# SLOVENSKI STANDARD

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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 676:2003**



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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

# EN 676

August 2003

ICS 27.060.20

Supersedes EN 676:1996

English version

# Automatic forced draught burners for gaseous fuels

Brûleurs automatiques à air soufflé pour combustibles gazeux

Automatische Brenner mit Gebläse für gasförmige Brennstoffe

This European Standard was approved by CEN on 3 April 2003.

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 Management Centre or to any CEN member.

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

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

**Management Centre: rue de Stassart, 36 B-1050 Brussels**



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# Contents

# Foreword

This document EN 676:2003 has been prepared by 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of an identical text or by endorsement, at the latest by February 2004, and conflicting national standards shall be withdrawn at the latest by February 2004.

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

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

NOTE This European Standard had also been proposed for inclusion in the mandate under the EU Directive 98/37/EC (Machinery Directive). As the mandate has been given after the Standard had been accepted by the Technical Committee for submission to Formal Vote and in order not to further delay its publication, it will be reviewed within the context of the Directive 98/37/EC directly after the publication.

According to edition 1996 the following fundamental changes are given:

— revisions for special applications;

— implementation of $NO_x$-classes and forming of arithmetic average values for determining the $NO_x$-values;

— implementation of appliance categories for forced draught burners.



Annexes A, B, C, D, E, F, G, H, J and ZA are informative.



This document includes a Bibliography.

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, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

# 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, can 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.

The technical committee responsible for the standard decided that the following appliance categories for forced draught burners should apply:

— single categories: $I_{2R}$ for natural gas and $I_{3R}$ for liquefied petroleum gas;

— dual category: $II_{2R/3R}$ for natural and liquefied petroleum gas.

All the burners of this standard marked with these categories are commissioned on site and the measured values are recorded in a commissioning report.

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.



Forced draught gas burners according to this standard are often used in industrial applications. The safety principles are the same as for forced draught gas burners used for household/commercial applications. Industrial forced draught gas burners however should operate safely in their industrial environment and the risks involved can differ from those for household applications. These industrial forced draught gas burners can be characterized by the ability to withstand industrial environmental influences, like moisture, high temperature, electrical and magnetic phenomena, vibrations, etc.



Principal requirements for installation and construction of gas burners and industrial thermal processing are covered by EN 746-family.

Special requirements for forced draught burners for industrial premises will be given as a note with the addition "Industrial application".

Further information and application limitation for EN 676 forced draught burners which are used for industrial application are given in informative annex I

## 1 Scope

This European 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 clause 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 with a single combustion chamber, 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.



## 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 these 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 (including amendments).



EN 88, *Pressure governors for gas appliances for inlet pressures up to 200 mbar.*

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

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

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

EN 334, *Gas pressure regulators for inlet pressures up to 100 bar.*

EN 1092-1, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated — Part 1: Steel flanges.*

EN 1092-2, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated — Part 2: Cast iron flanges.*

prEN 1092-3, Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated — Part 3: Copper alloy flanges.

EN 1643, *Valve proving systems for automatic shut-off valves for gas burners and gas appliances.*

EN 1854, *Pressure sensing devices for gas burners and gas burning appliances.*

EN 10208-1, *Steel pipes for pipelines for combustible fluids — Technical delivery conditions — Part 1: Pipes of requirement class A.*

EN 10208-2, *Steel pipes for pipelines for combustible fluids — Technical delivery conditions- Part 2: Pipes of requirement class B.*

EN 10216-1, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 1: Non-alloy steel tubes with specified room temperature properties.*

EN 10217-1, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 1: Non-alloy steel tubes with specified room temperature properties.*

EN 12067-1, *Gas/air ratio controls for gas burners and gas burning appliances — Part 1: Pneumatic types.*

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

prEN 50156-1, *Electrical equipment for furnaces and ancillary equipment — Part 1: Requirements for application design and installation.*

EN 60204-1, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements (IEC 60204-1:1997).*

EN 60335-1:1994, *Safety of household and similar electrical appliances — Part 1: General requirements (IEC 60335-1:1991, modified).*

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

EN 60947-5-1, *Low-voltage switchgear and controlgear — Part 5-1: Control circuit devices and switching elements — Electromechanical control circuit devices (IEC 60947-5-1:1997).*

ENV 10220, Seamless and welded steel tubes — Dimensions and masses per unit length.

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



EN ISO 3166-1, Codes for the representation of names of countries and their subdivisions – Part 1: Country codes (ISO 3166-1:1997).



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

## 3 Terms and definitions

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

### 3.1 General terms and definitions

**3.1.1**
**forced draught burner**
burner in which the total air for combustion is supplied by means of a fan

**3.1.2**
**automatic forced draught burner**
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**
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 part, or all, of the air for complete combustion of the gas is mixed with the gas upstream of the mixture outlet ports

**3.1.5**
**nozzle mixed burner**
burner in which part, or all, of the air required for combustion of the gas is mixed with the gas at, or downstream of, the air and gas ports

**3.1.6**
**integrated ignition burner**
burner with direct main ignition burner at reduced rate with by-pass start gas supply

**3.1.7**
**start gas rate**
gas rate ignited by the ignition device during the start-up of the burner

**3.1.8**
**industrial applications**
industrial applications means:

— the extraction,

— growth,

— refining,

— processing,

— production,

— manufacture or

— preparation

of materials, plants, livestock, animal products, food or artefacts.



**3.1.9**
**combustion chamber**
part of the appliance in which the combustion takes place

## 3.2 Specific terms and definitions

### 3.2.1 Combustible gases

**3.2.1.1**
**reference conditions**
these correspond to 15 °C, 1013,25 mbar, unless otherwise specified

**3.2.1.2**
**calorific value**
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

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/m³) of dry gas at the reference conditions, or

— megajoules per kilogram (MJ/kg) of dry gas.

**3.2.1.3**
**relative density**
ratio of the masses of equal volumes of dry gas and dry air at the same conditions of temperature and pressure

Symbol: $d$

**3.2.1.4**
**Wobbe index**
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

Symbols: gross Wobbe index: $W_s$

net Wobbe index: $W_i$

Units: either

— megajoules per cubic metre (MJ/m³) of dry gas at the reference conditions, or

— megajoules per kilogram (MJ/kg) of dry gas.



**3.2.1.5**
**gas pressure**
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).



**3.2.1.6**
**reference gases**
test gases on which burners operate under nominal conditions when they are supplied at the corresponding normal pressure

**3.2.1.7**
**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.

**3.2.1.8**
**normal pressure**
pressure under which the burners operate in nominal conditions when they are supplied with the corresponding reference gas

**3.2.1.9**
**limit pressures**
pressures representative of the extreme variations in the burner supply conditions

NOTE The test pressures are given in Table 5.

**3.2.1.10**
**supply pressure**
pressure measured at the measuring point M1 as specified in Figure 1, at which the nominal conditions are achieved

**3.2.1.11**
**adjustment pressure**
pressure measured at the measuring point M2 as specified in Figure 1, at which the nominal conditions are achieved

**3.2.1.12**
**burner head pressure**
pressure measured at the measuring point M3 as specified in Figure 1, at which the nominal conditions are achieved

**3.2.1.13**
**pressure in the combustion chamber**
pressure or depression, relative to atmospheric pressure, prevailing in the combustion chamber

### 3.2.2 Operation of the burner

#### 3.2.2.1 gas rate

**3.2.2.1.1**
**volumetric flow rate**
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: $V$



**3.2.2.1.2**
**nominal volumetric flow rate**
volumetric flow rate stated by the manufacturer, expressed in cubic metres per hour ($m^3/h$)



**3.2.2.1.3**
**maximum flow rate**
highest flow rate stated by the manufacturer, expressed in cubic metres per hour ($m^3/h$) at reference conditions

**3.2.2.1.4**
**minimum flow rate**
lowest flow rate stated by the manufacturer, expressed in cubic metres per hour ($m^3/h$) at reference conditions

**3.2.2.1.5**
**mass flow rate**
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)

**3.2.2.1.6**
**nominal mass flow rate**
mass flow rate stated by the manufacturer

**3.2.2.1.7**
**heat input**
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: $Q_F$

Unit: kilowatt (kW)

Burners with fixed heat input or single stage burners have a single heat input. Range-rated burners have a maximum heat input and a minimum heat input declared by the manufacturer.

**3.2.2.1.8**
**maximum heat input**
highest value of the heat input declared by the manufacturer

Symbol: $Q_{F\,max}$

**3.2.2.1.9**
**minimum heat input**
lowest value of the heat input declared by the manufacturer

Symbol: $Q_{F\,min}$

### 3.2.2.2 running conditions

**3.2.2.2.1**
**burners for permanent operation**
burners that are designed to remain in the running condition for more than 24 h without interruption

**3.2.2.2.2**
**burners for intermittent operation**
burners that are designed to remain in the running condition for less than 24 h

### 3.2.3 Gas line components

**3.2.3.1**
**gas line**
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



**3.2.3.2**
**range-rating device**
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 can be progressive or in discrete steps.

**3.2.3.3**
**automatic shut-off valve**
valve which opens when energised and closes automatically when de-energised

**3.2.3.4**
**filter/strainer**
device that enables foreign elements, which might otherwise cause failures in the system, to be collected

### 3.2.4 Adjusting, control and safety devices

**3.2.4.1**
**pressure governor**
device which maintains the downstream pressure constant to within fixed limits independent of variations, within a given range, of the upstream pressure

**3.2.4.2**
**adjustable pressure governor**
pressure governor fitted with a means of adjusting the loading on the diaphragm and thus the downstream pressure

**3.2.4.3**
**gas pressure protection devices**
device which compares the actual value of the pressure with the desired value, gives a signal when the actual value exceeds or drops below the desired value and initiates the controlled shut-down

**3.2.4.4**
**flame detector device**
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, can be assembled in a single housing for use in conjunction with a programming unit

**3.2.4.5**
**automatic burner control system**
system which comprises at least a programming unit and all the elements of a flame detector device. The various functions of an automatic burner control system can be in one or more housings.

**3.2.4.6**
**programming unit**
unit which 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.

**3.2.4.7**
**safe start check**
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

**3.2.4.8**
**controlled shut-down**
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



**3.2.4.9**
**safety shut-down**
process which is effected immediately following the response of a safety device 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.

**3.2.4.10**
**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

**3.2.4.11**
**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 main power and its subsequent restoration

**3.2.4.12**
**start signal**
signal, e. g. from a thermostat, which releases the system from its start position and commences the predetermined programme

**3.2.4.13**
**recycling**
process by which, after a safety shut-down, a full start-up sequence is automatically repeated

**3.2.4.14**
**valve proving system**
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

**3.2.4.15**
**ignition device**
any means (flame, electrical ignition or other means) used to ignite the gas at the ignition burner or at the main burner

**3.2.4.16**
**running position of the burner system**
position of the system in which the burner is in normal operation under the supervision of the programming unit and its flame detector device

**3.2.4.17**
**purge**
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

**3.2.4.17.1**
**pre-purge**
purge which takes place between the start signal and the energisation of the ignition device

**3.2.4.17.2**
**post-purge**
purge which takes place immediately following a controlled shut-down

### 3.2.5 Sequencing times

**3.2.5.1**
**pre-purge time**
period during which purge takes place at the proven air rate prior to the energisation of the ignition device



**3.2.5 2**
**post-purge time**
period between any shut-down and the moment the fan is switched off



**3.2.5.3**
**ignition time**
period between the opening of the gas valves and the first indication of the flame by the flame detector device

**3.2.5.4**
**first safety time**
period between the pilot gas valve, the start gas valve or main gas valve(s), as applicable, being energised and the pilot gas valve, start gas valve or main gas valve(s), as applicable, being de-energised 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.

**3.2.5.5**
**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 energised and the main gas valves being de-energised if the flame detector device signals the absence of a flame

**3.2.5.6**
**extinction safety time**
period that starts with the signal that the flame has been extinguished and ends with the signal to de-energize the safety shut-off valve of the gas supply

**3.2.5.7**
**total closing time**
period that starts with the signal that the flame has been extinguished and ends with the shut-off valves being closed