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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 2: Assessment of energy consumption

Gasbeheizte Geräte für die sanitäre Warmwasserbereitung für den Hausgebrauch - Geräte, die eine Nennwärmeleistung von 70 kW und eine Speicherkapazität von 300 Liter Wasser nicht überschreiten - Teil 2: Bewertung des Energieverbrauchs

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Appareils domestiques produisant de l'eau chaude sanitaire utilisant les combustibles gazeux - Appareils de débit calorifique inférieur ou égal a 70 kW et de capacité de stockage inférieure ou égale a 300 litres - Partie 2 : Évaluation de la consommation énergétique

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English Version

**Gas-fired domestic appliances producing hot water - Appliances
not exceeding 70 kW heat input and 300 l water storage
capacity - Part 2: Assessment of energy consumption**

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 l - Partie 2 : Évaluation
de la consommation énergétique

Gasbeheizte Geräte für die sanitäre Warmwasserbereitung
für den Hausgebrauch - Geräte, die eine
Nennwärmeleistung von 70 kW und eine Speicherkapazität
von 300 Liter Wasser nicht überschreiten - Teil 2:
Bewertung des Energieverbrauchs

This European Standard was approved by CEN on 25 May 2006.

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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 Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of 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.



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Foreword

This European Standard (EN 13203-2:2006) 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 December 2006, and conflicting national standards shall be withdrawn at the latest by December 2006.

This European Standard has been prepared under a mandate M/324 given to CEN by the European Commission and the European Free Trade Association.

This series “*Gas-fired domestic appliances producing hot water — Appliances not exceeding 70 kW heat input and 300 l water storage capacity*” consist of the following parts:

Part 1: Assessment of performance of hot water deliveries;

Part 2: Assessment of energy consumption.

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.

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1 Scope

This European Standard is applicable to gas-fired appliances producing domestic hot water. It applies to both instantaneous and storage appliances; waters-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 European Standard EN 13203 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.

The present European Standard EN 13203-2 sets out a method for assessing the energy performance of the appliances. It defines a number of daily tapping cycles 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

SIST EN 13203-2:2006

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.

EN 13203-1:2005, *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*

3 Terms and definitions

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

3.1

control cycle

time cycle for keeping components and/or the 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/or 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 Δt

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

SYMBOL T_m

3.3**domestic water test temperature**

temperature of the delivered water at which the tests are conducted

3.4**nominal domestic hot water heat input**

value of the heat input stated by the manufacturer for the production of domestic hot water¹.

SYMBOL Q_{nw}

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

3.5**off mode**

state of an appliance, selected by the user, in which domestic hot water can not be provided

3.6**stand-by mode**

operating state in which the appliance can provide domestic hot water at any time. In the case of an appliance with a control cycle for keeping components and/or the tank (if any) of the domestic hot water circuit at predetermined temperature, level no tapping is made

3.7**summer mode**

conditions during which the appliance supplies energy only for the production of domestic hot water

3.8**tank**

reservoir for domestic hot water

3.9**useful water**

quantity of water delivered for which the temperature increase is in accordance with the requirement fixed for each individual delivery of the tapping cycles

3.10**wasted water**

quantity of water delivered for which the temperature increase is not in accordance with the requirement fixed for each individual delivery of the tapping cycles

3.11**winter mode**

conditions during which the appliance supplies energy for the production of domestic hot water and/or space heating

4 General test conditions**4.1 Reference conditions**

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

- cold water temperature: (10 ± 2) , in °C;
- cold water pressure: $(2 \pm 0,1)$, in bar;

¹ The manufacturer is the organisation or company which assumes responsibility for the product.

- ambient air temperature: (20 ± 3) , in °C;
- electrical supply voltage: (230 ± 2) , in V.

4.2 Measurement uncertainties

Except where otherwise stated in the clauses describing the tests, the uncertainties of measurements carried out shall be not 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: $\pm 1 \%$;
- gas rate: $\pm 1 \%$;
- time: $\pm 0,2 \text{ s}$;
- temperatures:
 - ambient: $\pm 1 \text{ °C}$;
 - water: $\pm 0,5 \text{ °C}$;
 - gas: $\pm 0,5 \text{ °C}$;
- mass: $\pm 0,5 \%$;
- gas pressure: $\pm 2 \%$;
- gas calorific value: $\pm 1 \%$;
- gas density: $\pm 0,5 \%$;
- electrical energy: $\pm 2 \%$.

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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 $\pm 2 \%$.

4.3 Test conditions

4.3.1 General

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

For combination boilers the tests are carried out only in summer mode.

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:

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

"Rapid response thermometer" means a 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.

4.3.4 Steady state

Steady state operating conditions shall be 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 $\square T_2$ according to 3.8 of EN 13203-1:2005.

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 $\pm 2\%$ of the nominal domestic hot water heat input 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 Electrical supply

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

5 Determination of the energy consumption of appliances

5.1 General

The present clause defines the test methods to be employed in determining the energy consumption of appliances.

5.2 Tapping cycles

5.2.1 General

All patterns define a 24 h measurement cycle and within that cycle the starting times and the total energy content (in kWh equivalent of hot water tapped) of each draw-off are defined.

Furthermore, the draw-off can be characterized in two ways, either:

- a) “Basin” type draw-off (bath, dishwasher) versus “continuous flow” draw-offs (shower, handwash etc).

The aim of the former is to arrive at an average temperature of the tub, so all supplied energy can be considered useful from the very beginning of the draw-off (minimum useful temperature increase is 0 K).

The latter start to be useful only from a certain temperature (minimum useful temperature increase is 15 K lower than the desired temperature), or

- b) “Kitchen” type draw-off which is carried out with a water temperature increase of 45 K rather than the 30 K in a).

The tapping flow rates used to perform the different types of tapping of each of the five tapping cycles defined by Tables 2 to 6 should be taken as given by Table 1.

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When these tapping rates result in a tapping period of less than 15 s the flow rate should be decreased such that the tapping period is (15 ± 1) s.

If by design of the appliance the test cannot be carried out with these low flow rates, the minimum flow rate for the ignition of the appliance is taken.

If by design the appliance is fitted with an excess flow valve, the tests are carried out with this excess flow rate.

Table 1 — Tapping flow rates

Type of tapping	Energy (kWh)	Hot water flow rates corresponding to a temperature rise of 45 K (l/min)
Household cleaning	0,105	3 ± 0,5
Small	0,105	3 ± 0,5
Floor cleaning	0,105	3 ± 0,5
Dish washing	0,315	4 ± 0,5
Dish washing	0,420	4 ± 0,5
Dish washing	0,735	4 ± 0,5
Large (cycle n°1)	0,525	4 ± 0,5
Shower	1,400	6 ± 0,5
Shower (cycles n°4 et n°5)	1,800	6 ± 0,5
Bath	3,605	10 ± 0,5
Bath (cycle n°4)	4,420	10 ± 0,5
Shower + Bath (cycle n°5)	6,240	16 ± 0,5

NOTE For all other temperature rises a proportional correction is applied to the hot water flow rate, as follows:
 $K = (55 - 10) / (\text{delivered water temperature defined by 4.3.5.3.10}) - 2:2006$

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Table 2 — Tapping cycle n° 1

	Start (h.min)	Energy (kWh)	Type of delivery	ΔT desired (K), to be achieved during tapping	Min. ΔT (K), = start of counting useful energy
1	07.00	0,105	Small		15
2	07.30	0,105	Small		15
3	08.30	0,105	Small		15
4	09.30	0,105	Small		15
5	11.30	0,105	Small		15
6	11.45	0,105	Small		15
7	12.45	0,315	Dish washing	45	0
8	18.00	0,105	Small		15
9	18.15	0,105	Household cleaning		30
10	20.30	0,420	Dish washing	45	0
11	21.30	0,525	Large		30
Total		2,1			

Table 3 — Tapping cycle n° 2

	Start (h.min)	Energy (kWh)	Type of delivery	ΔT desired (K), to be achieved during tapping	Min. ΔT (K), = start of counting useful energy
1	07.00	0,105	Small		15
2	07.15	1,400	Shower		30
3	07.30	0,105	Small		15
4	08.01	0,105	Small		15
5	08.15	0,105	Small		15
6	08.30	0,105	Small		15
7	08.45	0,105	Small		15
8	09.00	0,105	Small		15
9	09.30	0,105	Small		15
10	10.30	0,105	Floor cleaning	30	0
11	11.30	0,105	Small		15
12	11.45	0,105	Small		15
13	12.45	0,315	Dish washing	45	0
14	14.30	0,105	Small		15
15	15.30	0,105	Small		15
16	16.30	0,105	Small		15
17	18.00	0,105	Small		15
18	18.15	0,105	Household cleaning		30
19	18.30	0,105	Household cleaning		30
20	19.00	0,105	Small		15
21	20.30	0,735	Dish washing	45	0
22	21.15	0,105	Small		15
23	21.30	1,400	Shower		30
Total		5,845			

Equivalent hot water litres at 60 °C

100,2