



BSI Standards Publication

Gas-fired overhead luminous radiant heaters for non-domestic use — Safety and energy efficiency

National foreword

This British Standard is the UK implementation of EN 419:2019. It supersedes BS EN 419-1:2009 and BS EN 419-2:2006, which are withdrawn.

The UK participation in its preparation was entrusted to Technical Committee GSE/20, Non-domestic space heaters (gas).

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

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English Version

Gas-fired overhead luminous radiant heaters for non-domestic use - Safety and energy efficiency

Appareils surélevés de chauffage à rayonnement
lumineux au gaz à usage non domestique - Sécurité et
efficacité énergétique

Gasbefeuerte Hellstrahlerheizgeräte für gewerbliche
und industrielle Anwendungen - Sicherheit und
Energieeffizienz

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European foreword

This document (EN 419:2019) has been prepared by Technical Committee CEN/TC 180 “Decentralized gas heating”, the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2020, and conflicting national standards shall be withdrawn at the latest by April 2020.

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

This document supersedes EN 419-1:2009 and EN 419-2:2006.

Aspects of safety and energy efficiency of appliances are brought together. Significant changes of the new document compared to the earlier standards are: incorporation recent state of the art of luminous heaters, incorporation of medium gas pressure appliances for industrial use, unique and more detailed description of method to determine radiant factor, incorporating terms and calculation scheme of Ecodesign Regulation (EU) No. 2015/1188.

The test gases, test pressures and appliance categories given in this European Standard are in accordance with those specified in EN 437:2018.

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

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

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

1 Scope

This document specifies the requirements and test methods for the construction, safety, rational use of energy, classification and marking of non-domestic gas-fired overhead luminous radiant heaters for environmental comfort, referred to in the body of the text as “appliances”.

This document is applicable to Type A₁ and Type A₃ appliances only (see 4.2.2) intended for use in other than residential dwellings:

- a) low gas pressure appliances operating at pressures up to and including 50 mbar;
- b) medium gas pressure appliances operating at pressures above 50 mbar and up to 2 bar.

This document is not applicable to:

- appliances designed for use in domestic dwellings;
- outdoor appliances;
- appliances of heat input in excess of 120 kW (based on the net calorific value of the appropriate reference gas);

This document is applicable to appliances which are intended to be type tested.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 88-1:2011+A1:2016, *Pressure regulators and associated safety devices for gas appliances - Part 1: Pressure regulators for inlet pressures up to and including 50 kPa*

EN 88-2:2007, *Pressure regulators and associated safety devices for gas appliances - Part 2: Pressure regulators for inlet pressures above 500 mbar up to and including 5 bar*

EN 125:2010+A1:2015, *Flame supervision devices for gas burning appliances - Thermoelectric flame supervision devices*

EN 126:2012, *Multifunctional controls for gas burning appliances*

EN 161:2011+A3:2013, *Automatic shut-off valves for gas burners and gas appliances*

EN 298:2012, *Automatic burner control systems for burners and appliances burning gaseous or liquid fuels*

EN 437:2018, *Test gases - Test pressures - Appliance categories*

EN 1057:2006+A1:2010, *Copper and copper alloys - Seamless, round copper tubes for water and gas in sanitary and heating applications*

EN 1106:2010, *Manually operated taps for gas burning appliances*

EN 10226-1:2004, *Pipe threads where pressure tight joints are made on the threads - Part 1: Taper external threads and parallel internal threads - Dimensions, tolerances and designation*

EN 10226-2:2005, *Pipe threads where pressure tight joints are made on the threads - Part 2: Taper external threads and taper internal threads - Dimensions, tolerances and designation*

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

EN 13410:2001, *Gas-fired overhead radiant heaters - Ventilation requirements for non-domestic premises*

EN 13611:2019, *Safety and control devices for burners and appliances burning gaseous and/or liquid fuels - General requirements*

EN 14459:2015, *Safety and control devices for burners and appliances burning gaseous or liquid fuels - Control functions in electronic systems - Methods for classification and assessment*

EN 14800:2007, *Corrugated safety metal hose assemblies for the connection of domestic appliances using gaseous fuels*

EN 60335-1:2012, *Household and similar electrical appliances - Safety - Part 1: General requirements*

EN 60335-2-102:2016, *Household and similar electrical appliances - Safety - Part 2-102: Particular requirements for gas, oil and solid-fuel burning appliances having electrical connections*

EN 60529:1991, *Degrees of protection provided by enclosures (IP Code)*

ISO 7-1:1994, *Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation*

EN ISO 228-1:2003, *Pipe threads where pressure-tight joints are not made on the threads - Part 1: Dimensions, tolerances and designation (ISO 228-1:2000)*

EN ISO 3166-1:2014, *Codes for the representation of names of countries and their subdivisions - Part 1: Country codes (ISO 3166-1:2013)*

EN ISO/IEC 17025:2005, *General requirements for the competence of testing and calibration laboratories (ISO/IEC 17025:2005)*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1 Appliance and its constituent parts

3.1.1

overhead luminous radiant heater

gas-fired appliance intended for installation at a height above head level, which is designed to heat the space beneath by radiation and in which the heat is produced by means of burning the

fuel at or near the outer surface of a material such as a ceramic plaque or gauze, or by means of a burner heating a gauze or similar material

3.1.2

atmospheric burner

aerated burner in which the air for combustion is entrained at atmospheric pressure

3.1.3

inlet connection

part of the appliance intended to be connected to the gas supply

3.1.4

mechanical joint

means of ensuring the soundness of an assembly of several (generally metallic) parts without the use of liquids, pastes, tapes, etc

Note 1 to entry: For example the following:

- a) metal to metal joints;
- b) conical joints;
- c) toroidal sealing rings ("O" rings);
- d) flat joints.

3.1.5

gas circuit

part of the appliance that conveys or contains the gas between the appliance gas inlet connection and the burner(s)

3.1.6

restrictor

device with an orifice, which is placed in the gas circuit so as to create a pressure drop and thus reduce the gas pressure at the burner to a predetermined value for a given supply pressure and rate

3.1.7

gas rate adjuster

component allowing to set the gas rate of the burner to a predetermined value according to the supply conditions

Note 1 to entry: Adjustment can be progressive (screw adjuster) or in discrete steps (by changing restrictors).

Note 2 to entry: The adjusting screw of an adjustable regulator is regarded as a gas rate adjuster.

Note 3 to entry: The action of adjusting this device is called "adjusting the gas rate".

Note 4 to entry: A factory sealed gas rate adjuster is considered to be non-existent.

Note 5 to entry: Immobilizing a gas rate adjuster by means as e.g. a screw is called "setting an adjuster".

Note 6 to entry: Arrangement in respect of the adjuster such that any attempt to change the adjustment breaks the sealing device or sealing material and makes this interference apparent is called "sealing an adjuster".

Note 7 to entry: A gas rate adjuster is considered to be non-existent if it has been factory sealed in a position such that it is not operational in the range of supply pressures corresponding to the appliance category.

Note 8 to entry: Putting an adjuster or a control (of temperature, pressure, etc.) out of action and sealing it in this position is called “putting an adjuster or a control out of service”; the appliance functions as if the adjuster or control had been removed.

3.1.8

injector

component that admits the gas into a burner

3.1.9

main burner

burner that is intended to ensure the thermal function of the appliance

Note 1 to entry: Main burner is generally called “the burner”

3.1.10

ignition burner

burner whose flame is intended to ignite another burner

3.1.11

ignition device

means (e.g. flame, electrical ignition device or other device) used to ignite the gas at the ignition burner or at the main burner

3.1.12

primary aeration adjuster

device enabling the primary air to be set at the necessary value according to the supply conditions

3.1.13

low gas pressure appliance

appliance operating at gas pressures up to and including 50 mbar

3.1.14

medium gas pressure appliance

appliance operating at gas pressures above 50 mbar and up to 2 bar

3.2 Adjusting, control and safety devices

3.2.1

automatic burner control system

system comprising a programming unit and all the elements of a flame detector device

Note 1 to entry: The various functions of an automatic burner control system may be in one or more housings.

3.2.2

programming unit

device which executes the programme reacting to signals from control and safety devices, gives control commands, controls the start-up sequence, supervises the burner operation and causes controlled shut-down, and, if necessary, safety shut-down and lock-out

Note 1 to entry: The programming unit follows a predetermined sequence of actions and always operates in conjunction with a flame detector. Such a sequence of operations involving switching on, starting up, supervising and switching off the burner is called “programme”.

3.2.3

flame detector

device by which the presence of a flame is detected and signalled

Note 1 to entry: The flame detector can consist of a flame sensor, an amplifier and a relay for signal transmission. These parts, with the possible exception of the actual flame sensor, may be assembled in a single housing for use in conjunction with a programming unit.

3.2.4

flame signal

signal given by the flame detector, normally when the flame sensor senses a flame

3.2.5

flame supervision device

device that, in response to a signal from the flame detector, keeps the gas supply open and shuts it off in the absence of the supervised flame

3.2.6

pressure regulator

device which maintains the outlet pressure constant independent of the variations in inlet pressure within defined limits

3.2.7

adjustable pressure regulator

regulator provided with means for changing the outlet pressure setting

3.2.8

volume regulator

device which maintains the gas rate constant within a given tolerance, independent of the upstream pressure

3.2.9

range-rating device

component on the appliance intended to be used by the installer to adjust the heat input of the appliance within a range of heat inputs stated by the manufacturer, to suit the actual heat requirements of the installation

Note 1 to entry: This adjustment may be progressive (e.g. by use of a screw adjuster) or in discrete steps (e.g. by changing restrictors).

3.2.10

automatic shut-off valve

valve designed to open when energized and to close automatically when de-energized

3.2.11**gas/air ratio control**

device that automatically adapts the combustion air rate to the gas rate or vice versa

3.3 Operation of the appliance**3.3.1****heat input****Q**

quantity of energy used in unit time corresponding to the volumetric and mass flow rates, the calorific value to be used being the net or gross calorific value

Note 1 to entry: The heat input is expressed in kilowatts (kW).

[SOURCE: EN 437:2018]

3.3.2**nominal heat input** **Q_n**

value of the heat input (kW) declared by the manufacturer

3.3.3**volume flow rate****V**

volume of gas consumed by the appliance in unit time during continuous operation

Note 1 to entry: The volume flow rate is expressed in m³/h, l/min, dm³/h or dm³/s.

[SOURCE: EN 437:2018]

3.3.4**mass flow rate****M**

mass of gas consumed by the appliance in unit time during continuous operation

Note 1 to entry: The mass flow rate is expressed in kg/h or g/h.

[SOURCE: EN 437:2018]

3.3.5**start gas**

gas that is supplied at the start gas rate either at the main burner or at a separate ignition burner

3.3.6**start gas rate**

restricted gas flow rate admitted either to a separate ignition burner or to the main burner during start up

3.3.7**start gas flame**

flame established at the start gas rate either at the main burner or at a separate ignition burner

3.3.8

flame stability

characteristic of flames which remain on the burner ports or in the flame reception zone intended by the construction

3.3.9

flame lift

total or partial lifting of the base of the flame away from the burner port or the flame reception zone provided by the design

Note 1 to entry: Flame lift may cause the flame to blow out, i.e. extinction of the air-gas mixture.

3.3.10

light-back

entry of a flame into the body of the burner

3.3.11

light-back at the injector

ignition of the gas at the injector, either as a result of light-back into the burner or by the propagation of the flame outside the burner

3.3.12

sooting

phenomenon appearing during incomplete combustion and characterized by deposits of soot on the surfaces or parts in contact with the combustion products or with the flame

3.3.13

first safety time

interval between the ignition burner valve, start gas valve or main gas valve, as applicable, being energized and the ignition burner valve, start gas valve or main gas valve, as applicable, being de-energized if the flame detector signals the absence of a flame at the end of this interval

Note 1 to entry: Where there is no second safety time, this is called the safety time.

3.3.14

second safety time

being a first safety time applicable to either an ignition burner or to a start gas flame only, the second safety time is the interval between the main gas valve being energized and the main gas valve being de-energized if the flame detector signals the absence of a flame at the end of this interval

3.3.15

running condition of the system

condition in which the burner is in normal operation under the supervision of the programming unit and its flame detector

3.3.16

controlled shut-down

process by which the power to the automatic shut-off valve(s) is removed immediately as a result of the action of a controlling function

3.3.17**safety shut-down**

process which is effected immediately following the response of a safety control or sensor or the detection of a fault in the burner control system and which puts the burner out of operation by immediately removing the power from the automatic shut-off valve(s) and the ignition device

3.3.18**non-volatile lock-out**

safety shut-down condition of the system such that a restart can only be accomplished by a manual reset of the system and by no other means

3.3.19**volatile lock-out**

safety shut-down condition of the system such that a restart can only be accomplished by either the manual reset of the system, or an interruption of the mains electrical supply and its subsequent restoration

3.3.20**spark restoration**

process by which, following loss of the flame signal, the ignition device will be switched on again without total interruption of the gas supply

Note 1 to entry: This process ends with the restoration of the running condition or, if there is no flame signal at the end of the safety time, with volatile or non-volatile lock-out.

3.3.21**automatic recycling**

process by which, after loss of flame during the running condition or accidental interruption of the operation of the appliance, the gas supply is interrupted and the complete start sequence is automatically re-initiated

NOTE This process ends with the restoration of the running condition or, if there is no flame signal at the end of the safety time, or if the cause of the accidental interruption has not disappeared, with volatile or non-volatile lock-out.

3.3.22**ignition opening time**

time interval between ignition of the supervised flame and the moment when the valve is held open

3.3.23

extinction safety time

time which elapses between the moment when the supervised flame is extinguished and the moment when:

- a) for an appliance without an automatic burner control system, the gas supply is shut-off:
 - 1) to the main burner;
 - 2) and/or to the ignition burner;
- b) or for an appliance with an automatic burner control system, the control system initiates shut- down of the burner by removing power to the automatic gas shut-off valves

3.4 Gases

3.4.1

Calorific value

CV

quantity of heat produced by the complete combustion, at a constant pressure equal to 1 013,25 mbar and a constant temperature of 15°C, of unit volume or mass of gas, the constituents of the combustible mixture being taken at reference conditions and the products of combustion being brought back to the same conditions, for which a distinction is made between:

- a) the gross calorific value H_s in which the water produced by combustion is assumed to be condensed (GCV);
- b) the net calorific value H_i in which the water produced by combustion is assumed to be in the vapour state (NCV)

Note 1 to entry: The calorific value is expressed either in MJ/m³ of dry gas at the reference conditions or in MJ/kg of dry gas.

[SOURCE: EN 437:2018]

3.4.2

relative density

d

ratio of densities of dry gas and dry air measured under the same conditions of temperature and pressure

3.4.3

Wobbe index

gross Wobbe index: W_s and net Wobbe index: W_i

ratio of the calorific value of a gas per unit volume and the square root of its relative density under the same reference conditions

Note 1 to entry: The Wobbe index is said to be gross or net according to whether the calorific value used is the gross or net calorific value.

Note 2 to entry: The Wobbe index is expressed in MJ/m³ of dry gas at the reference conditions or in MJ/kg of dry gas.

[SOURCE: EN 437:2018]

3.4.4**test pressures**

gas pressures used to verify the operational characteristics of appliances using combustible gases, consisting of normal and limit pressures

Note 1 to entry: Test pressures are expressed in mbar; 1 mbar = 10^2 Pa.

[SOURCE: EN 437:2018]

3.4.5**normal pressure** **p_n**

pressure under which the appliances operate in nominal conditions when they are supplied with the corresponding reference gas

Note 1 to entry: Pressures are expressed in mbar; 1 mbar = 10^2 Pa.

[SOURCE: EN 437:2018]

3.4.6**limit pressures****maximum limit pressure $p_{\max}$ and minimum limit pressure $p_{\min}$**

pressures representative of the extreme variations in the appliance supply conditions

Note 1 to entry: Pressures are expressed in mbar; 1 mbar = 10^2 Pa.

[SOURCE: EN 437:2018]

3.4.7**pressure couple**

combination of two distinct gas distribution pressures applied by reason of the significant difference existing between the Wobbe indices within a single family or group in which:

Note 1 to entry: The higher pressure corresponds to gases of low Wobbe index.

Note 2 to entry: The lower pressure corresponds to gases of high Wobbe index.

Note 3 to entry: Pressures are expressed in mbar; 1 mbar = 10^2 Pa.

[SOURCE: EN 437:2018]

3.5 Conditions of operation and measurement**3.5.1****reference conditions**

reference conditions applying in this standard, which are:

- a) for calorific values, temperature 15 °C;
- b) for gas and air volumes, dry, brought to 15 °C and to an absolute pressure of 1 013,25 mbar

3.5.2**cold condition**

condition of the appliance required for some tests and obtained by allowing the unlit appliance to attain thermal equilibrium at room temperature

3.5.3

hot condition

condition of the appliance required for some tests and obtained by heating to thermal equilibrium at the nominal heat input, any thermostat remaining fully open

3.5.4

thermal equilibrium

operating state of the appliance, corresponding to a particular setting of the input, reached after 40 minutes from a cold start, or earlier when:

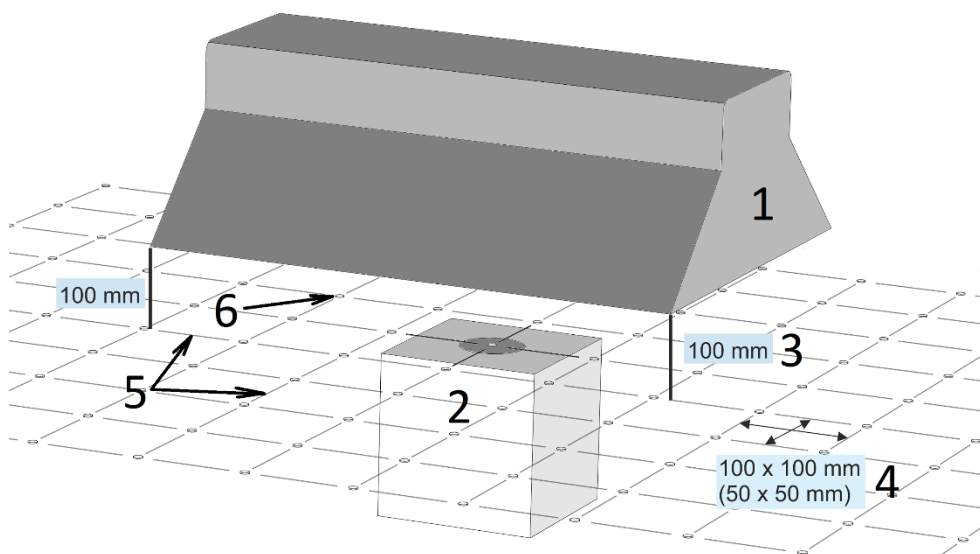
- a) the radiant output does not change by more than 1 % per 10 min, or:
- b) when the surface temperatures of the radiant parts of the appliance do not change by more than 2°C in 10 min.

3.5.5

radiant output

radiant power that is passing the measuring plane parallel to and 100 mm under the radiation reference plane of the heater

Note 1 to entry: See Figure 1.



Key

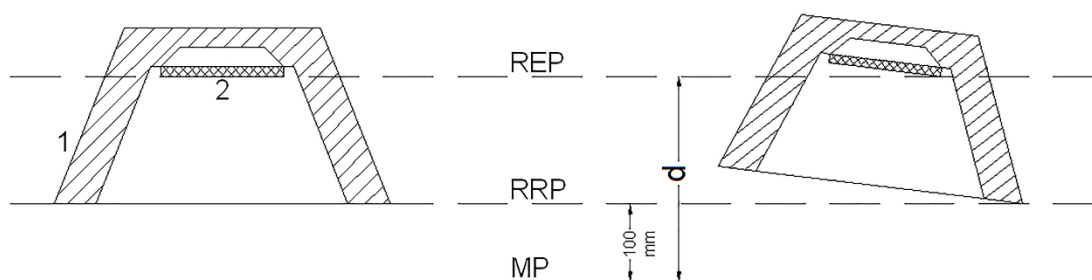
- 1 heater under test
- 2 radiometer with thermal protection housing
- 3 distance of measuring plane under the heater to radiation reference plane
- 4 grid size measuring grid
- 5 measuring plane
- 6 nodal point

Figure 1 — Measuring plane (MP)

3.5.6**radiation reference plane**

flat horizontal surface bound by the lower edge of the reflector or, in the case where radiant parts project below this lower edge of the reflector, the flat horizontal surface touching the lowest radiant part

Note 1 to entry: See Figure 2.

**Key**

- 1 heater under test
- 2 infrared emitter
- REP radiation emitter plane
- RRP radiation reference plane
- MP measuring plane
- d vertical distance sensor to emitter plane (see Annex I)

Figure 2 — Radiation reference plane (RRP) and radiation emitter plane (REP)

3.5.7**radiation emitter plane**

flat horizontal surface defined by the lower edge of the radiant surface of the burner of the radiant heater

Note 1 to entry: See Figure 2.

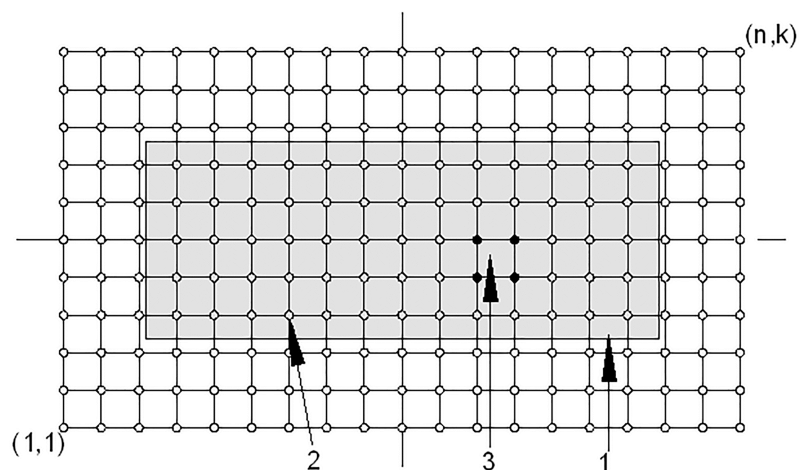
3.5.8**measuring plane**

plane parallel to the radiation reference plane and 100 mm below it; the top surface of the radiometer is moved on the measuring plane on the measuring grid

Note 1 to entry: See Figures 1 and 2.

3.5.9**measuring grid**

regular arrangement in the measuring plane of straight lines running parallel and perpendicular to the longitudinal axis of the appliance, the nodal points of the measuring grid being located at the points of intersection of these line (see Figure 3), the distances between these points being determined by the requirements in Clause 7

**Key**

- 1 heater
- 2 nodal point
- 3 measuring cell F_{ij}

Figure 3 — Measuring grid**3.5.10****irradiance** **E**

radiant power per unit area (W/m^2) incident upon a surface

3.6 Energy efficiency**3.6.1****radiant factor** **RF**

ratio of the radiant heat output emitted by the appliance through the radiation reference plane compared to the net heat input of the appliance based on the reference test gas

3.6.2**seasonal radiant factor** **RF_s**

annually weighted radiant factor, calculated as proportion of the radiant factor of the appliance at nominal net heat input and the radiant factor of the appliance at minimum net heat input (in case of appliances with heat input adaptation)

3.6.3**seasonal heat emission efficiency** **$\eta_{s,RF}$**

annually weighted efficiency of the heat emission performance of the appliance, taking into account the impact of the radiant output resp. radiant factor on the demanded room temperature

3.6.4**thermal efficiency NCV** $\eta_{th,NCV}$

ratio of the thermal heat output of the combustion system of the appliance compared to the heat input of the appliance based on the net calorific value of the relevant test gas – also called combustion efficiency NCV

3.6.5**thermal efficiency GCV** $\eta_{th,GCV}$

ratio of the thermal heat output of the combustion system of the appliance compared to the heat input of the appliance based on the gross calorific value of the relevant test gas – also called combustion efficiency GCV

3.6.6**seasonal thermal efficiency GCV** $\eta_{s,th}$

annually weighted thermal efficiency GCV, calculated as proportion of the thermal efficiency of the appliance at nominal gross heat input and the thermal efficiency of the appliance at minimum gross heat input (in case of appliances with heat input adaptation)

3.6.7**seasonal space heating energy efficiency GCV** η_s

annually weighted combined thermal and heat emission efficiency, modified by correction factors accounting for the contribution of the heat output adaptation capability of the appliance, the contribution of the auxiliary energy consumption of the appliance and the contribution of the energy consumption of a possible permanent pilot flame of the appliance

3.6.8**auxiliary energy consumption**

amount of auxiliary energy use of the appliance – namely electrical energy – to drive components of the appliance e.g.fans, valves and controls

3.7 Country of destination**3.7.1****direct country of destination**

country for which the appliance has been certified and which is specified by the manufacturer as the intended country of destination

Note 1 to entry: More than one country can be specified if the appliance, in its current state of adjustment, can be used in each of these countries.

3.7.2**indirect country of destination**

country for which the appliance has been certified, but for which, in its present state of adjustment, it is not suitable and subsequent modification or adjustment is essential in order that it can be utilized safely and correctly in this country

3.8 Symbols

For the purposes of this document, the symbols given in Table 1 apply.

Table 1 — Main symbols and abbreviations

Symbol	Dimension	Explanation
CO_{meas}	ppm	measured CO concentration (dry, air free)
d	-	relative density of dry gas to dry air
d_h	-	relative density of wet gas relative to dry air
d_r	-	relative density of reference gas to dry air
el	kW	electrical power consumption
el_{max}	kW	electrical power consumption at nominal heat input
el_{min}	kW	electrical power consumption at minimum heat input
el_{sb}	kW	electrical power consumption in standby mode
E	W/m ²	irradiance
E_{ij}	W/m ²	Irradiance at node
$\overline{E}_{ij}$	W/m ²	average irradiance of cell
F_{ij}	m ²	area of measurement cell
h_M	g/kg	humidity during the measurement of NOx
$H_{(actual)}$	MJ/m ³	actual net calorific value of test gas
H_i	MJ/m ³ (or MJ/kg)	Net calorific value of gas
H_s	MJ/m ³ (or MJ/kg)	Gross calorific value of gas
k	-	number of rows
M	kg/s	measured mass gas rate
M_{corr}	kg/s	corrected gas flow rate
M_{fg}	kg/s	flue gas mass flow rate
M_{meas}	kg/h	mass flow rate obtained under test conditions
M_o	kg/h (or g/h)	mass flow rate of gas under reference conditions
n	-	number of grid columns
$NOx_{seas,GCV}$	mg/kWh	seasonal weighted NOx value based on GCV
NOx_M	mg/kWh	NOx measured at h_M and T_M
NOx_{min}	mg/kWh	measured NOx at minimum heat input
NOx_{nom}	mg/kWh	measured NOx at nominal heat input
NOx_{ref}	mg/kWh	value of NOx corrected to reference conditions
$NOx_{seas,NCV}$	mg/kWh	seasonal weighted NOx value based on NCV
p	mbar	burner unit inlet pressure
p_a	mbar	atmospheric pressure

Symbol	Dimension	Explanation
p_g	mbar	gas supply pressure at the gas meter
p_n	mbar	normal pressure
p_{H_2O}	mbar	partial pressure of water vapour
p_{max}	mbar	maximum limit pressure
p_{min}	mbar	minimum limit pressure
p'_{max}	mbar	corrected maximum test pressure
p'_{min}	mbar	corrected minimum test pressure
p_w	mbar	saturation vapour pressure of test gas
P_{nom}	kW	nominal output
P_{pilot}	kW	pilot flame consumption
Q	kW	heat
Q_{in}	kW	heat input
$Q_{in,nom}$	kW	nominal heat inputs
$Q_{in,min}$	kW	minimum heat input
Q_o	kW	corrected heat input
$Q_{out,em}$	kW	heat emission output by radiation
Q_M	kW	actual heat input with respect to actual net calorific value
$Q_{(R)C}$	kW	radiant output at reference conditions
$Q_{(R)M}$	kW	radiant output
RF	-	radiant factor
RFs	-	seasonal weighted radiant factor
S	$\mu V/W/m^2$	radiometer sensitivity
t_a	$^{\circ}C$	ambient temperature
$t_{comp,max}$	$^{\circ}C$	maximum component temperature
$t_{comp,meas}$	$^{\circ}C$	measured component temperature
t_g	$^{\circ}C$	gas temperature
t_{max}	$^{\circ}C$	maximum component temperature
t_{meas}	$^{\circ}C$	measured component temperature
U	μV	radiometer sensor voltage
$U_{(c)}$	μV	correction voltage for each nodal point
$U_{c(x)}$	μV	grid column correction
V_{corr}	m^3/s	corrected volumetric flow rate
V	m^3/s	measured volumetric gas rate expressed under conditions at the meter
$V_{CO,M}$	%	measured CO concentration (dry, air free)

Symbol	Dimension	Explanation
$V_{CO, N}$	%	CO concentration (dry, air free)
$V_{CO_2, M}$	%	measured CO ₂ concentration (dry, air free)
$V_{CO_2, N}$	%	CO ₂ concentration (dry, air free)
V_o	m ³ /s (or l/min, dm ³ /min, dm ³ /s)	volumetric flow rate of gas under reference conditions
$V_{O_2, M}$	%	measured oxygen concentration (dry, air free)
V_{meas}	m ³ /s	volumetric flow rate under test conditions
V_{nom}	m ³ /s	gas flow rate at nominal heat input
W_i	MJ/m ³ (or MJ/kg)	Net Wobbe index
W_s	MJ/m ³ (or MJ/kg)	Gross Wobbe index
T_{total}	-	total transmission coefficient
$\eta_{s,th}$	%	seasonal thermal efficiency
$\eta_{s,RF}$	%	seasonal heat emission efficiency
$\eta_{s, on}$	%	seasonal space heating energy efficiency

4 Classification of appliances

4.1 Classification of gases and categories

4.1.1 Classification of low pressure gases and categories

Gases are classified into families, groups and ranges in accordance with EN 437:2018. Low pressure appliances are classified into categories in accordance with EN 437:2018.

4.1.2 Classification of medium pressure gases

Medium pressure appliances are classified into categories according to the gases they are intended to use. For the purpose of this standard, a similar method of classification as in 4.1.1 has been applied to medium pressure appliances.

4.2 Classification according to the mode of evacuation of the combustion products

4.2.1 General

Appliances are classified into several types according to the method of evacuation of the combustion products and admission of the combustion air.

NOTE Further informations on appliance types are given in CEN/TR 1749:2014.

4.2.2 Type A

An appliance not intended for connection to a flue or to a device for evacuation of the products of combustion to the outside of the room in which the appliance is installed.

This standard applies to:

- a) Type A₁: a Type A appliance without a fan.
- b) Type A₃: a Type A appliance with a fan upstream of the combustion chamber/heat exchanger

5 Constructional requirements

5.1 General

5.1.1 Conversion to different gases

For converting the appliance from a gas of one group or family to a gas of another group or family and/or to adapt to different gas distribution pressures only the operations given below for each category are allowed.

It is recommended that these operations should be possible without disconnecting the appliance.

5.1.2 Category I

For conversions within category I to other gases or to other gas supply pressures or to other gas pressure couples, only the following actions or combination of actions are allowed:

- a) replacement of injectors or orifices or restrictors;
- b) replacement or adjustment of primary air adjusters or venturi inserts;
- c) adjustment of burner pressure;
- d) replacement of regulator spring or replacement of regulator;
- e) adjustment of gas/air ratio on gas/air ratio controllers;
- f) changes of configuration parameters by data exchange according to the requirement of EN 14459:2015;

No other modifications to the appliance are allowed.

5.1.3 Category II and III

In addition to the requirements in 5.1.2 only the following additional operations or combination of operations are acceptable for conversions within categories of appliance designed for use with gases of the first and second families, and categories of appliance designed for use with gases of the first, second and third families.

- a) adjustment of the gas rate of the ignition burner(s), either by using an adjuster or by a change of injector or restrictor and, if necessary, a change of the complete ignition burner(s) or of some of its/their parts.
- b) adjustment of the low pressure cut –off level of the pressure switch, if any.
- c) putting the regulator out of service under the conditions of 5.2.6.
- d) putting the gas rate adjuster(s) out of service under the conditions given in 5.2.2.

No other modifications to the appliance are allowed.

5.1.4 Materials and method of construction

The quality and thickness of the materials used in the construction of the appliances and the method of assembling the various parts, shall be such that the constructional and operational characteristics are not significantly altered during a reasonable lifetime and under normal conditions of installation and use.

In particular, all parts of the appliance and the combustion circuit shall withstand the mechanical, chemical and thermal conditions to which they may be subjected when the appliance is used normally. Materials downstream of the burner shall be corrosion-resistant or be effectively protected against corrosion.

Materials used in the appliance shall be non-combustible.

The use of materials containing asbestos, cadmium or chromium VI is forbidden.

Hard solder containing cadmium shall not be used in the construction of the appliances. Solder that has a melting point below 450 °C after application shall not be used for gas-carrying parts.

Copper shall not be used for gas-carrying parts where the temperature is likely to exceed 100 °C.

5.1.5 Accessibility for maintenance and use

Parts which are accessible during use and servicing, in accordance with the instructions for use and servicing, shall be free from sharp edges and corners that might cause damage or personal injury during use and servicing.

Components and controls shall be arranged such that they are readily accessible for adjustment, maintenance or exchange. Where necessary, access doors or removable panels shall be provided.

Parts that are intended to be removed for maintenance or cleaning shall be readily accessible, shall be simple to assemble correctly and difficult to assemble incorrectly. Such parts shall be difficult to assemble incorrectly where incorrect assembly would create a hazardous condition or result in damage to the appliance and its controls.

Parts of the appliance which are not intended to be removed by the user and for which removal would affect safety shall be capable of removal only with the aid of tools.

5.1.6 Means of sealing the gas circuit

Holes for screws, studs, etc. intended for the assembly of components shall not open into the gasways. The wall thickness between holes (including threads) and gasways shall be not less than 1 mm.

The soundness of components and assemblies connected to the gas circuit and likely to be dismantled according to the instructions for use and servicing shall be ensured by means of mechanical joints (e.g. metal to metal joints, O-ring joints or packing) but excluding the use of any sealing compound (e.g. tape, mastic or paste). The soundness shall be maintained after dismantling and re-assembly.

Sealing compounds may be used for permanent threaded assemblies. The sealing material shall remain effective under normal conditions of appliance use.

5.1.7 Flexible gas connection

To accommodate the dynamic thermal expansion of luminous heaters a flexible gas connection shall be realized by the use of flexible gas hoses.

Flexible gas hoses used for the installation of luminous heaters shall be of stainless steel construction. The minimum diameter of the hose shall not be less than the diameter of the inlet connection. The minimum length of the flexible hose shall not be less than 0,5 m. The maximum length of the flexible hose including the fittings shall not be greater than 2,5 m.

If flexible gas hoses are supplied by the manufacturer as a part of the appliance, they shall meet the requirements of EN 14800:2007.

If flexible gas hoses are supplied by the installer they shall meet the applicable national standards and Codes of Practice in the destination country.

5.1.8 Supply of combustion air and evacuation of combustion products

5.1.8.1 Air inlets

The cross-sectional area of the inlet air passageway(s) shall not be adjustable.

5.1.8.2 Appliance outlet

The cross-sectional area of the combustion circuit shall not be adjustable. Any outlet for products of combustion shall be so designed and arranged that it is protected against inadvertent blockage.

5.1.9 Gas inlet connection

The gas connection shall be designed such that there will be no inappropriate passage of gas from the entry of air to the gas circuit. The gas connection shall be accessible.

The clearance around the connection, after removing if necessary, shall be adequate to allow the use of tools required to make the connection. It shall be possible to make all the connections without special tools.

It shall be possible to connect the appliance by rigid metallic or flexible metallic means to the gas supply pipe. The inlet connection shall be one of the following types:

- a) a thread conforming to EN ISO 228-1:2003. In this case the end of the gas inlet connection shall have a flat annular surface at least 3 mm wide for thread sizes 1/2 and 3/8 and at least 2,5 mm wide for thread size 1/4, to allow the interposition of a sealing washer. Moreover, when the end of the gas inlet connection has a thread of nominal size 1/2, it shall be possible to insert a gauge of 12,3 mm diameter to a depth of at least 4 mm;
- b) a thread conforming to ISO 7-1:1994;

- c) a thread conforming to EN 10226-1:2004 or EN 10226-2:2005;
- d) a compression fitting suitable for copper tube conforming to EN 1057:2006+A1:2010;
- e) a straight tube at least 30 mm long, the end of which is cylindrical, smooth and clean, to allow connection by means of a compression fitting as specified in d);

NOTE The conditions of inlet connections prevailing in the various countries are given in A.4.

The gas inlet connection shall be so secured that connections to the gas supply can be made without disturbing any controls or gas-carrying components of the appliance.

Appliances shall be provided with adequate means of support or suspension other than the gas supply pipe.

5.1.10 State of operation

Means shall be provided to allow observation of any ignition burner flame during commissioning and servicing.

It shall at all times be possible to ascertain visually whether the appliance is in operation or whether the main burner has been extinguished.

5.1.11 Electrical safety

The electrical equipment of the appliance shall be so designed and constructed as to obviate hazards of electrical origin and shall comply with the requirements of EN 60335-2-102:2016 which cover such hazards.

If the appliance is fitted with electronic components or electronic systems providing a safety function, these shall comply with the relevant requirements of EN 298:2012 or respectively EN 13611:2019.

If the nature of the electrical protection of the appliance is specified on the data plate, this specification shall comply with EN 60529:1991.

5.1.12 Operational safety in the event of fluctuation, interruption and restoration of the auxiliary energy

Interruption and subsequent restoration of the electricity supply at any time during the starting up or operation of the appliance shall result in:

- a) continued safe operation; or
- b) closure of the main burner gas valve; or
- c) volatile or non-volatile lock-out where the appliance is fitted with an automatic burner control system; or
- d) safety shut-down followed by automatic recycling.

Interruption and subsequent restoration of the electricity supply shall not override any "lock-out" condition except where the appliance is intended to be reset by means of switching off and on the electricity supply to the appliance, e.g. volatile lock-out. Such resetting shall only be possible if any interruption and subsequent restoration of the electricity supply cannot give rise to a hazardous appliance condition.

NOTE Requirements relating to the continued and safe operation of the appliance in the event of normal and abnormal fluctuation of auxiliary energy are specified in 6.7.1.3.

5.2 Requirements for adjusting, control and safety devices

5.2.1 General

The functioning of any safety device shall not be overruled by that of any control device.

The failure of a safety, controlling or regulating device shall not lead to an unsafe situation.

All adjusting, control and safety devices shall be suitable for a gas pressure of at least 120 % of the normal gas pressure to which it is subjected to on the appliance.

Any parts of the appliance that are not intended to be altered by the user or the installer shall be protected in an appropriate manner. Paint may be used for this purpose provided that it withstands the temperature to which it is subjected during normal operation of the appliance.

The adjusting screws shall be arranged in such a way that they cannot fall into the gas-ways.

The soundness of the gas circuit shall not be put at risk by the presence of adjusters and range-rating devices.

Adjustment of the adjuster and/or of the range rating device may be continuous (e.g. use of an adjusting screw) or discrete (e.g. change of restrictors).

The adjusters shall be adjustable only with the use of a tool and they shall be capable of being set in the operating position.

The appliance shall not incorporate any controls which need to be manipulated by the user when the appliance is in normal operation.

5.2.2 Gas rate adjusters

Gas rate adjusters shall be used for appliances using several groups of 1st family gas and optional for appliances of other gas groups.

An adjuster shall:

- a) be sealed if adjustment is made during production;
- b) be able to be sealed if adjustment is carried out as part of the installation or servicing procedure.

For appliances in a category which includes a “+” sign, the adjusters shall be sealed.

5.2.3 Range-rating devices

The appliance may have a range-rating device.

If this device and the gas rate adjuster are one and the same, the installation instructions shall specify the use of the adjuster.

5.2.4 Primary aeration adjusters

Primary aeration adjusters shall be pre-set and sealed in the positions during production appropriate for the gas for which the appliance has been adjusted.

5.2.5 Controls and safety devices

5.2.5.1 General

The functioning of any safety devices shall not be overruled by that of any control device.

5.2.5.2 Manual controls

Manual valves, push buttons or electrical switches that are essential for normal operation and commissioning of the appliance shall be provided with the appliance.

Where the operation of the main burner is normally controlled by a manual valve, the means of operating the valve shall be readily accessible to the user from floor level.

If the appliance is intended for ON/OFF operation only the manual means of operation shall be clearly marked.

5.2.5.3 Manual valves

Manual valves shall meet the requirements of EN 1106:2010.

Any manual valve shall be of the 90° turn type unless it is incorporated in a flame supervision device.

Manual valves shall be so designed or positioned as to prevent inadvertent operation but shall be easy to operate when required. They shall be so designed that in operation the OPEN and CLOSED positions are readily distinguishable.

When a manual valve is provided at the inlet of the appliance, it shall be capable of operating at a pressure equal to 1,5 times the maximum supply pressure and shall be readily accessible.

Manual valves used solely for OPEN/CLOSED operation shall be provided with positive stops at the OPEN and CLOSED positions.

5.2.6 Regulators

Regulators shall comply with EN 88-1:2011+A1:2016 or EN 88-2:2007.

Appliances intended to operate with first family gases shall have a gas pressure regulator; appliances with heat inputs above 70 kW Hi operating on second family gases shall also be fitted with a gas pressure regulator.

For other appliances a gas pressure regulator is optional.

Where fitted the regulator shall control the gas supply to the burner and any ignition burner. The regulator shall be fitted in the appliance gas circuit upstream of the automatic shut-off valve(s) unless the regulator is incorporated in a multifunctional control.

The design and accessibility of the regulator shall be such that it can be easily adjusted or put out of service for use with another gas, but precautions shall be taken to make unauthorized interference with the adjustment difficult.

However, for appliances in a '+' category, the gas regulator shall not be operational in the range of the two normal pressures of the pressure couple, i.e. Twenty mbar to 25 mbar or it shall be possible to put the regulator partially out of service for these pressures.

5.2.7 Flame supervision devices

The appliance shall incorporate a flame supervision device.

Thermo-electric flame supervision devices shall comply with EN 125:2010+A1:2015 or EN 13611:2019.

Electronic flame supervision devices incorporated in automatic burner controls shall comply with EN 298:2012 except that the application shall have a flame ionization current of at least $0,2 \times 10^{-6}$ amperes.

5.2.8 Multifunctional controls

Multifunctional controls shall comply with EN 126:2012.

5.2.9 Automatic shut-off valves

Automatic shut-off valves shall comply with EN 161:2011+A3:2013.

Unless the appliance is fitted with a thermo-electric flame supervision device the gas supply to the main burner shall be under the control of at least one automatic shut-off valve connected in the gas circuit of either Class A or Class B capability.

The start gas supply shall be under the control of at least one automatic shut-off valve of either Class A, Class B, Class C or Class D capability.

5.2.10 Gas strainers

A strainer shall be fitted at the inlet of any gas circuit incorporating an automatic shut-off valve(s) to prevent the ingress of foreign matter.

NOTE The strainer may be integral with the upstream automatic shut-off valve.

The maximum strainer hole dimension shall not be greater than 1,5 mm and the mesh shall not permit a 1 mm pin gauge to pass through it.

In gas circuits incorporating more than one automatic shut-off valve only one strainer needs to be fitted, provided it gives adequate protection to all valves.

For valves incorporating a shearing action (self-cleaning) the strainer may be omitted.

Where a regulator is fitted upstream of the automatic shut-off valve(s) the strainer may be fitted upstream of the regulator.

5.2.11 Automatic burner control system

5.2.11.1 General

Where an appliance is fitted with an automatic burner control system it shall comply with EN 298:2012 or respectively EN 13611:2019 for burner controls with a thermocouple flame supervision device.

5.2.11.2 Manually operated devices

The design and operation of push-buttons, switches, etc. shall be that way that incorrect handling or out of sequence shall not adversely affect the safety of any automatic burner control system.

5.2.11.3 Flame detector

The flame detector shall incorporate a means to prevent the energization of any gas valve and of the ignition device if a flame or flame simulating condition is present during the start-up period.

Upon flame failure in the running condition the flame detector shall cause one of the following:

- a) non-volatile lock-out; or
- b) volatile lock-out; or
- c) one of the following provided that such action cannot give rise to a hazardous condition
 - 1) safety shut-down followed by automatic recycling; or
 - 2) spark restoration.

Where a spark restoration system is used, the time allowed before the automatic shut-off valve(s) closes may be extended to permit the re-ignition attempt, but this extended time shall not exceed the first safety time.

5.2.11.4 Ignition burner flame establishment

The main gas automatic shut-off valve(s) shall not be energized to admit the main gas flow to the main burner until after the ignition burner flame has been detected.

5.2.11.5 Direct main burner flame establishment

The ignition spark (or other means of ignition e.g. hot surface igniter) shall be de-energized at or before the end of the safety time.

The main burner valve(s) shall not be energized before the ignition spark (or other means of ignition) is energized. If the main burner flame is not detected by the end of the safety time, volatile or non-volatile lock-out shall result.

5.2.11.6 Safety shut-down

The flame detector shall affect closure of all automatic shut-off valves.

5.2.12 Air / gas ratio controls

Air/gas ratio controls shall be designed and constructed so that reasonably foreseeable damage does not give rise to a change capable of affecting safety.

Where a pneumatic air/gas ratio control is used, this shall comply with the requirements of EN 88-1:2011+A1:2016.

Where an electronic air/gas ratio control is used, this shall comply with the relevant requirements of EN 12067-2:2004.

Control tubes shall be made of metal with suitable mechanical connections or other materials with at least equivalent properties and in this case are considered immune to breakage, accidental disconnection and leakage after soundness checks. If this requirement is met, they are not subject to the specific tests.

Control tubes for air and combustion products shall have a minimum cross-sectional area of 12 mm² with a minimum internal dimension of 1 mm. Provided that evidence is given and precautions are taken to avoid condensation in the control tubes, the minimum cross-sectional area of air control tubes may be 5 mm². All control tubes shall be located and fixed so that any stagnation of condensate is avoided and positioned such that creasing, leakage or breakage is prevented. Where more than one control tube is used the relevant connection position for each shall be obvious.

Air / gas ratio control shall be adjusted on production site and suitable provisions shall be taken to prevent other adjustments. In case adjustments in the field are allowed, instructions shall be given in the installation manual (see 10.2.2). In particular clear references shall be made to the method of adjustment, the settings, the equipment needed and the accuracy of the equipment needed. The impact of inaccurate adjustment shall be explained.

NOTE 1 The following examples are considered to be suitable additional provisions:

- a) physical removal of the adjustment screws (or other method of rendering these inoperative);
- b) physical preventing access to the adjustment screws (e.g. filling access holes);

c) addition of a suitably worded warning label affixed to the gas valve and/or in close proximity to the adjusting screws, this label shall be clearly visible to any gas operative whilst gaining access to the adjuster screws.

NOTE 2 Gas/air controls have typically two adjustments ('throttle' and 'offset') and the requirements of this clause apply to both.

If the appliance installation instructions indicate that the valve can be adjusted, by a suitably qualified gas operative using appropriate instruments, a provision shall be made to indicate that the valve setting has been changed.

NOTE 3 An example of a suitable provision is to use a paint spot on the adjusting device.

The appliance installation instructions shall include instructions on how the settings shall be checked if, at the time of installation or service, there is an indication that the gas/air ratio control settings have been altered. The appliance installation instructions shall indicate the action to be taken if the the settings are found to be incorrect.

If the appliance installation instructions allow the gas/air ratio controls to be adjusted then the method for adjustment shall be described.

5.3 Ignition devices

5.3.1 General

5.3.1.1 Appliances with manually ignited ignition burners

There shall be ready access for lighting the ignition burner.

5.3.1.2 Appliances with automatic ignition

When the appliance is installed in accordance with the technical instructions intended for the installer it shall be possible to light the appliance from an easily accessible position by means of an electrical or other convenient ignition device incorporated in the appliance.

Ignition burners and ignition devices shall be protected by design and position against diminution or extinction resulting from e.g. draughts, products of combustion, overheating, condensation, corrosion or matter falling from above.

Ignition burners, ignition devices and their mountings shall be so designed that they can only be located rigidly and correctly in relation to every component and burner with which they are designed to operate.

5.3.2 Ignition device for the main burner

The main burner shall be fitted with an ignition burner or other automatic ignition device for direct ignition.

Where the heat input is 6 kW (Hi) or less the main burner may be ignited directly by manual means, provided that the main flame is supervised. In industrial applications where the appliance operates 24 h per day and manual ignition occurs only once a week or less, direct main burner ignition up to 10 kW (Hi) is accepted.

5.3.3 Ignition burners

If different ignition burners are used when the appliance is converted from one gas to another, they shall be marked, easy to substitute for one another and easy to fit. The same applies to injectors where only they have to be changed. Injectors shall carry an indelible means of identification and shall only be removable with the aid of a tool.

Ignition burners shall be protected against blockage by gas-borne particulate matter.

5.4 Main burner

The cross-sectional area of the flame ports shall not be adjustable.

The burner shall be so located and arranged that misalignment cannot occur. It shall not be possible to remove the main burner assembly without the use of tools.

5.5 Pressure test points

The appliance shall be fitted with at least two pressure test points. One shall be fitted upstream of the first control and safety device and the other downstream of the last gas flow rate control and in a position carefully selected so as to permit measurements to be made.

For appliances not fitted with a regulator a single test pressure point may be fitted.

The test points shall have an external diameter of $(9_{-0,5}^0)$ mm and a useful length of at least 10 mm to permit ready connection to a pressure measuring device. The minimum diameter of the bore shall not exceed 1 mm.

5.6 Injectors

Injectors and removable restrictors shall carry an indelible means of identification. It shall be possible to change injectors and restrictors without having to move the appliance from its installed position. However, injectors shall only be removable with the aid of a tool.

6 Operational requirements

6.1 Test methods

6.1.1 Characteristics of test gases: reference and limit gases

The test gases, test pressures and appliance categories for low pressure appliances are given in EN 437:2018. For medium pressure appliances the test gases and appliance categories given in EN 437:2018 are used, the appropriate test pressures are given in 6.1.3.2.5.

NOTE Appliances are intended for use with gases of different qualities. One of the aims of this standard is to check that the performance of an appliance is satisfactory for each family or group of gases for which it is designed and for the pressure for which it is designed, if necessary using the adjusting devices.

6.1.2 Conditions for preparation of the test gases

The requirements for the preparation of test gases are given in EN 437:2018.

6.1.3 Practical application of test gases

6.1.3.1 Choice of test gases

The requirements for the characteristics and choice of test gases are given in EN 437:2018.

Gases required for the tests described in Clauses:

- 6.3 Heat input
- 6.4 Pressure regulator
- 6.5 Limiting temperatures

- 6.6 Ignition, cross-lighting and flame stability
- 6.7 Combustion, CO, NO_x
- 7 Radiant efficiency

shall be as specified in EN 437:2018.

For those tests described in other clauses, it is permissible in order to facilitate testing to replace the test gas by a gas actually distributed. When an actual distributed gas is used for certain tests, this gas shall belong to the gas family and group to which the reference gas, which it replaces, belongs and the Wobbe index of the distributed gas shall be within $\pm 5\%$ of that of the reference gas.

When tests have to be carried out with only one of the reference gases, the priority according to the appliance category shall be G 20, G 25, G 30 or G 31.

6.1.3.2 Conditions of supply and adjustment of the appliance

6.1.3.2.1 Initial adjustment of appliance

Before all the required tests are carried out, the appliance shall be fitted with the appropriate equipment (injector(s)) corresponding to the gas family or gas group to which the specified test gas belongs. Any gas rate adjuster(s) are set in accordance with the technical instructions using the appropriate reference gas(es) (see 6.1.3.1) and the corresponding normal pressure(s) given in 6.1.3.2.5.

This initial adjustment of the appliance is subject to the limitations given in 5.1.1.

6.1.3.2.2 Supply pressures

Except where an adjustment of the supply pressure is necessary (as described in 6.1.3.2.3 and 6.1.3.2.4) the normal, minimum and maximum supply pressures to be used for testing purposes shall be in accordance with 6.1.3.2.5.

Unless otherwise specified, the initial adjustment of the appliance shall not be altered.

6.1.3.2.3 Adjustment of heat inputs

For tests requiring adjustment of the burner to the nominal heat input and/or any other heat input as specified in the technical instructions, it shall be ensured that the pressure upstream of the injector(s) is such that the heat input obtained is within $\pm 2\%$ of that specified (by altering the pre-set adjuster(s) or the appliance regulator, if adjustable, or the appliance supply pressure).

The specified heat input shall be determined in accordance with 6.3 and with the appliance supplied with the appropriate reference gas(es).

6.1.3.2.4 Corrected pressures

Where, in order to obtain the nominal heat input within $\pm 2\%$, it is necessary to use an appliance inlet pressure, p , different from the normal pressure p_n , those tests normally carried out at the minimum or maximum test pressures $p_{\min}$ and $p_{\max}$ shall be carried out at the corrected test pressures $p'_{\min}$ and $p'_{\max}$.

The corrected test pressures are calculated using Formula (1):

$$\frac{p'_{\min}}{p_{\min}} = \frac{p'_{\max}}{p_{\max}} = \frac{p}{p_n} \quad (1)$$

where:

p_n is the normal test pressure in mbar;

$p_{\min}$ is the minimum test pressure in mbar;

$p_{\max}$ is the maximum test pressure in mbar;

p is the appliance inlet pressure in mbar;

$p'_{\min}$ is the corrected minimum test pressure in mbar;

$p'_{\max}$ is the corrected maximum test pressure in mbar.

6.1.3.2.5 Test pressures

For low pressure appliances the test pressures, i.e. the pressures required at the gas inlet connection of the appliance, are given in Tables 2, 3.

These pressures and the corresponding injectors are used in accordance with the national conditions given in EN 437:2018 Annex B, for the country in which the appliance is to be installed.

In case the technical instructions specify a normal pressure at the appliance inlet other than that given in Tables 2 and 3, the Formula (1) in article 6.1.3.2.4 shall be used to determine the corresponding values for $p_{\min}$ and $p_{\max}$.

Table 2 — Test pressures where no pressure couple exists ^{a)}

Appliance categories having as index	Test gas	p_n mbar	$p_{\min}$ mbar	$p_{\max}$ mbar
First family: 1A	G 110, G 112	8	6	15
Second family: 2H	G 20, G 21 G 222, G 23	20	17	25
Second family: 2L	G 25, G 26 G 27	25	20	30
Second family: 2E	G 20, G 21 G 222, G 231	20	17	25