# SLOVENSKI STANDARD
# SIST EN 676:1997

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**Samodejni plinski ventilatorski gorilniki**

Automatic forced draught burners for gaseous fuels

Automatische Brenner mit Gebläse für gasförmige Brennstoffe

Bruleurs automatiques a air soufflé pour combustibles gazeux



**Ta slovenski standard je istoveten z:** **EN 676:1996**

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English version

# Automatic forced draught burners for gaseous fuels

Brûleurs automatiques à air soufflé pour combustibles gazeux

Automatische Brenner mit Gebläse für gasförmige Brennstoffe



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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.

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**CEN**

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

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



Ref. No. EN 676:1996 E

## Contents

## Foreword

This European Standard has been prepared by the Technical Committee CEN/TC 131 "Gas burners using fans" the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 1997, and conflicting national standards shall be withdrawn at the latest by April 1997.

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 the 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, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

## 0 Introduction

This European Standard is primarily intended for automatic forced draught gas burners having a combustion air fan, operated with gaseous fuels, and intended to be marketed as a complete assembly.

EN 437 sets out a system of classification of appliances into categories defined according to the gases and pressures for which they are designed.

Such a system of classification, when applied to forced draught burners, may lead to difficulties in defining the precise category to which a particular burner should be allocated. For example many burners are designed to operate on a wide range of fuel gases with little or no modification other than adjustment of air supply.

It is therefore the opinion of the Technical Committee responsible for this standard that further studies of the classification system as applied to forced draught burners need to be carried out.



However it should be noted that the Gas Appliance Directive requires the specification of the type of gas and the supply pressure used as well as the burner category.

## 1 Scope

This standard specifies the terminology, the general requirements for the construction and operation of automatic forced draught gas burners and also the provision of control and safety devices, and the type test procedure for these burners.

This standard is applicable to

- automatic gas burners with a combustion air fan (hereinafter called "burners") that are equipped as described in 4, intended for use in heat generators of different types, and that are operated with fuel gases.

- total pre-mixed burners and nozzle mixed burners.

The standard is applicable to

- single burners, although such burners are fitted to a single appliance, in which case the requirements of the relevant appliance standard shall additionally apply;

- single-fuel and dual-fuel burners when operating only on gas;

- the gas function of dual-fuel burners designed to operate simultaneously on gaseous and liquid fuels in which case the requirements of EN 267 will also apply in respect of the liquid fuel function.

This standard does not apply to induced draught burners and burners intended for use in industrial processes although some aspects of the standard may be relevant .

## 2 Normative references

This European standard incorporates, by means of dated or undated references, 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 those publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.



EN 88
Pressure governors for gas appliances for inlet pressure up to 200 mbar

EN 161
Automatic shut-off valves for gas burners and gas appliances



EN 267
Atomizing oil burners of monobloc type - Testing

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

EN 437
Test gases, test pressures, appliance categories

prEN 1643
Valve proving systems for automatic shut - off valves for gas burners and gas appliances

prEN 1854
Pressure sensing devices for gas burners and gas appliances

prEN 12067 - 1
Gas / air ratio controls for gas burners and gas burning appliances - Part 1: Mechanical types

EN 23166
Codes for the representation of names of countries; ISO 3166 : 1993

EN 60529
Degrees of protection provided by enclosures (IP code), IEC 529 : 1989

EN 60335-1
Safety of household and similar electrical appliances – part 1: General requirements;
(IEC 335-1 : 1991, modified )

EN 60730-1
Automatic electrical controls for household and similar use Part 1:General requirements (IEC 730-1 : 1993)

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 6976
Natural gas - Calculation of calorific value, density, relative density and Wobbe index from composition

ISO 7005-1
Metallic flanges; part 1: steel flanges

ISO 7005-2
Metallic flanges; part 2: cast iron flanges

ISO 7005-3
Metallic flanges; part 3: copper alloy and composite flanges

## 3 Definitions

For the purposes of this standard the following definitions apply:



### 3.1 General definitions

#### 3.1.1 forced draught burner

A burner in which the combustion air is introduced by means of a fan.



#### 3.1.2 automatic forced draught burner

A burner that is fitted with an automatic ignition, flame monitoring and burner control devices. Ignition, flame monitoring and the on/off switching of the burner occur automatically. The heat input of the burner can be adjusted during operation either automatically or manually.

#### 3.1.3 dual-fuel burner

A burner in which both gaseous and liquid fuels can be burnt either simultaneously or in succession.

#### 3.1.4 total pre-mixed burner

Burner in which at least all the theoretical air for complete combustion of the gas is mixed with the gas upstream of the mixture outlet ports.

#### 3.1.5 nozzle mixed burner

A burner in which part, or all, of the theoretical air required for combustion of the gas is mixed with the gas at, or downstream of, the air and gas ports.

#### 3.1.6 start gas rate

The gas rate ignited by the ignition device during the start-up of the burner.

### 3.2 Combustible gases

#### 3.2.1 reference conditions

These correspond to 15 °C, 1013,25 mbar, unless otherwise specified [EN 437].

### 3.2.2 calorific value

The quantity of heat produced by the combustion, at a constant pressure equal to 1013,25 mbar, 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 [EN 437].

A distinction is made between

- the gross calorific value : in which the water produced by combustion is assumed to be condensed. Symbol: $H_s$, and
- the net calorific value: in which the water produced by combustion is assumed to be in the vapour state. Symbol: $H_i$.

Units: either

- megajoules per cubic metre (MJ/m$^3$) of dry gas at the reference conditions, or
- megajoules per kilogram (MJ/kg) of dry gas.

### 3.2.3 relative density

The ratio of the masses of equal volumes of dry gas and dry air at the same conditions of temperature and pressure.

Symbol: $d$

### 3.2.4 wobbe index

The ratio of the calorific value of a gas per unit volume and the square root of its relative density under the same reference conditions. The Wobbe index is said to be gross or net according to whether the calorific value used is the gross or net calorific value [EN 437].



Symbols: gross Wobbe index: $W_s$;
net Wobbe index: $W_i$.

Units: either

- megajoules per cubic metre (MJ/m$^3$) of dry gas at the reference conditions, or
- megajoules per kilogram (MJ/kg) of dry gas.



### 3.2.5 gas pressure

The static pressure of the moving gas, relative to the atmospheric pressure, measured at right angles to the direction of flow of the gas. It is expressed in millibars (mbar) or in bars (bar).

### 3.2.6 reference gas - limit gases

In each gas family or group, test gases are defined as follows.

#### 3.2.6.1 reference gases

Test gases on which burners operate under nominal conditions when they are supplied at the corresponding normal pressure.

#### 3.2.6.2 limit gases

Test gases representative of the extreme variations in the characteristics of the gases for which burners have been designed.

NOTE: The characteristics of the reference and limit gases are given in table C.1.

### 3.2.7 normal pressure - limit pressures

In each gas family or group, test pressures are defined as follows.

#### 3.2.7.1 normal pressure

The pressure under which the burners operate in nominal conditions when they are supplied with the correspon-

ding reference gas.

**3.2.7.2** limit pressures

Pressures representative of the extreme variations in the burner supply conditions.

NOTE: The test pressures are given in table 4.

3.2.7.3 supply pressure

The pressure measured at the measuring point M1 as specified in figure 1, at which the nominal conditions are achieved.

**3.2.7.4** adjustment pressure

The pressure measured at the measuring point M2 as specified in figure 1, at which the nominal conditions are achieved.

**3.2.8** pressure in the combustion chamber

The pressure or depression, relative to atmospheric pressure, prevailing in the combustion chamber.

## 3.3 Operation of the burner

### 3.3.1 gas rate

**3.3.1.1** volumetric flow rate

The volume of gas consumed by the burner in unit time during continuous operation.
Units: cubic metres per hour ($m^3/h$), litres per minute (l/min), cubic decimetres per hour ($dm^3/h$) or cubic decimetres per second ($dm^3/s$).



Symbol: *V*

**3.3.1.2** nominal volumetric flow rate



The volumetric flow rate stated by the manufacturer, expressed in cubic metres per hour ($m^3/h$).

**3.3.1.3** maximum flow rate

The highest flow rate stated by the manufacturer, expressed in cubic metres per hour ($m^3/h$) at reference conditions.

**3.3.1.4** minimum flow rate

The lowest flow rate stated by the manufacturer, expressed in cubic metres per hour ($m^3/h$) at reference conditions.

**3.3.1.5** mass flow rate

The mass of gas consumed by the burner in unit time during continuous operation.

Symbol: *M*

Units: kilograms per hour (kg/h), or grams per hour (g/h).

**3.3.1.6** nominal mass flow rate

The mass flow rate stated by the manufacturer.

**3.3.1.7** heat input

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

Symbol: *Q*

Unit: kilowatt (kW).

#### 3.3.1.8 nominal heat input

The value of the heat input declared by the manufacturer.

Fixed heat input or range-rated burners have a single nominal heat input. Range-rated burners can be adjusted between the maximum nominal heat input and the minimum nominal heat input stated by the manufacturer.

Symbol: $Q_N$

#### 3.3.1.9 minimum heat input

The lowest heat input specified by the manufacturer at which the burner can operate in accordance with the operational requirements.

### 3.3.2 running conditions

#### 3.3.2.1 burners for permanent operation

Burners that are designed to remain in the running condition for more than 24 h without interruption.

#### 3.3.2.2 burners for non-permanent operation

Burners that are designed to remain in the running condition for less than 24 h.

## 3.4 Gas line components

### 3.4.1 gas line

The part of the burner which is made up of the valves and controls and safety devices in which gas is conveyed between the inlet connection and the burner head.



### 3.4.2 range-rating device

A component on the burner intended to be used for adjusting the heat input, within a range of heat inputs stated by the manufacturer, to suit the actual heat requirements of the installation.

This adjustment may be progressive or in discrete steps.



### 3.4.3 automatic shut-off valve

A device that automatically opens, closes or varies the gas rate on a signal from the control circuit and/or the safety circuit.

### 3.4.4 filter/strainer

A device that enables particles of dirt, which might otherwise cause failures in the system, to be collected.

## 3.5 Adjusting, control and safety devices

### 3.5.1 pressure governor

A device which maintains the downstream pressure constant to within fixed limits independent of variations, within a given range, of the upstream pressure.

### 3.5.2 adjustable pressure governor

A pressure governor fitted with a means of adjusting the loading on the diaphragm and thus the downstream pressure.

### 3.5.3 flame detector device

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

It 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.

### 3.5.4 automatic burner control system

An automatic burner control system comprises at least a programming unit and all the elements of a flame detector device. The various functions of an automatic burner control system may be in one or more housings.

### 3.5.5 programming unit

A programming unit reacts 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 non-volatile lock-out. The programming unit follows a predetermined sequence of actions and always operates in conjunction with a flame detector device.

### 3.5.6 safe start check

A procedure employing a protection circuit or circuits, to establish whether or not a fault in a safety system or a flame simulating condition exists prior to start-up.

### 3.5.7 controlled shut-down

The process by which the power to the gas shut-off valve(s) is removed before any other action takes place, e. g. as a result of the action of a controlling function.

### 3.5.8 safety shut-down

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

NOTE: Safety shut-down can also occur as a result of an interruption/decrease of the power supply.



### 3.5.9 lock-out



#### 3.5.9.1 non-volatile lock-out

The 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.



#### 3.5.9.2 volatile lock-out

The 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 main power and its subsequent restoration.

### 3.5.10 start signal

The signal, e. g. from a thermostat, which releases the system from its start position and commences the predetermined programme.

### 3.5.11 recycling

The process by which, after a safety shut-down, a full start-up sequence is automatically repeated.

### 3.5.12 valve proving system

A system to check the effective closure of the start gas or main gas safety shut-off valves, and which is capable of detecting small gas leakage rates.

### 3.5.13 ignition device

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

## 3.6 Purge

The forced introduction of air into the combustion chamber and flue passages, in order to displace any remaining fuel/air mixture and/or products of combustion.

#### 3.6.1 pre-purge

The purge which takes place between the start signal and the energization of the ignition device.

#### 3.6.2 post-purge

The purge which takes place immediately following a controlled shut-down.

### 3.7 Sequencing times

#### 3.7.1 pre-purge time

The period during which purge takes place at the proven air rate prior to the energization of the ignition device.

#### 3.7 2 post-purge time

The period between any shut-down and the moment the fan is switched off.

#### 3.7.3 ignition time

The period between the opening of the gas valves and the first indication of the flame by the flame detector device.

#### 3.7.4 first safety time

The period between the pilot gas valve, the start gas valve or main gas valve(s), as applicable, being energized and the pilot gas valve, start gas valve or main gas valve(s), as applicable, being de-energized if the flame detector device signals the absence of a flame.

NOTE: Where there is no second safety time, this is called the safety time.



#### 3.7.5 second safety time

Where there is a first safety time applicable to either a pilot or start gas flame only, the second safety time is the period between the main gas valves being energized and the main gas valves being de-energized if the flame detector device signals the absence of a flame.



#### 3.7.6 extinction safety time

The period that starts with the signal that the flame has been extinguished and ends with the signal to shut off the gas supply.

#### 3.7.7 total closing time

The period that starts with the signal that the flame has been extinguished and ends with the shut-off valves being closed.

### 3.8 Combustion

#### 3.8.1 flame stability

The capacity of flame to remain on the burner head or in the flame reception zone intended by the design.

#### 3.8.2 flame lift

The total or partial lifting of the base of the flame away from the burner head or the flame holding zone provided by the design.

#### 3.8.3 light back

The unintended movement of the flame front to a point upstream of its normal stable operating position.

## 4 Constructional and operational requirements

### 4.1 Conversion to different gases

The precautions to be taken when converting from a gas of one group or family to a gas of another group or family and/or to adapt for different gas supply pressures shall be given by the manufacturer in the instructions

for operation.

## 4.2 Construction

### 4.2.1 Design

The design and construction of the burner shall be such that with the intended input or input range and within the prescribed range of pressure, the fuel gas that is to be used is burned completely and safely. Moving parts (for example, fans) shall be shielded if the enclosure provided does not ensure adequate protection.

The construction of the burner shall be in such a way that no instability, distortion or breakage likely to impair its safety can occur.

Levers and similar devices which have to be operated by the installer or user shall be appropriately identified.

### 4.2.2 Accessibility for maintenance and use

Constructional parts accessible during use and maintenance shall be free from sharp edges and corners that might cause damage or personal injury during use or maintenance.Burners that can be withdrawn or swivelled out of position without the use of tools shall be interlocked (for example, by means of limit switches) in such a way that they cannot be operated in the withdrawn or swivelled position.

The interlock device shall be fail safe in design and, if it is a limit switch, shall comply with EN 60730-1.

### 4.2.3 Soundness

Holes for screws, studs, etc. intended for the assembly of parts shall not open into gasways. The wall thickness between drillings and gasways shall be at least 1 mm. This requirement shall not apply to orifices for measurement purposes or to components within the burner head.

The soundness of parts and assemblies making up the gas circuit and likely to be dismantled during regular maintenance in situ shall be achieved by means of mechanical joints, for example metal-to-metal joints, gaskets, or O-ring joints, but excluding the use of all sealing materials such as tape, paste or liquids. All sealing materials shall remain effective under normal conditions of burner use.



### 4.2.4 Materials



The quality and thickness of the materials used in the construction of the burner shall be selected in such a way that the constructional and performance characteristics of the system do not deteriorate during operation. In particular, all the components of a burner shall withstand the mechanical, chemical and thermal loads that may be encountered during operation. Under normal conditions of use, maintenance and adjustment, they shall not show any changes that could affect their normal functioning.

If the housing contains any metal parts not made of corrosion-resistant material, these shall be suitably protected with an effective anti-corrosion coating.

Asbestos or asbestos-containing materials shall not be used.

Copper shall not be used for gas carrying parts where its temperature is likely to exceed 100 °C. Solder that has a melting point below 450 °C after application shall not be used for gas carrying parts.

### 4.2.5 Mounting

The burner shall be designed in such a way that it can be effectively mounted on the heat generator.

The burner components shall be arranged and secured in such a manner that their correct operating position, and above all, the correct position of the burner orifices, cannot change during operation. The correct operating position shall be maintained when accessories are dismantled and re-fitted.

Parts of the burner that are set or adjusted at the stage of manufacture and which should not be manipulated by the user or installer shall be sealed.

Components requiring regular maintenance shall be so arranged or so designed that they are easily detachable. Furthermore, they shall be designed or marked in such a way that if the manufacturer's instructions are followed they cannot be replaced incorrectly.

### 4.2.6 Connections

Inlet connections with pressure-tight joints made on the threads, connections within the burner with pressure--

tight joints made on the threads that are not loosened for maintenance, and connections for parts that are not frequently dismantled and re-fitted shall be designed in accordance with ISO 7-1.

Connections which have to be loosened for maintenance purposes shall be designed in accordance with ISO 228-1. Flange connections shall comply with ISO 7005-1, ISO 7005-2 and ISO 7005-3.

NOTE: Attention is drawn to Annex D which sets out the connection method permitted or prohibited in certain countries.

## 4.3 Equipment

### 4.3.1 Motors and fans

Motors and fans shall be so protected by suitable guards, shields or screens of adequate size, strength and durability that they are not liable to be touched accidentally. The degree of protection shall be at least IP 20, according to EN 60529. Removal of such guards, shields or screens shall be possible only with the use of commonly available tools.

Belt drives, where used, shall be so designed or positioned as to afford protection to the operator.

Means shall be provided to facilitate adjustment of belt tension. Access to such means shall be possible only with the use of commonly available tools.

Motors and fans shall be mounted in such a way as to minimise noise and vibration. Lubrication points, if provided, shall be readily accessible.

### 4.3.2 Electrical Safety

For the electrical equipment and connections of the burner the following requirements of EN 60335-1 shall apply:

a) - rated value;

b) - protection against accessibility to live parts;
- leakage current and electric strength;
- internal wiring;
- supply connection and external flexible cords;
- connection terminals for external conductors;
- provision for earthing;
- creepage distances, clearances and distances through insulation;
- components;

c) - radiation;
- resistance to heat, fire and tracking.



In addition the documentation of the electrical connections for the individual components shall be provided by means of an electrical wiring and connection diagram.

### 4.3.3 Adjustable air damper

Every burner shall be fitted with an adjustable air damper or similar device for controlling the air flow. This device shall be adjustable only by means of a tool. The adjusting positions of the air damper shall be visible, possibly after removal of a cap.

If the burner is provided with a manual means of adjusting the combustion air flow, this means shall be so designed that, after adjustment according to the manufacturer's instructions, it is capable of being set and sealed.

### 4.3.4 Gas line components

#### 4.3.4.1 General

All gas line components shall be designed for the individual inlet pressure of the burner or be protected against any excessive increase in pressure by means of relevant safety devices.

#### 4.3.4.2 Manually operated shut-off valve

A quick-acting manually operated shut-off valve shall be provided upstream of all controls to isolate the burner. This valve need not be supplied by the manufacturer, but it shall be specified in the manufacturer's installation instructions.

In addition burners shall be provided with such manually operated shut-off valves as are essential for their commissioning and normal operation.

The manual valve shall be capable of operating at a pressure equal to 1,5 times the maximum supply pressure and shall be readily accessible.

Manual valves shall be of the 90° turn type and shall be so designed 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.

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

#### 4.3.4.3 Filter/strainer

A filter/strainer shall be fitted at the inlet of the safety shut-off valve system to prevent the ingress of foreign matter.

The maximum strainer hole dimension shall not be greater than 1,5 mm and the mesh shall not permit the passage of a 1 mm pin gauge.



#### 4.3.4.4 Gas pressure governor

The main gas and start gas supplies shall be under the control of a device to ensure that the pressure at the burner head remains stable and the heat input does not vary by more than ± 5 % from the specified value over the range of values specified in table 4.



If the device is a constant pressure governor operating at governor inlet pressures up to 200 mbar, it shall comply with EN 88.

For governor inlet pressures greater than 200 mbar, the pressure governor shall be suitable for these pressures.

Where a gas pressure governor is fitted it shall control the gas supply to the main burner and to any ignition burner having a heat input greater than 2 kW. The main burner and any ignition burner may also be governed separately.

The accessibility of the pressure governor shall be such that it can be easily adjusted or put out of operation for use with another gas, but precautions shall be taken to make unauthorised adjustment difficult.

#### 4.3.4.5 Gas pressure sensing devices

The burner shall be fitted with a device to cause safety shut-down when the supply pressure falls below a pre-determined value.

A high gas pressure sensing device shall be fitted when there is no gas pressure governor.

Where a high gas pressure sensing device is fitted, it shall cause non-volatile lock-out:

a) if the heat input to the burner exceeds 1,15 times the nominal heat input or

b) if the pressure at the burner head exceeds 1,3 times the burner head pressure at the nominal inlet pressure.