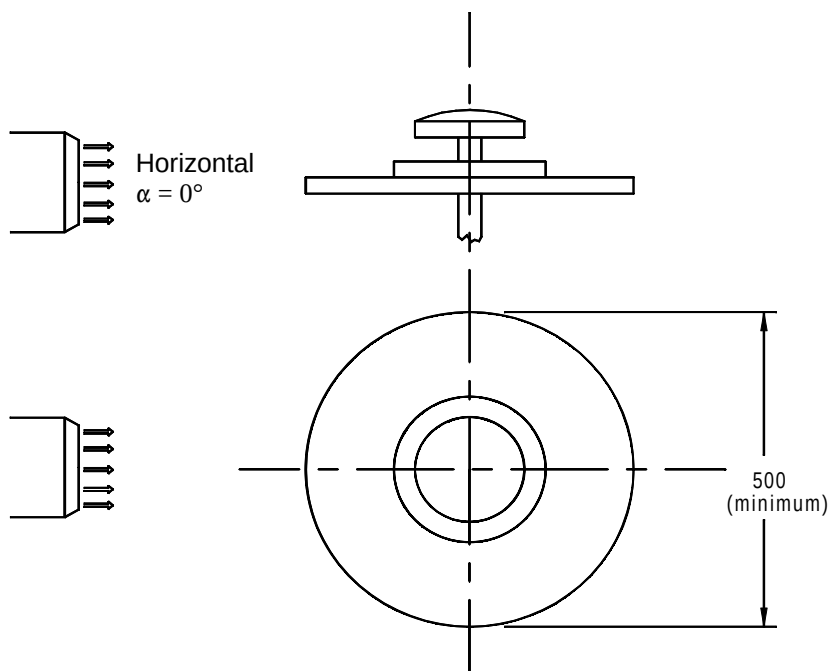
Figure 1 - Apparatus for testing appliance soundness



All dimensions in mm

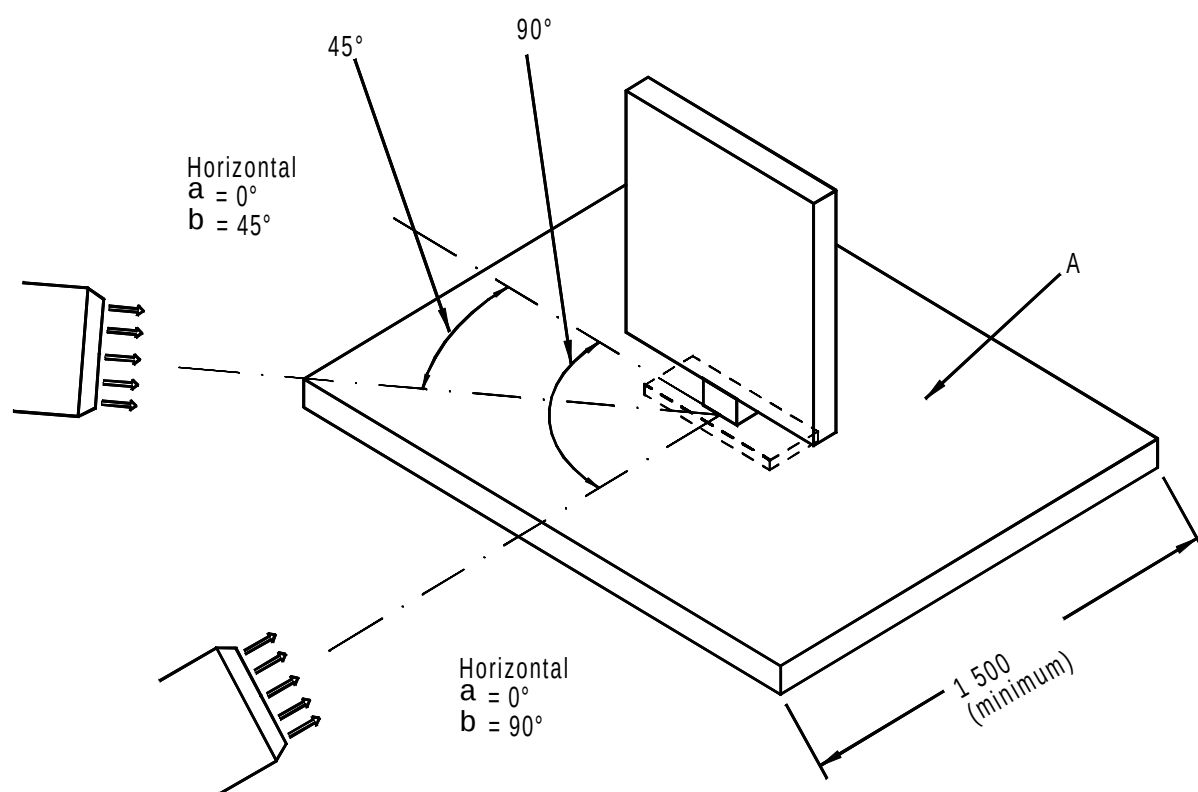
A: Test wall

Figure 2 - Apparatus for wall terminal wind test



All dimensions in mm

Figure 3 - Apparatus for roof terminal wind test



All dimensions in mm

A: Floor

Figure 4: Apparatus for floor terminal wind test

Annex A

(normative)

Supply situation in various countries

Table A.1 - Heater categories marketed in various countries

[illegible]

Table A.2 - Normal working pressures for heaters

Gas Category	I _{3+(28-30/37)}		I _{3 B/P(30)}	I _{3 B/P(50)}	I _{B(28-30)} ^a	I _{3P(30)} ^a	I _{3P(37)} ^a	I _{3P(50)} ^a
Working Pressure	28/37 mbar	30/37 mbar	30 mbar	50 mbar	28/30 mbar	30 mbar	37 mbar	50 mbar
Country								
AT			X	X				X
BE	X							
CH	X							
CZ								
DE			X	X				X
DK			X					
ES	X							
FI			X					
FR	X				X		X	
GB	X				X		X	
GR								
IE	X				X		X	
IS								
IT		X	X					
LU								
NL			X			X		
NO			X					
PT		X			X		X	
SE			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.

¹⁾ These categories are utilized in some countries for mobile homes and may be used also for this type of appliances.

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

Country	without thread	threaded complying to		connection to copper tube complying to ISO 274
		ISO 7-1	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				

Annex ZA (informative)

Clauses of this European Standard addressing essential requirements or other provisions of EU Directives

This European standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association and supports essential requirements of EU Directive 90/396/EEC.

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

The clauses of this standard quoted in the following table are likely to support requirements of Directive 90/396/EEC. Compliance with these clauses of this standard provides one means of conforming with the specific requirements of the Directive concerned and associated EFTA regulations.

Table ZA. 1: Correlation between clauses of EN 624 and the essential requirements of European directive 90/393/EEC

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 for installer Instructions for user Warning notices on appliance on packaging Official Language	7.4, 7.5 7.3 7.1.2 7.2 7.1.2, 7.2, 7.3, 7.4
1.2.1	Installer instructions Type of gas Gas supply pressure Flow of fresh air – for combustion supply – danger of unburned gases (3.2.3) Dispersal of combustion products Forced draft burners	7.4 7.4 7.4, 7.3 Not applicable 7.4, 7.3 Not applicable
1.2.2	User instructions – instructions for safe use – restrictions on use	7.3 7.3
1.2.3	Warning notices with – type of gas – gas supply pressure – restrictions-	7.1, 7.2, 7.3, 7.4 7.1, 7.2, 7.3, 7.4 7.1, 7.2, 7.3, 7.4
1.3	Fittings Instructions	Not applicable
2	Materials	
2.1	Appropriate for their purpose	5.2
2.2	Properties of the materials	Not applicable (this standard is for type approval only)
3	Design and construction	
3.1	General	
3.1.1	Safety of construction	5.2, 5.4
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
3.1.8	Pressurised parts	Not applicable
3.1.9	Failure of devices, – Gas circuit: – automatic shut-off valves: – flame supervision device: – air proving device: – automatic burner control system: – thermostat/overhead protection: – governors: – multifunctional controls:	5.8.1 5.8.2 5.12 5.12.3.4 5.12.3 5.12.3.5 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
3.7	Foodstuffs and water used for sanitary purposes	
	Sanitary water	Not applicable

BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Tel: 020 8996 9000. Fax: 020 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: 020 8996 9001. Fax: 020 8996 7001.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre. Tel: 020 8996 7111. Fax: 020 8996 7048.

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration. Tel: 020 8996 7002. Fax: 020 8996 7001.

Copyright

Copyright subsists in all BSI publications. BSI also holds the copyright, in the UK, of the publications of the international standardization bodies. Except as permitted under the Copyright, Designs and Patents Act 1988 no extract may be reproduced, stored in a retrieval system or transmitted in any form or by any means – electronic, photocopying, recording or otherwise – without prior written permission from BSI.

This does not preclude the free use, in the course of implementing the standard, of necessary details such as symbols, and size, type or grade designations. If these details are to be used for any other purpose than implementation then the prior written permission of BSI must be obtained.

If permission is granted, the terms may include royalty payments or a licensing agreement. Details and advice can be obtained from the Copyright Manager. Tel: 020 8996 7070.