

Combined Test Method for the Measurement of Domestic Cooking Hob Performance

[Draft Version 9.7]

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Foreword

This document was developed to provide a single test method that could be used to measure all types of cooking hobs with a common methodology. This test methodology measures the efficiency and performance of both gas and electric cooking hobs, in order to provide performance data on which to establish an energy label class and other indices of performance/emission-related metrics on the energy label. This test method also includes the measurement of emissions from fuel-combusting type cooking hobs, to calculate the emissions rate per unit energy. This test method is largely based on the existing European and International Standard, EN IEC 60350, Household electric cooking appliances. The test method is designed to be representative of typical household use.

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1. SCOPE

This method establishes a measurement procedure for the efficiency and performance of all common domestic cooking hobs including electric-type (*e.g.*, resistance, infrared, induction) and hobs burning gaseous fuels (*e.g.*, natural gas, propane, butane, hydrogen, gas-hydrogen mix). This method also establishes a method for measuring the air pollution emissions from cooking hobs using gaseous fuels.

2. NORMATIVE REFERENCES

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60350-2:2018 Household electric cooking appliances- Part 2: Hobs – Methods for measuring the performance

EN 60350-2:2018 + A1:2021 Household electric cooking appliances- Part 2: Hobs – Methods for measuring the performance

EN 30-1-1:2021 Domestic cooking appliances burning gas Part 1-1: Safety-General

CR 1404: 1994 Determination of emissions from appliances burning gaseous fuels during type testing

AS/NZS 5263.0: 2023 Gas appliances, Part 0: General requirements

Note Hereinafter the standards shall be cited without the corresponding year of edition, meaning the cited edition above.

3. TERMS AND DEFINITIONS

Unless otherwise stated, the terms and definitions given in EN 60350-2, and EN 30-1-1 are applicable in this document.

3.1 Hob

appliance or part of a cooking appliance that on its top horizontal surface incorporates one or more cooking zones, cooking areas and/or fuel burners that are able to heat cookware, including a control unit.

Note 1 to entry: A hob is also known as a cooktop;

Note 2 to entry: A control unit for the cooking zones/areas/burners can be included on the top surface of the hob itself or integrated in a cooking range / oven;

Note 3 to entry: The hob can be free-standing, built-in or part of a cooker assembly.

3.2 Electric hob

hob where heat can be generated from electrical energy.

3.3 Gas hob

hob where heat can be generated from the combustion of a fuel gas.

3.4 Cooking zone

limitative marking or structure on the surface of a hob where one cookware is placed and heated or an attached area to the surface

EXAMPLE

A cooking zone can be:

- a single zone or a multiple zone;
- a solid hotplate;
- a tubular hotplate;
- a radiant cooking zone
- an induction cooking zone
- a burner on a gas hob

Note 1 to entry: Cooking zones which are used without cookware but by positioning the food directly on the surface are not included.

Note 2 to entry: Sometimes there is a decoration symbol, e.g. a cross, to mark the centre of the **cooking zone** additionally.

3.5 Combination zone

cooking zone where heat can be generated either from electrical energy or from the combustion of a fuel gas.

4. LIST OF MEASUREMENTS

- Energy consumption and heating up time with standard sized cookware (see Clause 6)
- Energy consumption and heating up time with smaller-sized cookware (see Clause 7)
- Power measurement of low power modes (see Clause 8)
- Measurement of nitrogen dioxide (NO₂) emissions for gas hobs and combination hobs (see Clause 9)

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5. CONDITIONS FOR MEASUREMENTS

5.1 Test Room

The tests shall be carried out in a substantially draft-free room where the airspeed is less than or equal to 0.5 m/s at the location of the unit under test and in which the laboratory temperature is maintained at $(23 \pm 2) ^\circ\text{C}$.

Ambient temperature in the test room shall be measured at a point located at the same height as the appliance under test and 0,5 m horizontally away from the front edge. The ambient temperature measurement shall not be influenced by the appliance under test or any other appliance.

The absolute air pressure in the test room shall be between 913 hPa and 1063 hPa.

5.2 Electricity Supply

The supply voltage shall be maintained at the main terminal of the appliance under test at 230 V with a relative tolerance of $\pm 1 \%$ or at 400 V with a relative tolerance of $\pm 1 \%$ as defined by the manufacturer's installation guide. The supply voltage shall be essentially sinusoidal with a frequency of $(50 \pm 0.5) \text{ Hz}$.

In the case where the appliance under test has a fixed cable, the plug (or the end of the cable) shall be the reference point to maintain the specified voltage.

Supply voltage and frequency shall be recorded at regular intervals of no more than 1 s throughout the duration of all tests.

5.3 Gas Supply

Gas hobs shall be connected to a gas supply as described in EN 30-1-1 Clause 7.1.1.

5.4 Instrumentation and Measurements

Instruments used and measurements made shall comply with the specifications in EN 60350-2 Clause 5.3.

See EN 30-1-1 Clause 7.4 for the accuracy requirements for equipment to measure input energy for gas hobs.

5.5 Installing the Appliance

Electrical hobs, or the appliance of which they form a part, shall be installed as described in EN 60350-2 Clauses 5.4 and 6.4.

Gas hobs shall be installed as described in EN 30-1-1 Clauses 7.1.3.2 and 7.1.3.3

Burners on gas hobs shall undergo a preliminary test to determine the maximum gross heat input using the reference gas supply.

5.6 Initial Conditions

Prior to every test the conditions described in EN 60350-2 Clause 5.5 shall apply.

5.7 Selecting Standardised Cookware

The cookware for testing all electric cooking zones shall be manufactured to be consistent with the specifications set out in EN 60350-2 Clause 5.6.1 for standardised cookware including the lid and the thermocouple.

The selection of the appropriate diameter of standardised cookware for the tests on electric hobs shall be made according to EN 60350-2 Table 3. For cooking areas, cookware shall be selected according to EN 60350-2 Annex A.

The cookware for testing all gas cooking zones shall be manufactured to be consistent with the specifications set out in EN 60350-2 Clause 5.6.1 for standardised cookware including the lid and the thermocouple except that the construction material for all parts shall be commercial quality aluminium and glue shall not be used to attach the wall to the base.

The selection of the appropriate diameter of standardised cookware for the tests on gas hobs shall be based on the maximum gross heat input of each burner as measured in Clause 5.5 in accordance with Table 1.

Table 1 – Sizes of standardised cookware to be used for testing gas burners

Measured maximum gross heat input of the burner (i) kW	External diameter of the standardised cookware or standardised frying pan mm
$i \leq 1.0$	$120 \pm 0,5$
$1.0 < i \leq 1.5$	$150 \pm 0,5$
$1.5 < i \leq 2.0$	$180 \pm 0,5$
$2.0 < i \leq 2.5$	$210 \pm 0,5$
$2.5 < i \leq 3.0$	$240 \pm 0,5$
$3.0 < i$	$270 \pm 0,5$

All other details of the cookware to be used for testing hobs are specified in Table 3 of EN 60350-2 and Figures a, b, c & d that follow it.

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6. ENERGY CONSUMPTION AND HEATING UP TIME

6.1 General

See EN 60350-2 Clause 7.1

6.2 Purpose

See EN 60350-2 Clause 7.2

6.3 Standardised cookware selection

Select standardised cookware in accordance with EN 60350-2 Clauses 5.7 and 7.3

6.4 Positioning the standardised cookware on a cooking zone

Refer to EN 60350-2 Clause 7.4 to determine how the standardised cookware should be positioned.

6.5 Procedure for measuring energy consumption for a boiling process with standardised cookware

6.5.1 General

The test involves determining energy consumption to heat up to 90°C and to maintain a temperature of at least 87,5°C for a further 20 min. This procedure is based on the requirements set out in EN 60350-2 Clause 7.5, but modified to reflect real use.

6.5.2 Test procedure

i. Follow EN 60350-2 Clause 7.5.1

The tolerance to be applied to the water load given in EN 60350-2 Table 3 shall be $\pm 5\text{g}$.

ii. Begin the test with the power control set to full power.

iii. When the water temperature reaches 90 °C for the first time, change the power control setting to minimum. Simmering time starts at this point.

iv. Allow simmering to continue for 20 min. If boiling occurs during the simmering stage, this shall be recorded in the test report and the test shall continue uninterrupted.

v. Check the temperature (T_s) at the end of the simmering period and determine the validity of the test as follows.

- If the temperature of the water is within the range of $(90 \pm 2,5) ^\circ\text{C}$, then the test is valid,
- If the temperature of the water is above the range of $(90 \pm 2,5) ^\circ\text{C}$, and a lower power control setting is not available then the test is valid.
- If the temperature of the water is outside the range of $(90 \pm 2,5) ^\circ\text{C}$, and there is scope to adjust the power control setting towards the target temperature, then the test is invalid and it shall be repeated using a more suitable power control setting for the simmering stage.

NOTE: For power controls without detents, the position for the simmering setting should be marked. The simmering setting could differ if a knob is turned from higher position to a lower position compared to turning from a lower position to a higher position. It is recommended that the setting is always approached from the same direction.

For clear marking of the simmering setting, a polar coordinate paper can be useful (see EN 60350-2, Annex B).

vi. After finishing, set the appliance to off mode. If the appliance doesn't offer an off mode, set it to standby mode.

vii. Perform the test three times on each cooking zone (and each mode if applicable).

In the case of combination zones, separate sets of tests shall be carried out using electric and gas modes in turn.

6.5.3 Test records

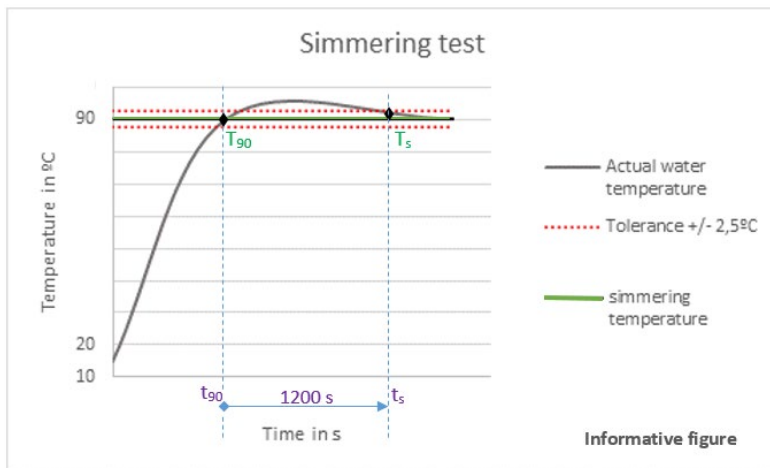
The following data shall be recorded:

- Continuously, the energy consumption (gas and/or electric) starting at t_0 and ending at $t_s + 1$ min, in $\text{W}\cdot\text{h}$;

NOTE 1: The energy consumption of components such as fans and displays, which are automatically switched on with the appliance, are included in the measurement.

NOTE 2: Other related parameters could be needed to determine the energy consumption.

- The time t_{90} , in min and s;
- The water temperatures, from initial to final (T_s), in $^\circ\text{C}$;
- The power (gas and/or electric) during the simmering time (t_s), in W;
- The ambient temperature at the start of the test (when the hob is switched on) and at the end of the test (after 20 min of simmering time), in $^\circ\text{C}$;
- The absolute air pressure at the start of the test and the end of the test, in hPa.



6.5.4 Evaluation and calculation

Follow the procedure specified in EN 60350-2 Clause 7.5.4, except checking of T_c (this temperature is not applicable).

Check that the change to simmering setting was performed when $\bar{T}_{90} = (90_{-0,5}^{+1})^{\circ}\text{C}$

6.6 Procedure for measuring the heating up time for a boiling process

Follow the procedure and requirements set out in EN 60350-2: Clause 7.6.

The tolerance to be applied to the water load given in EN 60350-2 Table 3 shall be $\pm 5\text{g}$.

NOTE: Clause 6.6 may be carried out as part of Clause 6.5.

7. MEASUREMENT OF ENERGY CONSUMPTION WITH SMALLER-SIZED COOKWARE

7.1 General

This procedure measures energy consumption for the situation where the user selects cookware that has a base one size smaller than the required size for the cooking zone being tested.

Clause 7 does not apply to cooking areas.

7.2 Procedure

Follow the procedure given in Clause 6 except in 6.3, where the standardised cookware selected for the test shall be one size smaller (i.e., 30 mm smaller diameter) than the specification given in Table 1 in this document or Table 3 in EN 60350-2 as applicable. The mass of water used for the test shall be the amount shown in Table 3 of EN 60350-2 corresponding to the size of standardised cookware used.

8. MEASUREMENT OF POWER IN LOW POWER MODES

For all hobs that are connected to the mains supply, follow the procedures given in EN 60350-2 Clause 12.

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9. MEASUREMENT OF NITROGEN DIOXIDE EMISSIONS (NO₂)

9.2 General

All burners and the gas cooking zones of combination hobs shall be tested to determine the mass of nitrogen dioxide (NO₂) emitted per kWh gross heat input and the mass of NO₂ emitted per hour.

9.3 Apparatus

Exhaust gases shall be collected using a device that separates the gases from any steam as described in EN30-1-1 Figure 10 with the following exception: Item 1 in the diagram, the sampling tube, shall be constructed from a material such as stainless steel or glass that is not reactive to NO₂ or nitrogen monoxide (NO).

Nitrogen monoxide, carbon dioxide and NO_x shall be measured using the instruments described in the relevant clauses of CR 1404, correcting for interferences from carbon dioxide and water vapour.

9.3 Test procedure

Immediately prior to testing, and immediately after the test, the ambient air shall be tested to determine levels of NO, NO₂ and hydrocarbons present. If levels of hydrocarbons in excess of 5 ppm are detected, then testing shall not proceed.

Burners shall be tested under each of the following conditions:

- i. Maximum power setting, cookware size, lid and quantity of water as determined in Clause 6 with the water at boiling point. For this test, the burner shall not be adjusted to a nominal heat input setting
- ii. Maximum power setting, cookware size, lid and quantity of water as determined in Clause 7 with the water at boiling point. For this test, the burner shall not be adjusted to a nominal heat input setting

Measure NO, NO_x and carbon dioxide levels under each of the above conditions for a period of 15 min.

9.4 Calculations

The mean concentrations of these gases measured over the last 5 min of each test period shall be used in the analysis specified in AS/NZS 5263.0 Clause ZC.32.6 to determine the mass of NO₂ emitted per Joule gross heat input. If ambient NO levels exceeded 0.05 during the test, and were higher than the NO levels in the emissions, then the measured NO_x level shall be taken as equal to the NO₂ levels.

Calculate the mass of NO₂ emitted per hour (ERT) according to the following formula:

$$ERt = ER \times H \times 3.600 / 10^6$$

Where

Ert = mass of NO₂ emitted in (mg/h)

ER = Emission rate of NO₂ (ng/J)

H = Gross heat input rate (kW)

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