Gas-fired domestic appliances producing hot water – Appliances not exceeding 70 kW heat input and 300 l water storage capacity – Part 1: Assessment of performance of hot water deliveries

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Gas-fired domestic appliances producing hot water - Appliances not exceeding 70 kW heat input and 300 l water storage capacity - Part 1: Assessment of performance of hot water deliveries

Appareils domestiques produisant de l'eau chaude sanitaire utilisant les combustibles gazeux - Appareils de débit calorifique inférieur ou égal à 70 kW et de capacité de stockage inférieure ou égale à 300 litres - Partie 1 : Evaluation de la performance en puissance d'eau chaude

Gasbeheizte Geräte für die sanitäre Warmwasserbereitung für den Hausgebrauch - Geräte, die eine Nennwärmebelastung von 70 kW und eine Speicherkapazität von 300 Liter Wasser nicht überschreiten - Teil 1: Bewertung der Leistung der Warmwasserbereitung

This European Standard was approved by CEN on 18 May 2006.

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Foreword

This document (EN 13203-1:2006) has been prepared by Technical Committee CEN/TC 109 “Central heating boilers using gaseous fuels”, the secretariat of which is held by NEN.

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of an identical text or by endorsement, at the latest by January 2007, and conflicting national standards shall be withdrawn at the latest by January 2007.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, 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 United Kingdom.
1 Scope

This document is applicable to gas-fired appliances producing domestic hot water. It applies to both instantaneous and storage appliances; water-heaters and combination boilers that have:

— heat input not exceeding 70 kW; and
— hot water storage capacity (if any) not exceeding 300 l.

In the case of combination boilers, with or without storage, domestic hot water production is integrated or coupled, the whole being marketed as a single unit.

This document is formed in two parts, which cover two aspects of domestic hot water production.

EN 13203-1 sets out in qualitative and quantitative terms the performance in delivery of domestic hot water for a selected variety of uses. It also gives a system for presenting the information to the user. This first part compliments EN 26, EN 89 and EN 625.

EN 13203-2 sets out a method for assessing the energy performance of the appliances. It defines a number of daily delivery programmes for each domestic hot water use, kitchen, shower, bath and a combination of these, together with corresponding test procedures, enabling the energy performances of different gas-fired appliances to be compared and matched to the needs of the user.

2 Normative references

The following referenced documents are indispensable for the application 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 625, Gas-fired central heating boilers - Specific requirements for the domestic hot water operation of combination boilers of nominal heat input not exceeding 70 kW.

3 Terms and definitions

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

3.1 control cycle
time cycle for keeping components and/or the hot water tank (if any) of the domestic hot water circuit at predetermined temperature level, consists of an «ON» duration time during which the heating of the domestic hot water (by gas energy and auxiliary energy) is operating, and an «OFF» duration time during which no heating occurs

3.2 domestic water mean temperature
average temperature of the water delivered during the time $\Delta t$

$$T_m = \frac{1}{\Delta t} \int T \cdot dt$$

SYMBOL $T_m$

3.3 domestic water test temperature
temperature of the delivered water at which the tests are conducted
3.4  
**hot water tank**
reservoir for domestic hot water

3.5  
**kitchen specific rate**
domestic hot water rate corresponding to a mean temperature rise of 45 K that the appliance can supply

SYMBOL  \( D_c \)

NOTE  \( D_c \) is expressed in litre per minute (l/min)

3.6  
**minimum declared water rate**
lowest water rate stated by the manufacturer maintaining a stable temperature

SYMBOL  \( D_m \)

NOTE  \( D_m \) is expressed in litre per minute (l/min)

3.7  
**nominal domestic hot water heat input**
value of the heat input stated by the manufacturer for the production of domestic hot water

SYMBOL  \( Q_{nw} \)

NOTE  \( Q_{nw} \) is expressed in kilowatt (kW)

3.8  
**overall performance factor**
umerical value used to quantify the overall performance associated with domestic hot water use, corresponding to the sum of the products of the particular performance factors multiplied by the weighting coefficients

SYMBOL  \( F \)

\[
F = \sum_{i=1}^{n} a_i f_i
\]

3.9  
**particular performance factor**
numerical value which quantifies each of the performance criteria listed in Table 1

SYMBOL  \( f_i \)

3.10  
**specific rate**
domestic hot water rate declared by the manufacturer corresponding to a mean temperature rise of 30 K that the appliance can supply in two successive delivery periods

SYMBOL  \( D \)

NOTE  \( D \) is expressed in litre per minute (l/min)

3.11  
**summer mode**
conditions during which the appliance supplies energy only for the production of domestic hot water

\[ \text{1 The manufacturer is the organization or company which assumes responsibility for the product.} \]
3.12 tapping capability
hot water delivery rate, declared by the manufacturer, at which water can be drawn off for a specified time or times (5 ; 10 ; 20 min or continuous) with a predetermined temperature rise

SYMBOL \( R \)

NOTE \( R \) is expressed in litre per minute (l/min)

3.13 temperature fluctuation at a constant water rate
difference between the minimum and maximum water temperatures that can occur during delivery at a constant water rate with a constant inlet temperature

SYMBOL \( \Delta T_2 \)

NOTE \( \Delta T_2 \) is expressed in Kelvin (K)

3.14 temperature fluctuation between successive deliveries
maximum domestic hot water temperature difference between successive deliveries

SYMBOL \( \Delta T_3 \)

NOTE \( \Delta T_3 \) is expressed in Kelvin (K)

3.15 temperature stabilization time following a variation of the water flow rate
time taken to obtain a predetermined fluctuation, following a rapid variation of the water flow rate

SYMBOL \( t_s \)

NOTE \( t_s \) is expressed in second (s)

3.16 temperature variation according to water rate
variation of the mean hot water temperature consequent upon variations of the water flow rate

SYMBOL \( \Delta T_1 \)

NOTE \( \Delta T_1 \) is expressed in Kelvin (K)

3.17 waiting time
time taken to reach, at appliance outlet, 90 % of the domestic hot water temperature rise of 45 K without subsequently falling below 34 K

SYMBOL \( t_m \)

NOTE \( t_m \) is expressed in second (s)

3.18 weighting coefficient
numerical coefficient used to quantify the importance given to each particular performance factor in connection with the use of domestic hot water

SYMBOL \( a_i \)
3.19
Rapid response thermometer
Measuring instrument with a response time such that 90 % of the final temperature rise, from 15 °C to 100 °C, is obtained within about 1 s, when the sensor is plunged into still water.

4 General test conditions

4.1 Reference conditions
Unless otherwise stated, the general test conditions are as follows:

— cold water temperature: (10 ± 2) °C;
— cold water pressure: (2 ± 0,1) bar;
— ambient air temperature: (20 ± 3) °C;
— electrical supply voltage: (230 ± 2) V

4.2 Measurement uncertainties
Except where otherwise stated in the clauses describing the tests, the uncertainties of measurements carried out shall not be greater than the maximum uncertainties indicated below.

These uncertainties correspond to two standard deviations.

The laboratory evaluates these standard deviations taking account of the various sources of uncertainty: contribution from the instrument, repeatability, calibration, ambient conditions, etc.

— water rate: ± 1 %;
— gas rate: ± 1 %;
— time: ± 0,2 s;
— temperatures:
  — ambient: ± 1 °C;
  — water: ± 0,5 °C;
  — gas: ± 0,5 °C;
— mass: ± 0, 5 %;
— gas pressure: ± 2 %;
— gas calorific value: ± 1 %;
— gas density: ± 0,5 %;
— electrical energy: ± 2 %.

The stated measurement uncertainties relate to individual measurements. For measurements that combine a number of individual measurements, smaller uncertainties on the individual measurements may be necessary to ensure a total uncertainty within ± 2 %.
4.3 Test conditions

4.3.1 General

Except where otherwise stated, the appliance is tested under the following conditions.

4.3.2 Test room

The appliance is installed in a well-ventilated, draught-free room (air speed less than 0.5 m/s).

The appliance is protected from direct solar radiation.

4.3.3 Water supply

For the tests:

— domestic water pressure is the static inlet pressure under dynamic conditions measured as close as possible to the appliance;

— inlet and outlet temperatures of the domestic water are measured in the centre of the flow and as close as possible to the appliance.

The inlet temperatures are measured immediately upstream of the water inlet connection. Except where otherwise stated, the outlet temperatures are measured immediately downstream of the outlet connection or, in the case of an appliance with spout delivery, by means of an immersed temperature measuring device, e.g. a u-tube fitted at the outlet of a tube of the same length as the minimum length of the spout normally supplied by the manufacturer.

The hot water temperature is measured with a rapid response thermometer.

4.3.4 Steady state

Steady state operating conditions are regarded as established when the rate of change of the domestic hot water temperature at the appliance outlet has become less than the temperature fluctuation at constant water rate ($\Delta T_2$).

4.3.5 Initial adjustment of the appliance

The appliance is installed in accordance with the manufacturer's instructions.

The heat input shall be adjusted to within ± 2 % of the nominal domestic hot water heat input determined according to the relevant clause of EN 625 under the conditions prevailing at the time of the test.

The delivered water temperature at the appliance outlet is defined as follows (see Figures A.1.1 and A.1.2):

a) appliances with an adjustable temperature: the tests are carried out at a temperature not greater than 65 °C, with a minimum temperature increase equal to or greater than 45 K above water inlet temperature.

b) appliances with a fixed temperature: the tests are carried out at the temperature specified by the manufacturer, with a minimum temperature increase equal to or greater than 45 K.

The same conditions of initial adjustment stated by the manufacturer are used for all the tests. These conditions are included in the test report.

4.3.6 Initial state conditions

All the tests of this standard are conducted as follows (see Figures A.2.1 and A.2.2):
when there is no control cycle to consider; at least one hour after the previous delivery;

— when there is a control cycle to consider: after a time corresponding to 20 % (but not exceeding 1 h) of the "OFF" time of the burner. The time is taken from the time the burner turns off.

The same initial state conditions are used for all the tests. These conditions are included in the test report.

For appliances with a central heating function, tests are conducted in summer mode.

4.3.7 Electrical supply

The appliance is supplied with the nominal voltage or a voltage included within the range of nominal voltages.

5 Characterisation of the domestic hot water function of appliances

5.1 General

The domestic hot water function of domestic hot water appliances is characterised in two different ways:

— firstly, according to the domestic hot water specific rates, the tapping capability and the corresponding uses (see 5.2);

— secondly, according to the quality of the domestic hot water produced (see 5.3); obtaining a number of stars corresponding to a determined level of performance.

5.2 Characterisation according to the domestic hot water rates

5.2.1 Specific rate

5.2.1.1 Requirement

The measured value of the specific rate shall be not lower than 95 % of that stated by the manufacturer.

5.2.1.2 Test

The appliance is adjusted to deliver hot water at the rate stipulated by the manufacturer for this test.

The pressure loss across the appliance shall not exceed 2 bar.

During the measurement of the specific rate, the minimum temperature increase shall be equal to or greater than 30 K.

Before the test, the appliance is adjusted in accordance with 4.3.4. A first delivery is carried out over a period of 10 min, followed by 20 min with no delivery and then by a second delivery over a period of 10 min (see Figures A.3.1 and A.3.2).

The test follows the sequence:

— water delivery of 10 min duration;

— 20 min period of no water delivery;

— further water delivery of 10 min duration.

Measurements of temperature and flow rate are made and recorded, at intervals not exceeding 2 s. A plot of temperature against time is made, to obtain the mean water temperature rise during each delivery.