



SLOVENSKI STANDARD **oSIST prEN 13203-2:2017**

01-december-2017

Plinske gospodinjske naprave za pripravo tople sanitarne vode - 2. del: Ocenjevanje porabe plina

Gas-fired domestic appliances producing hot water - Part 2: Assessment of energy consumption

Gasbeheizte Geräte für die sanitäre Warmwasserbereitung für den Hausgebrauch - Teil 2: Bewertung des Energieverbrauchs

Appareils domestiques produisant de l'eau chaude sanitaire utilisant les combustibles gazeux - Partie 2 : Evaluation de la consommation énergétique

Ta slovenski standard je istoveten z: prEN 13203-2

ICS:

91.140.65 Oprema za ogrevanje vode Water heating equipment

oSIST prEN 13203-2:2017

en,fr,de

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

DRAFT
prEN 13203-2

November 2017

ICS

Will supersede EN 13203-2:2015

English Version

Gas-fired domestic appliances producing hot water - Part 2: Assessment of energy consumption

Appareils domestiques produisant de l'eau chaude
sanitaire utilisant les combustibles gazeux - Partie 2 :
Evaluation de la consommation énergétique

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 109.

If this draft becomes a European Standard, 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.

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European foreword

This document (prEN 13203-2:2017) has been prepared by Technical Committee CEN/TC 109 "", the secretariat of which is held by NEN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 13203-2:2015.

The main purpose of this revision is to provide a means of conforming to requirements of Commission Delegated Regulation (EC) n° 813/2013, (EC) n° 811/2013, (EC) n° 812/2013 and (EC) n° 814/2013.

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 ZA, B, C or D, which is an integral part of this document.

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Introduction

The safety operation of the boiler or water heater is not covered by this standard. Safety should be proved by means of the essential safety requirements of the Gas Appliances Directive 2009/142/EC. This may be achieved by compliance with the appropriate existing harmonized standards.

NOTE Useful standards are EN 26, EN 89, EN 15502-1, EN 15502-2-1 and EN 15502-2-2.

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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 tank appliances; waters-heaters and combination boilers that have:

- a heat input not exceeding 400 kW; and
- a hot water storage tank capacity (if any) not exceeding 2000 l.

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

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. The present document sets out a method for assessing the energy performance of the appliances. It defines a number of daily load profiles 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. Where other technologies are combined with a gas-fired boiler or a water heater to produce domestic hot water, specific parts of EN 13203 apply.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1

storage tank

reservoir for domestic hot water

3.2

nominal domestic hot water heat input

Q_{nw}

value of the heat input for the production of domestic hot water stated in the instructions (unit: kilowatt (kW))

3.3

summer mode

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

3.4

winter mode

conditions during which the combination boiler supplies energy for the production of domestic hot water and space heating

3.5

domestic water test temperature

temperature of the delivered water at which the tests are conducted

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3.6

control cycle

the time cycle for keeping components and/or the storage 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

3.7

useful water

quantity of water delivered at the tap for which the temperature increase is in accordance with the requirement fixed for each individual delivery of the load profiles

3.8

wasted water

quantity of water delivered at the tap for which the temperature increase is not in accordance with the requirement fixed for each individual delivery of the load profiles

3.9

stand by mode

operating state in which the appliance can provide domestic hot water at any time

Note 1 to entry In the case of an appliance with a control cycle for keeping components and/or the storage tank (if any) of the domestic hot water circuit at predetermined temperature level no draw-off is made.

3.10

off mode

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

3.11

useful water flow rate

D_{useful}

quantity of water delivered by unit time at the tap for which the temperature increase is in accordance with the requirement fixed for each individual draw-off of the load profiles

3.12

useful water temperature

water temperature, expressed in degrees Celsius, delivered at the tap

3.13

appliance flow rate

quantity of water delivered by the appliance by unit time before the mixing device, if applicable

3.14

appliance water temperature

T_d

water temperature, expressed in degrees Celsius, delivered by the appliance before the mixing device

3.15

water temperature rise

ΔT_m (in K)

difference between the useful water temperature and the cold water temperature, at which hot water is contributing to the reference energy as specified in the load profiles

3.16**water temperature rise for basin draw-off types** **ΔT_p (in K)**

difference between the useful water temperature and the cold water temperature, to be achieved during the water draw-offs, with a minimum value as specified in the load profiles

Note 1 to entry The minimum temperature difference for basin draw-offs as specified in the load profiles shall be achieved at least once during the water draw-offs.

3.17**rapid response temperature sensor**

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 shall be as follows:

- cold water temperature: 10 °C;
 - maximum average variation over the test period: ± 2 K;
- cold water pressure: $(2 \pm 0,1)$ bar;
- ambient air temperature: 20 °C;
 - maximum average variation over the test period ± 2 K;
 - maximum variation during the tests ± 2 K;
- electrical supply voltage: (230 ± 2) V (single phase).

4.2 Measurement uncertainties**4.2.1 General**

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.

The standard deviations shall be evaluated taking into account the various sources of uncertainty: contribution from the instrument, repeatability, calibration, ambient conditions, etc.

- water flow rate: ± 1 %;
- gas flow rate: ± 1 %;
- time: $\pm 0,2$ s;
- temperatures:
 - ambient: ± 1 K;
 - water: $\pm 0,5$ K;

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- gas: $\pm 0,5$ K;
- gas pressure: ± 1 %;
- gas calorific value: ± 1 %;
- gas density: $\pm 0,5$ %;
- 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 % under the steady-state conditions as defined by 4.2.2.

These uncertainties correspond to two standard deviations (2σ).

4.2.2 Steady-state conditions

Steady-state operating conditions are regarded as established when the appliance operates for sufficient time to reach thermal stabilization.

To reach the steady-state the water temperature at the outlet of the appliance shall not vary by more than $\pm 0,5$ K.

NOTE This condition can be reached with a gas which is different from the reference gas, provided that the appliance is supplied with the reference gas for at least 5 min before the requirements are verified.

4.3 Test conditions**4.3.1 General**

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

For combination gas boiler, the tests shall be carried out only in summer mode as defined in 3.3, and the appliance shall be set in summer mode.

For all tests defined by this standard, the same adjustment of the appliance shall be maintained.

The load profile used for the measurement shall be the one declared according to the technical instruction of the appliance (see also Annex C).

The test shall be performed in the setting in which the appliance is delivered, and which is documented as such in the technical instructions.

If there are temporary user's settings (automatically self-resetting within 24 h), these shall not be active.

4.3.2 Test room

The appliance shall be installed in a well-ventilated, draught-free room (air speed less than 0,5 m/s).

The appliance shall be protected from direct solar radiation and radiation from heat generators.

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 (see Figure B.2);
- the inlet and outlet temperatures of the domestic water shall be measured in the centre of the flow and as close as possible to the appliance (see Figure B.3) or at the tap.

The inlet temperatures shall be measured immediately upstream of the water inlet connection. Except where otherwise stated, the outlet temperatures shall be 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 together with the appliance.

Water temperatures shall be measured with a rapid response temperature sensor.

4.3.4 Initial adjustment of the appliance

The appliance shall be installed in accordance with the installation instructions.

The heat input shall be adjusted to within $\pm 2\%$ of the nominal domestic hot water heat input.

The adjustment of the appliance water temperature (T_d) shall be as follows (see Figure A.1 and Figure A.2):

- a) Appliances with an adjustable temperature: the tests shall be carried out at a temperature not greater than 65°C , with a minimum temperature increase than 45 K above water inlet temperature. For the load profile XS the minimum temperature setting shall be equal to or greater than 35°C (ΔT 25 K above water inlet temperature).
- b) Appliances with a fixed temperature: the tests shall be carried out at the temperature specified in the appliance documentation, with a minimum temperature increase equal to or greater than preferably 45 K above the water inlet temperature. For the load profile XS the minimum temperature setting shall be equal to or greater than 35°C (ΔT 25 K above water inlet temperature)

NOTE The test conditions of 4.3.1 are applicable.

The same conditions of initial adjustment stated in the appliance documentation shall be used for all the tests.

These conditions shall be included in the test report.

4.3.5 Conditions for the determination of the maximum load profile

The measurement of the domestic hot water efficiency shall be performed with the maximum load profile or the one just below this load profile:

- a) Instantaneous appliances shall be set to the nominal heat input as stated on the data plate. If the user instructions specify that it is possible to adjust the outlet temperature, this temperature shall be set to the maximum possible value not exceeding 65°C .
- b) Storage appliances shall be set to the nominal heat input as stated on the data plate. If the user instructions specify that different modes are possible to be selected, the one that is able to store more energy that delivers more hot water during 24 h period shall be used.

NOTE 1 See Annex C (informative).

NOTE 2 In case of maximal load profile 3XL or 4XL the label testing should be XXL.

The load profile as used for the domestic hot water performance test shall be stated in the user instructions.

4.3.6 Electrical supply

The appliance shall be supplied with the nominal voltage stated in the installation instructions.

5 Determination of the energy consumption of the appliance

5.1 General

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

5.2 Load profiles

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 “basin” type draw-off versus “continuous flow” draw-off.

The aim of the “basin” type 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 temperature rise (ΔT_p) to be achieved during tapping, shall be 30 K for floor cleaning and bath and 45 K for the dish washes.

The aim of the “continuous flow” type is to use only the water with a minimum temperature. For the shower, household cleaning and large draw-offs a temperature rise of 30 K shall be reached before counting the useful energy. For the small draw-offs a temperature rise of 15 K shall be reached.

NOTE 1 The temperature rises (in K) based on 10 °C inlet water temperature stated above are equivalent to the temperatures (in °C) given by the load profiles tables in Regulations n° 811/2013, n° 812/2013, n° 813/2013 and n° 814/2013. The tapping flow rates used to perform the different draw-offs of each of the eight load profiles are defined by Tables 1 to 8.

When these water draw-off flow rates result in a tapping period of less than 15 s the water flow rate should be decreased such that the tapping period is (16 ± 1) s.

In the load profiles, the requirements for water flow rate and temperatures are based on the delivery at the tap in a mix of hot and cold water. Under the conditions of the initial adjustment, the appliance itself produces hot water with a minimum temperature rise of 45 K. For the load profile XS the minimum temperature setting shall be equal to or greater than 35°C (ΔT 25 K above water inlet temperature).

To fulfil the requirements stated in Tables 1 to 8 mixing hot water from the appliance with cold water of 10 °C at the tap is allowed either by using a mixing device (see Figures B.1 and B.5) or by recalculating the appliance flow rate (D_{min}) according to the following formula:

$$D_{min} = D_{useful} \frac{\Delta T_{useful}}{\Delta T_d} \quad (1)$$

Where:

D_{min}	is the minimum test rig setting for the appliance flow rate of each individual draw-off at temperature rise corresponding to ΔT_d , in l/min;
D_{useful}	is the useful water flow rate according to Tables 1 to 8, in l/min;
ΔT_d	is the appliance water temperature rise, with a minimum of 30 K;
ΔT_{useful}	is the higher value between the temperature rise to be achieved and the minimum temperature rise for counting the useful energy according to Tables 1 to 8.

If the appliance cannot deliver these flow rates, for instance due to the flow restrictor, it shall be checked that the requirements are fulfilled by checking that (D_{min}) is delivered.

If by design the appliance is fitted with a flow restrictor, the tests shall be carried out with this flow restrictor.

The tests shall be performed by using the useful water flow rates defined by Tables 1 to 8.

Table 1 — Load profile XS

Draw-off n°	Start (h.min)	Energy (kWh)	Type of draw-off	Useful water flow rate at the tap (l/min)	ΔT_p to be achieved during tapping (K)	Minimum ΔT_m for counting useful energy (K)
1	07.30	0,525	Medium	3		25
2	12.45	0,525	Medium	3		25
3	20.30	1,050	Large	3		25
Q_{ref}		2,100				

Equivalent hot water litres at 60°C

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Table 2 — Load profile S

Draw-off n°	Start (h.min)	Energy (kWh)	Type of draw-off	Useful water flow rate at the tap (l/min)	ΔT_p to be achieved during tapping (K)	Minimum ΔT_m for counting useful energy (K)
1	07.00	0,105	Small	3		15
2	07.30	0,105	Small	3		15
3	08.30	0,105	Small	3		15
4	09.30	0,105	Small	3		15
5	11.30	0,105	Small	3		15
6	11.45	0,105	Small	3		15
7	12.45	0,315	Dish washing n°1	4	45	0
8	18.00	0,105	Small	3		15
9	18.15	0,105	Household cleaning	3		30
10	20.30	0,420	Dish washing n°2	4	45	0
11	21.30	0,525	Large	5		35
Q_{ref}		2,100				

Equivalent hot water litres at 60°C

36