



# SLOVENSKI STANDARD

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**Preskusni plini - Preskusni tlaki - Kategorije naprav (vključ'no z dopolnilom A1)**

Test gases - Test pressures - Appliance categories

Prüfgase - Prüfdrücke - Gerätekategorien

Gaz d'essais - Pressions d'essais - Catégories d'appareils

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**ICS:**

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| 27.060.20 | Plinski gorilniki          | Gas fuel burners   |
| 91.140.40 | Sistemi za oskrbo s plinom | Gas supply systems |

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EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN 437:2003+A1**

March 2009

ICS 27.060.20; 91.140.40

Supersedes EN 437:2003

English Version

**Test gases - Test pressures - Appliance categories**

Gaz d'essais - Pressions d'essais - Catégories d'appareils

Prüfgase - Prüfdrücke - Gerätekategorien

This European Standard was approved by CEN on 6 December 2002 and includes Amendment 1 approved by CEN on 10 January 2009.

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## Foreword

This document (EN 437:2003+A1:2009) has been prepared by Technical Committee CEN/TC 238 "Test gases, test pressures and categories of appliances", the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2009, and conflicting national standards shall be withdrawn at the latest by September 2009.

This document replaces A1 EN 437:2003 A1.

This document includes Amendment 1, approved by CEN on 2009-01-10.

The start and finish of text introduced or altered by amendment is indicated in the text by tags A1 A1.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports the requirements of 2.2 of the "Gas Appliances" Directive (90/396/EEC).

Annex A is normative. Annexes B, C and D are informative.

EN 437 is intended to provide all the CEN Technical Committees preparing standards on gas appliances with definitions for test gases, test pressures and categories of appliances for use by these committees within the limits of the scope defined in clause 1.

Similarly, it is emphasized that distributors of 2<sup>nd</sup> family gases using pressure couples should restrict themselves to their use in the normal manner but may, in exceptional circumstances and for short periods, use gases of the lowest Wobbe index at the lowest pressure, under conditions in which the safety of the appliance has to be ensured.

The standard seeks to clarify the present situation with respect to test gases, test pressures and appliance categories.

The concern for clarity has led to the elucidation of numerous categories and national situations or conditions. The complexity of the standard is likely to increase as new members join the Union.

This revised standard incorporates the two previously published amendments and includes new appliance categories, the reason for which does not lie essentially with new gas resources but with new technical developments for appliances.

A1 This standard can be considered as an important stage in the harmonization of test gases, test pressures and appliance categories and the quality of information on gas usage in Europe.

The standard also applies to Albania, Croatia, Republic of Macedonia and Turkey, countries whose national standardisation body is affiliate member of CEN (see Annex D).

Annex B gives national situations relating to gases, gas pressures and appliance categories that apply nationally or locally. The information provided is included under the responsibility of the national standardisation bodies. The tables give the available information. A1

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

## EN 437:2003+A1:2009 (E)

## 1 Scope

This standard specifies the test gases, test pressures and categories of appliances relative to the use of  $\text{A}_1$  gaseous fuels  $\text{A}_1$  of the first, second and third families. It serves as a reference document in the specific standards for appliances that fall within the scope of the Council Directive on the approximation of the laws of Member States concerning gas appliances (90/396/EC).

The standard makes recommendations for the use of the gases and pressures to be applied for the tests. The full procedure will be given in the corresponding appliance standards.

**NOTE** The test gases and the test pressures specified in this standard are in principle intended to be used with all the appliances in order to establish conformity with the corresponding standards.

However, the use of some test gases and test pressures may not be appropriate in the following cases:

- appliances with nominal heat input greater than 300 kW;
- appliances constructed on site;
- appliances in which the final design is influenced by the user;
- appliances constructed for use with high supply pressures (notably direct use of the saturated vapour pressure).

In these cases, the specific appliance standards may specify other test conditions in order to establish compliance with their requirements.

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## 2 Normative references

$\text{A}_1$  The following referenced documents are indispensable for the application of this European Standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.  $\text{A}_1$

$\text{A}_1$  EN ISO 3166-1:2006, *Codes for the representation of names of countries and their subdivisions – Part 1: Country codes (ISO 3166-1:2006)*  $\text{A}_1$

$\text{A}_1$  EN ISO 6976:2005, *Natural gas – Calculation of calorific values, density, relative density and Wobbe index from composition (ISO 6976:1995 including Corrigendum 1:1997, Corrigendum 2:1997 and Corrigendum 3:1999)*  $\text{A}_1$

## 3 Terms and definitions

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

### 3.1

#### gas appliance

appliance burning  $\text{A}_1$  gaseous fuels  $\text{A}_1$

$\text{A}_1$  **NOTE** For the purposes of this standard the term "gaseous fuels" means any fuel that is in the gaseous state at a temperature of 15 °C, and under a pressure of 1 bar.  $\text{A}_1$

### 3.2

#### test gases

gases intended for the verification of the operational characteristics of  $\text{A}_1$  gas appliances  $\text{A}_1$ . They consist of reference gases and limit gases

### 3.3

#### reference gases

test gases with which appliances operate under nominal conditions when they are supplied at the corresponding normal pressure

**3.4****limit gases**

test gases representative of the extreme variations in the characteristics of the gases for which appliances have been designed

**3.5****test pressures**

gas pressures used to verify the operational characteristics of  $\text{A}_1$  gas appliances  $\text{A}_1$ . They consist of normal and limit pressures

NOTE The gas pressures used are expressed in millibars (mbar) 1 mbar =  $10^2$  Pa

**3.6****normal pressure**

$p_n$

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

**3.7****limit pressures**

maximum pressure:  $p_{\max}$ ; minimum pressure:  $p_{\min}$

pressures representative of the extreme variations in the appliance supply conditions

**3.8****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

- the higher pressure corresponds only to gases of low Wobbe index ;
- the lower pressure corresponds to gases of high Wobbe index.

**3.9****reference conditions**

these correspond to 15 °C, 1 013, 25 mbar, unless otherwise specified

**3.10****relative density**

$d$

ratio of the masses of equal volumes of dry gas and dry air under the same conditions of temperature and pressure: 15 °C or 0 °C and 1 013, 25 mbar

**3.11****calorific value**

quantity of heat produced by the complete combustion, at a constant pressure equal to 1 013,25 mbar, of a 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  $H_g$ : the water produced by combustion is assumed to be condensed;
- the net calorific value  $H_i$ : the water produced by combustion is assumed to be in the vapour state

NOTE The calorific value is expressed:

- either in megajoules per cubic metre ( $\text{MJ/m}^3$ ) of dry gas under the reference conditions;
- or in megajoules per kilogram ( $\text{MJ/kg}$ ) of dry gas.

**3.12****Wobbe index**

gross Wobbe index  $W_g$ ; net Wobbe index  $W_i$

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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

NOTE The Wobbe indices are expressed -

- either in megajoules per cubic metre (MJ/m<sup>3</sup>) of dry gas under the reference conditions
- or in megajoules per kilogram (MJ/kg) of dry gas.

### 3.13

#### heat input

$Q$

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

NOTE The heat input is expressed in kilowatts (kW)

### 3.14

#### nominal heat input

$Q_n$

value of the heat input declared by the manufacturer

### 3.15

#### mass flow rate

$M$

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

NOTE The mass flow rate is expressed in kilograms per hour (kg/h) or grams per hour (g/h)

### 3.16

#### volume flow rate

$V$

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

NOTE The volume flow rate is expressed in cubic metres per hour (m<sup>3</sup>/h), litres per minute (l/min), cubic decimetres per hour (dm<sup>3</sup>/h) or cubic decimetres per second (dm<sup>3</sup>/s).

### 3.17

#### gas family

group of  $A_1$  gaseous fuels  $A_1$  with similar burning behaviour linked together by a range of Wobbe indices (see Table 1)

### 3.18

#### gas group

specified range of Wobbe index within that of the family concerned (see Table 1); this range is determined on the general principle that appliances utilising this gas group would operate safely when burning all gases within this range without adjustments.

NOTE Adjustment of the appliance may be permitted in accordance with the special national or local conditions that apply in some countries (see B.4). For gases corresponding to national or local conditions, see Tables B.5 and D.5

### 3.19

#### appliance category

means of identifying the gas families and/or gas groups that a gas appliance is designed to utilize safely and to the desired performance level (see individual appliance standards).

NOTE General appliance categories are described in 6.1. Special appliance categories marketed nationally or locally are described in B.4 and annex D.

## 4 Gases

### 4.1 Classification

Gases are classified into three families, each family may be divided into groups, (themselves being divided into ranges, see annex B), as a function of the Wobbe index, according to the values given in Table 1.

**Table 1 – Summary of gas families and groups as a function of the Wobbe indices**

| Gas families and groups | Gross Wobbe index at 15 °C and 1 013,25 mbar |              |
|-------------------------|----------------------------------------------|--------------|
|                         | MJ/m <sup>3</sup>                            |              |
|                         | minimum                                      | maximum      |
| First family            |                                              |              |
| — Group a               | 22,4                                         | 24,8         |
| Second family           |                                              |              |
| — Group H               | 39,1<br>45,7                                 | 54,7<br>54,7 |
| — Group L               | 39,1                                         | 44,8         |
| — Group E               | 40,9                                         | 54,7         |
| Third family            |                                              |              |
| — Group B/P             | 72,9<br>72,9                                 | 87,3<br>87,3 |
| — Group P               | 72,9                                         | 76,8         |
| — Group B               | 81,8                                         | 87,3         |

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### 4.2 Test gases

The composition and principal characteristics of the different test gases corresponding to the gas families or groups are given in Tables 2 and 3.

In particular cases specified in the individual appliance standards, gas G 24, whose characteristics are given in Table 3, may be used but only at the normal test pressure.

The calorific values of the third family gases, expressed in megajoules per cubic metre in Table 2, may also be expressed in megajoules per kilogram of dry gas, as shown in Table 3.

**[A1]** The values in Tables 2 and 3, measured and expressed at 15 °C, are derived from EN ISO 6976:2005. **[A1]**

The conditions for the preparation of the test gases are given in annex A.

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**Table 2 – Characteristics of the test gases <sup>a</sup> for the first and second families, gas dry at 15 °C and 1 013,25 mbar**

| Gas family and Group                    | Test gases                                  | Designation | Composition by volume<br>% C                                                      | $W_i$<br>MJ/m <sup>3</sup> | $H_i$<br>MJ/m <sup>3</sup> | $W_s$<br>MJ/m <sup>3</sup> | $H_s$<br>MJ/m <sup>3</sup> | $d$   |
|-----------------------------------------|---------------------------------------------|-------------|-----------------------------------------------------------------------------------|----------------------------|----------------------------|----------------------------|----------------------------|-------|
| Gases of the first family <sup>b</sup>  |                                             |             |                                                                                   |                            |                            |                            |                            |       |
| Group a                                 | Reference gas                               | G 110       | CH <sub>4</sub> = 26<br>H <sub>2</sub> = 50<br><br>N <sub>2</sub> = 24            | 21,76                      | 13,95                      | 24,75                      | 15,87                      | 0,411 |
|                                         | Light back limit gas                        | G 112       | CH <sub>4</sub> = 17<br>H <sub>2</sub> = 59<br>N <sub>2</sub> = 24                | 19,48                      | 11,81                      | 22,36                      | 13,56                      | 0,367 |
| Gases of the second family <sup>b</sup> |                                             |             |                                                                                   |                            |                            |                            |                            |       |
| Group H                                 | Reference gas                               | G 20        | CH <sub>4</sub> = 100                                                             | 45,67                      | 34,02                      | 50,72                      | 37,78                      | 0,555 |
|                                         | Incomplete combustion and sooting limit gas | G 21        | CH <sub>4</sub> = 87<br><br>C <sub>3</sub> H <sub>8</sub> = 13                    | 49,60                      | 41,01                      | 54,76                      | 45,28                      | 0,684 |
|                                         | Light back limit gas                        | G 222       | CH <sub>4</sub> = 77<br>H <sub>2</sub> = 23                                       | 42,87                      | 28,53                      | 47,87                      | 31,86                      | 0,443 |
|                                         | Flame lift limit gas                        | G 23        | CH <sub>4</sub> = 92,5<br>N <sub>2</sub> = 7,5                                    | 41,11                      | 31,46                      | 45,66                      | 34,95                      | 0,586 |
|                                         | Over heating limit gas <sup>d</sup>         | G 24        | CH <sub>4</sub> = 68<br>C <sub>3</sub> H <sub>8</sub> = 12<br>H <sub>2</sub> = 20 | 47,01                      | 35,70                      | 52,09                      | 39,55                      | 0,577 |
| Group L                                 | Reference gas light back limit gas          | G 25        | CH <sub>4</sub> = 86<br>N <sub>2</sub> = 14                                       | 37,38                      | 29,25                      | 41,52                      | 32,49                      | 0,612 |
|                                         | Incomplete combustion and sooting limit gas | G 26        | CH <sub>4</sub> = 80<br>C <sub>3</sub> H <sub>8</sub> = 7<br>N <sub>2</sub> = 13  | 40,52                      | 33,36                      | 44,83                      | 36,91                      | 0,678 |
|                                         | Flame lift limit gas                        | G 27        | CH <sub>4</sub> = 82<br>N <sub>2</sub> = 18                                       | 35,17                      | 27,89                      | 39,06                      | 30,98                      | 0,629 |
| Group E                                 | Reference gas                               | G 20        | CH <sub>4</sub> = 100                                                             | 45,67                      | 34,02                      | 50,72                      | 37,78                      | 0,555 |
|                                         | Incomplete combustion and sooting limit gas | G 21        | CH <sub>4</sub> = 87<br>C <sub>3</sub> H <sub>8</sub> = 13                        | 49,60                      | 41,01                      | 54,76                      | 45,28                      | 0,684 |
|                                         | Light back limit gas                        | G 222       | CH <sub>4</sub> = 77<br>H <sub>2</sub> = 23                                       | 42,87                      | 28,53                      | 47,87                      | 31,86                      | 0,443 |
|                                         | Flame lift limit gas                        | G 231       | CH <sub>4</sub> = 85<br>N <sub>2</sub> = 15                                       | 36,82                      | 28,91                      | 40,90                      | 32,11                      | 0,617 |
|                                         | Over heating limit gas <sup>d</sup>         | G 24        | CH <sub>4</sub> = 68<br>C <sub>3</sub> H <sub>8</sub> = 12<br>H <sub>2</sub> = 20 | 47,01                      | 35,70                      | 52,09                      | 39,55                      | 0,577 |

<sup>a</sup> For gases used nationally or locally, see B.5.  
<sup>b</sup> For other groups, see B.5.  
<sup>c</sup> See also Annex A.  
<sup>d</sup> Limit gas used only for certain types of appliance, specified in the individual appliance standards.

A1

A1 deleted text A1

**Table 3 - Characteristics of the test gases <sup>a</sup> for the third family, gas dry at 15 °C and 1 013,25 mbar**

| Gas family and Group                          | Test gases                                                                          | Designation | Composition by volume<br>% d           | $W_i$<br>MJ/m <sup>3</sup> | $H_i$<br>MJ/m <sup>3</sup>   MJ/kg |       | $W_s$<br>MJ/m <sup>3</sup> | $H_s$<br>MJ/m <sup>3</sup>   MJ/kg |       | $d$   |
|-----------------------------------------------|-------------------------------------------------------------------------------------|-------------|----------------------------------------|----------------------------|------------------------------------|-------|----------------------------|------------------------------------|-------|-------|
| Gases of the third family <sup>b</sup>        |                                                                                     |             |                                        |                            |                                    |       |                            |                                    |       |       |
| Third family and Groups B/ P<br><br><br>and B | Reference gas                                                                       | G 30        | n-C <sub>4</sub> H <sub>10</sub> = 50  | 80,58                      | 116,09                             | 45,65 | 87,33                      | 125,81                             | 49,47 | 2,075 |
|                                               | Incomplete combustion and sooting limit gas                                         |             | i- C <sub>4</sub> H <sub>10</sub> = 50 |                            |                                    |       |                            |                                    |       |       |
|                                               | Flame lift limit gas                                                                | G 31        | C <sub>3</sub> H <sub>8</sub> = 100    | 70,69                      | 88,00                              | 46,34 | 76,84                      | 95,65                              | 50,37 | 1,550 |
|                                               | Light back limit gas                                                                | G 32        | C <sub>3</sub> H <sub>6</sub> = 100    | 68,14                      | 82,78                              | 45,77 | 72,86                      | 88,52                              | 48,94 | 1,476 |
| Group P                                       | Reference gas, Incomplete combustion, flame lift and sooting <sup>c</sup> limit gas | G 31        | C <sub>3</sub> H <sub>8</sub> = 100    | 70,69                      | 88,00                              | 46,34 | 76,84                      | 95,65                              | 50,37 | 1,550 |
|                                               | Light back and sooting limit gas <sup>c</sup>                                       | G 32        | C <sub>3</sub> H <sub>6</sub> = 100    | 68,14                      | 82,78                              | 45,77 | 72,86                      | 88,52                              | 48,94 | 1,476 |

<sup>a</sup> For gases used nationally or locally, see B.5.

<sup>b</sup> For other groups, see B.5.

<sup>c</sup> The appliance standards may only specify one sooting limit gas.

<sup>d</sup> See also Annex A.

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**NOTE** The characteristics for second family gases at reference conditions other than 15 °C for metering and 15 °C for combustion can be calculated using the coefficients given in EN ISO 21843:2005, Annex A (normative). As an example the characteristics of the reference gases of the second family at 0 °C for metering and for combustion and 1 013,25 mbar (dry gas) are given in Table 4.

**Table 4 – Characteristics of the reference gases of the second family at 0 °C and 1 013,25 mbar**

| Gas group | Test gas                            | Designation | Composition by volume<br>% | $W_i$             | $H_i$             | $W_s$             | $H_s$             | $d$   |
|-----------|-------------------------------------|-------------|----------------------------|-------------------|-------------------|-------------------|-------------------|-------|
|           |                                     |             |                            | MJ/m <sup>3</sup> | MJ/m <sup>3</sup> | MJ/m <sup>3</sup> | MJ/m <sup>3</sup> |       |
| Group H   | Reference gas                       | G 20        | CH <sub>4</sub> = 100      | 48,20             | 35,90             | 53,61             | 39,94             | 0,555 |
| Group L   | Reference gas, light back limit gas | G 25        | CH <sub>4</sub> = 86       | 39,45             | 30,87             | 43,88             | 34,34             | 0,613 |
|           |                                     |             | N <sub>2</sub> = 14        |                   |                   |                   |                   |       |
| Group E   | Reference gas                       | G 20        | CH <sub>4</sub> = 100      | 48,20             | 35,90             | 53,61             | 39,94             | 0,555 |

## 5 Test pressures

The values of the test pressures, i.e. the static pressure to be applied at the gas inlet connection to the appliance whilst in operation, are given in Tables 6 and 7.

**NOTE** For Tables 6 and 7, the test conditions will be specified in the individual appliance standards.

However:

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- for the combustion test in still air with G 21 the appliance is first adjusted on G 20 to give an increase of 5 % in the nominal heat input where a gas pressure governor exists, and an increase of 7,5 % in the absence of a governor. Gas G 21 is then substituted for G 20 without altering this adjustment;
- tests for ignition and crosslighting should be carried out at an inlet pressure of 0,7 times the normal pressure ( $p_n$ ) using the reference gas(es) for the first and second families.

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**Table 5 (A1) – Test pressures where no pressure couple exists<sup>a</sup>**

Pressures in millibars

| Appliance categories having as index          | Test gas                                                         | $P_n$           | $p_{\min}$ | $p_{\max}$ |
|-----------------------------------------------|------------------------------------------------------------------|-----------------|------------|------------|
| 1 <sup>st</sup> family 1a                     | G 110<br>G 112                                                   | 8               | 6          | 15         |
| 2 <sup>nd</sup> family<br>2H                  | G 20, G 21,<br>G 222, G 23                                       | 20              | 17         | 25         |
| 2 <sup>nd</sup> family<br>2L                  | G 25, G 26,<br>G 27                                              | 25              | 20         | 30         |
| 2 <sup>nd</sup> family<br>2E                  | G 20, G 21,<br>G 222, G 231                                      | 20              | 17         | 25         |
| 2 <sup>nd</sup> family<br><br>2N <sup>d</sup> | G 20, G 21,<br>G 222, G 231,<br>G 25, G 26,<br>G 27 <sup>a</sup> | 20              | 17         | 30         |
|                                               | G 25, G 26,<br>G 27                                              | 25              | 20         | 30         |
| 3 <sup>rd</sup> family<br>3B/P                | G 30, G 31,<br>G 32                                              | 29 <sup>b</sup> | 25         | 35         |
|                                               | G 30, G 31,<br>G 32                                              | 50              | 42,5       | 57,5       |
| (A1) 3 <sup>rd</sup> family, 3P               | G 31, G 32                                                       | 30              | 25         | 35 (A1)    |
| 3 <sup>rd</sup> family<br>3P                  | G 31, G 32                                                       | 37              | 25         | 45         |
|                                               | G 31, G 32                                                       | 50              | 42,5       | 57,5       |
| 3 <sup>rd</sup> family<br>3B <sup>c</sup>     | G 30, G 31,<br>G 32                                              | 29              | 20         | 35         |

<sup>a</sup> For test pressures corresponding to gases distributed nationally or locally, refer to Table B.5.

<sup>b</sup> Appliances of this category may be used, without adjustment, at the specified supply pressures of 28 mbar to 30 mbar.

<sup>c</sup> The tests with G 31 and G 32 are carried out at the normal pressure only ( $p_n = 29$  mbar), these test gases being more severe than any gas distributed. This condition covers the normal variations in the gas supply.

<sup>d</sup> See definition in 6.1.2.2.