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INTERNATIONAL
STANDARD**

**CEI
IEC
61591**

Edition 1.1

2005-11

Edition 1:1997 consolidée par l'amendement 1:2005
Edition 1:1997 consolidated with amendment 1:2005

**Hottes de cuisine à usage domestique –
Méthodes de mesure de l'aptitude
à la fonction**

**Household range hoods –
Methods for measuring performance**



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International Electrotechnical Commission, 3, rue de Varembe, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch



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CONTENTS

FOREWORD	5
1 Scope	9
2 Normative reference	9
3 Definitions	9
4 Classification	11
5 List of measurements	11
6 General conditions for measurements	13
7 Overall dimensions	13
8 Maximum effective capture area	13
9 Length of the supply cord	15
10 Mass of the range hood	15
11 Volumetric airflow	15
12 Grease absorption	17
13 Odour extraction	19
14 Effectiveness of the hob light	21
15 Maintenance	23
16 Other features	23
Figure 1 – Measurement of air flow.....	25
Figure 2 – Pressure/air flow curve	27
Figure 3 – Arrangement for the grease absorption test.....	29
Figure 4 – Example of a test room	31
Figure 5 – Pan used for the test	33

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**HOUSEHOLD RANGE HOODS –
METHODS FOR MEASURING PERFORMANCE**

FOREWORD

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International Standard IEC 61591 has been prepared by IEC technical committee 59: Performance of household electrical appliances.

This consolidated version of IEC 61591 is based on the first edition (1997) [documents 59/171/FDIS and 59/181/RVD] and its amendment 1 (2005) [documents 59K/105A/FDIS and 59K/123/RVD].

It bears the edition number 1.1.

A vertical line in the margin shows where the base publication has been modified by amendment 1.

The committee has decided that the contents of the base publication and its amendments will remain unchanged until the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

HOUSEHOLD RANGE HOODS – METHODS FOR MEASURING PERFORMANCE

1 Scope

This International Standard applies to range hoods incorporating a fan for the recirculation or forced removal of air from above a hob situated in a household kitchen.

It can also be used for range hoods with external blowers, if these blowers are controlled by the range hood and the blower is defined in the technical documentation (e.g. name plate data) and instructions for installation.

This standard defines the main performance characteristics of range hoods and specifies methods for measuring these characteristics, for the information of users.

This standard does not specify required values for performance characteristics.

NOTE This standard does not deal with:

- safety requirements (IEC 60335-2-31)¹;
- acoustical noise (IEC 60704-2-13)²

2 Normative reference

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.

ISO 5167-1:1991, *Measurement of fluid flow by means of pressure differential devices – Part 1: Orifice plates, nozzles and Venturi tubes inserted in circular cross-section conduits running full*

3 Definitions

For the purpose of this International Standard, the following definitions apply.

3.1

range hood

appliance installed over a hob and through which air is passed to remove contaminants from the room

3.2

recirculating-air range hood

range hood containing filters to remove contaminants after which the cleaned air is discharged back into the room

¹ IEC 60335-2-31:1995, *Safety of household and similar electrical appliances – Part 2: Particular requirements for range hoods*

² IEC 60704-2-13:2000, *Household and similar electrical appliances – Test code for the determination of airborne acoustical noise – Part 2-13: Particular requirements for range hoods*

3.3**air-extraction range hood**

range hood which discharges the collected air to the outside of the building by means of ducting

3.4**rated voltage**

voltage assigned to the range hood by the manufacturer

3.5**grease absorption factor**

the percentage of grease retained within a filter

NOTE To the grease filter belong all detachable coverings, filter frames, supports or the like, which are located in the air stream and are intended to be removed for cleaning.

3.6**odour reduction factor**

the capability of the range hood to reduce odours

3.7**odour dispersion time**

time taken to reduce odours to a defined level after the odour generating source has been switched off

3.8**external blower**

blower, which is mounted separately from the range hood

4 Classification

According to type:

- recirculating-air range hood;
- air-extraction range hood.

NOTE A range hood may be constructed to incorporate both types.

5 List of measurements

Performance is determined by assessing the following:

- overall dimensions;
- maximum effective capture area;
- length of supply cord;
- mass;
- volumetric airflow;
- ability to absorb grease;
- ability to extract odours;
- effectiveness of hob light;
- maintenance;
- features.

6 General conditions for measurements

Unless otherwise specified, the measurements are made under the following conditions.

6.1 Test room

The tests are carried out in a substantially draught-free room. The ambient temperature of the room is maintained at $20\text{ °C} \pm 5\text{ °C}$.

6.2 Installation

The range hood and the external blower, if applicable, is (are) installed in accordance with the manufacturer's instructions.

The maximum sized duct according to the instructions is to be used to connect to the blower.

6.3 Supply voltage

The range hood and the external blower, if applicable, are supplied at the rated voltage $\pm 1\%$.

If a voltage range is specified by the manufacturer the range hood and the external blower, if applicable, are to be supplied at the nominal voltage of the country in which the appliance is intended to be used. In this case the test voltage has to be stated in the report.

6.4 Filters

The range hood is fitted with new filters for each test of clauses 12 and 13.

6.5 Fan control

The tests are carried out with any fan control adjusted to the highest setting for normal use.

NOTE 1 If a boost position is incorporated, this is not taken into account.

NOTE 2 A boost position is a setting of a control for occasional use which results in a higher temporary fan speed.

7 Overall dimensions

The overall dimensions of the range hood are measured. The length, depth and height, including any control knobs or other projections, are stated in millimetres. The dimensions of the range hood in the storage position are also measured if different.

For air-extraction range hoods, the diameter of the air-outlet orifice is measured and stated.

8 Maximum effective capture area

The overall length and depth of the projection of the area bounded by the horizontal outline of the hood is measured and stated in millimetres. Any extendible visor is fully opened and the increased area included in the dimensions.

9 Length of the supply cord

The distance between the points of entry of the cord into the range hood or the external blower and the plug is measured and stated in metres rounded downwards to the nearest 0,05 m.

It is stated if the range hood or the external blower is for direct connection to the fixed wiring.

10 Mass of the range hood

The mass of the range hood and the external blower, including any filters, supply cord and plug, is measured and stated in kilograms, rounded upwards to the nearest 0,1 kg.

11 Volumetric airflow

The airflow is measured according to the method contained in ISO 5167-1.

The air outlet of the range hood is connected to a pressure compensation chamber (see Figure 1). The air then passes through an auxiliary fan and baffle. An orifice plate or other suitable device is incorporated in order to measure the dynamic pressure for the calculation of airflow. Means are provided for the measurement of static pressure in the compensation chamber. The odour extraction filter is installed for the test.

The range hood is operated and by suitably adjusting the auxiliary fan or the baffle, the airflow corresponding to various pressures can be determined.

The measurements are made with the controls positioned at the highest and lowest settings.

The airflow of recirculating-air range hoods is determined when the pressure in the compensation chamber is at ambient pressure.

The airflow of air-extraction range hoods is determined for discharge into a flue, which has the following pressure drop depending on the diameter of the air outlet orifice:

100 mm :	30 Pa	working point 3
120 - 125 mm :	15 Pa	working point 2
150 - 160 mm :	5 Pa	working point 1

when there is an airflow of 200 m³/h and a pressure drop of 5, 15 or 30 Pa"

NOTE 1 A pressure/air flow curve is determined for the range hood under test.

Figure 2 shows the pressure/airflow curves for nominal flues, a typical curve for a range hood and the derivations of airflow from it.

The airflow is stated for the working point given for the actual diameter for both of the fan speeds, adjusted to a temperature of 20 °C and a pressure of 1013 hPa.

The airflow is stated in m³/h.

NOTE 2 Alternative working points corresponding to other pressure drops may be specified instead, in which case the pressure drop has to be stated in the report.

12 Grease absorption

This test is used to measure the efficiency of the grease filter.

NOTE To the grease filter belong all detachable coverings, filter frames, plates or supports, which are intended to be removed for cleaning.

For range hoods with an external blower the external blower does not need to be mounted during the grease absorption test. The desired airflow rate can instead be achieved by using the auxiliary fan and controlling the air flow with a suitable device.

The mass of the range hood is measured without the grease filter and without the odour extraction filter of recirculating-air range hoods. The mass of the grease filter is determined separately, immediately after drying. The range hood is installed in a chamber, the arrangement being such that all the air in the chamber has to pass through the hood.

The air outlet of the range hood is connected to an absolute filter having a collecting efficiency of at least 99,995 %. The frame of the absolute filter shall not pick up any humidity. The absolute filter is dried and then immediately weighed after which it is installed in the chamber, its sides being sealed to the walls of the chamber. The air outlet from the chamber is connected to an auxiliary fan for controlling the pressure. The arrangement is shown in Figure 3.

In order to dry the filters, they are placed in a cabinet for 1 h at a temperature of 50 °C.

NOTE 1 In case of doubt, the absolute filter is dried for a further 3 h during which time the mass should not reduce by more than 0,5 g.

A suitable hob element is placed 600 mm below the lowest part of the range hood. A uncoated commercially available pan is used with a solid bottom and a minimum thickness of 8 mm (Figure 5). The pan shall be of the same diameter as the hob element. It is used to heat a pan having a diameter of 200 mm \pm 20 mm and a height of approximately 125 mm. The inside of the base of the pan is maintained at a temperature of 250 °C \pm 5 °C. The temperature is measured by a thermocouple with steel tube of class 2 or equivalent and should have a suitable diameter. For mounting the thermocouple see Figure 5.

The range hood is operated at the highest setting of the control, ignoring any boost setting. The auxiliary fan is adjusted to the working point linked to the largest diameter the range hood allows in delivery condition (see Figure 2). The pressure above the recirculating-air range hoods is adjusted so that the airflow is that measured during the test of clause 11.

Corn oil having a viscosity of 80 cSt \pm 5 cSt at 20 °C is dripped on to the heated pan at a rate of 1,6 ml/min together with water which is dripped at a rate of 2,3 ml/min. The points from which the oil and water are dripped are 10 mm \pm 0,5 mm apart. The position of the pan and means for supplying the oil and water is also shown Figure 3.

NOTE 2 The drip-rate is approximately 45 per minute for oil and 80 per minute for water.

The test is carried out for 30 min after which the supply of oil and water is stopped and the hob switched off. The range hood is switched off 10 min later.

The range hood is weighed again after removal of the grease filter and the mass of oil retained is determined. The grease filter and absolute filters are placed in a drying cabinet for 1 h at a temperature of 50 °C after which they are weighed immediately and the mass of oil they contain is determined.

The mass is to be measured to within $\pm 0,1$ g.

NOTE 3 Oil which drips from the filters during the drying process is added to the mass determined.

The grease absorption factor g_f is calculated in per cent from:

$$g_f = \frac{wg}{wr + wt + wg} \times 100$$

where

wg is the mass of oil in the grease filter;

wr is the mass of oil retained in the airways of the range hood;

wt is the mass of oil retained in the absolute filter.

The test is carried out twice and the average grease absorption factor is stated.

13 Odour extraction

This method is used to assess the effectiveness of odour filters of recirculating-air range hoods. It is also used to assess the capability of air-extraction range hoods to remove odours in which case the airflow is adjusted to the actual working point (see Clause 11 and Figure 2).

The test is carried out in a sealed room having a volume of $22 \text{ m}^3 \pm 2 \text{ m}^3$, the walls of which are impervious to methyl-ethyl ketone (MEK). A range is installed along one of the longer walls of the room together with kitchen cabinets. The range hood is installed centrally above the hob, at a height of 600 mm above it and between wall cabinets. The kitchen furniture cabinets shall be sealed from the rest of the air in the test room. If an air-extraction range hood is being tested, it is necessary to provide a ventilating grille which can be closed and an air dispersion screen. It is in this case also necessary to have an exhaust air duct system incorporating a shut-off valve, an airflow meter and in most cases an auxiliary fan. For range hoods with an external blower the external blower does not need to be mounted during the odour extraction test. The desired airflow rate can instead be achieved using the auxiliary fan. The room, kitchen furniture, ventilating grille and associated screen, together with the layout, are shown in Figure 4.

NOTE 1 When handling MEK, normal precautions have to be taken.

NOTE 2 When testing air-extraction range hoods, measures should be taken to prevent the inlet-air from being contaminated with MEK from the outlet-air.

The characteristics of the test room are established without the range hood being operated. A pan, with a diameter of $200 \text{ mm} \pm 20 \text{ mm}$ and a height of approximately 125 mm, is placed on the front, left-hand hob element, having the same base diameter as the pan. The temperature in the base of the pan, 40 mm from its side, shall be maintained at $170^\circ\text{C} \pm 10^\circ\text{C}$. A solution containing $12 \text{ g} \pm 0,1 \text{ g}$ of methyl-ethyl ketone (MEK) in $300 \text{ g} \pm 1 \text{ g}$ of distilled water is continually dripped onto the pan at such a rate that all the solution has been used after approximately 30 min. The solution is evenly dispersed throughout the room by means of a fan. The concentration of MEK in the room (C_1) is measured at the end of the application period.

NOTE 3 The specifications of the pan are the same as for the grease absorption test (see Clause 12 and Figure 5).

NOTE 4 The concentration in the test room (C_1) can be measured without any range hood being installed.

The concentration of MEK is detected using four sampling points each separated by 500 mm vertically, as shown in Figure 4. The detection equipment for measuring the MEK concentration is located outside the room. PTFE tubes 2,5 mm in diameter of equal length and connected to each other are suitable to link the sampling points to the measuring equipment.

NOTE 5 The room is considered to be adequately sealed if the concentration of MEK in the room drops by less than 5 % 1 h after the solution has been distributed.

NOTE 6 Flame ionization equipment is suitable for measuring the concentration of MEK.

The room is ventilated until the concentration of MEK is less than 1% of C_1 .

The odour extraction filters are conditioned by heating at $50\text{ °C} \pm 5\text{ °C}$ for at least 16 h. They are then fitted into the range hood which is operated for 30 min.

The range hood is then operated and the MEK solution dripped onto the heated pan so that 312 g has evaporated within 30 minutes $\pm 15\text{ s}$. The air-extraction range hoods are switched off, the ventilating grille closed, the shut-off valve closed and a fan having an airflow of $250\text{ m}^3/\text{h} \pm 50\text{ m}^3/\text{h}$ positioned on the centre of the floor operated. The concentration of MEK in the room (C_2) is measured when the value has stabilized. With the recirculating-air range hoods still in operation, the time taken for the concentration of MEK to fall from C_2 to 15 % of C_1 is also determined. This is the odour dispersion time.

NOTE 7 Recirculating-air range hoods are not switched off before measuring C_2 .

NOTE 8 The odour dispersion time is not measured for air-extraction range hoods.

The odour reduction factor O_f is calculated in per cent as follows:

$$O_f = \frac{C_1 - C_2}{C_1} \times 100$$

where

C_1 is the concentration of MEK at the end of application without the range hood operating;

C_2 is the concentration of MEK at the end of application with the range hood operating.

The odour reduction factor and the odour dispersion time are stated. Island range hoods (directly mounted on the ceiling) are tested as wall mounted range hoods. The cabinets on both sides are removed.

14 Effectiveness of the hob light

The room in which the odour extraction test is performed is used to assess the effectiveness of the hob light (see Figure 4), the range hood being positioned 600 mm above the hob. The range and adjacent worktops are covered with a sheet of matt-black painted plywood approximately 20 mm thick or similar board. The board is to extend at least 500 mm over each adjacent worktop. The rear wall between the hob and range hood is similarly covered with board or painted matt-black.

The hob light is switched on and a suitable lux meter is used to measure the luminance at four points on the board representing the centres of the hob elements, as shown in Figure 4.

NOTE All other light sources are extinguished when making the measurement.

The average of the values of lux measured over the two rear hob elements and over the two front hob elements is calculated. The arithmetic average of the four measurements is also calculated and this value is stated as the luminance in lux. It is also stated whether the luminance is higher at the back or front of the hob.

15 Maintenance

The following items are assessed and stated:

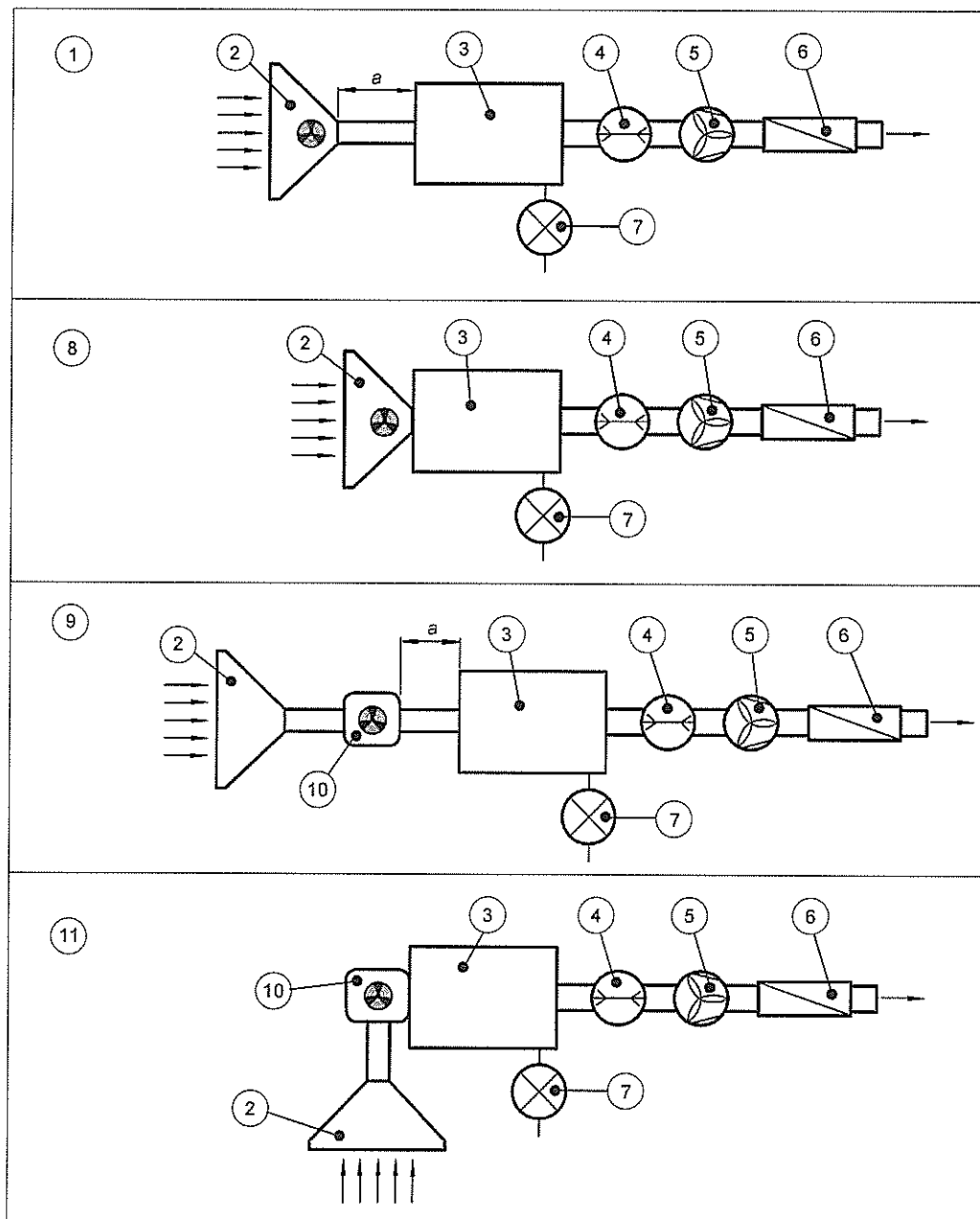
- the ease of cleaning the range hood in comparison with the instructions given by the manufacturer;
- the ease of cleaning the filters;
- the type of filter and whether or not it is replaceable.

16 Other features

Other features of the range hood are stated.

NOTE Examples of features are:

- accessibility of controls;
- number of fan speeds;
- filter change indicator;
- boost position of the control.



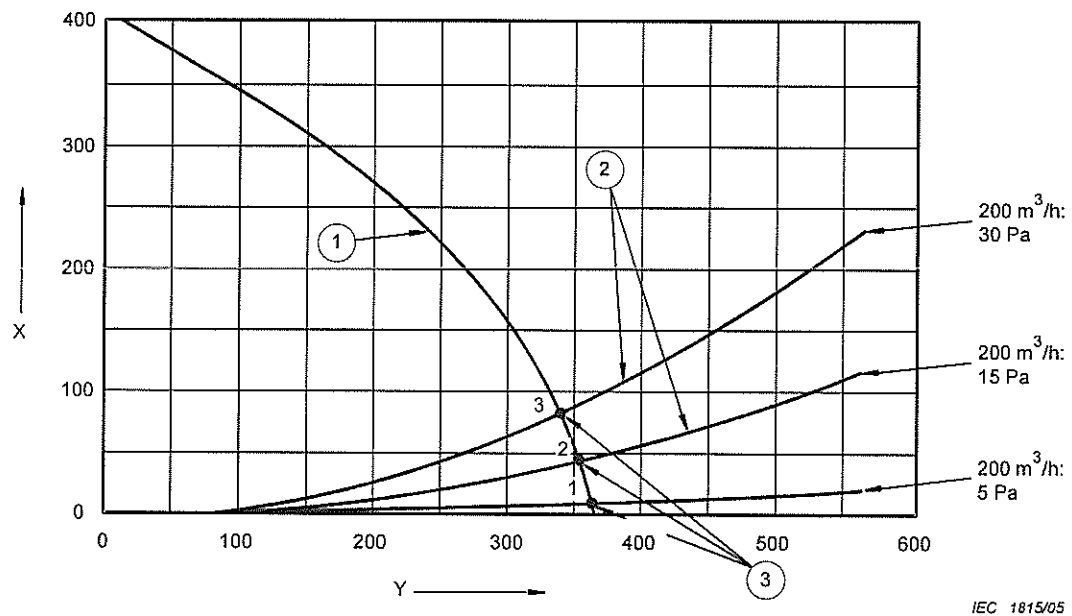
IEC 1814/05

Key

- | | | | |
|---|--|----|---|
| a | 5 times the diameter of the pipe | 6 | Baffle |
| 1 | Air extraction range hood with internal blower | 7 | Static pressure gauge |
| 2 | Range hood | 8 | Recirculating-air range hood with internal blower |
| 3 | Pressure compensation chamber | 9 | Range hood with external blower with in-house use |
| 4 | Orifice plate for airflow measurement | 10 | External blower |
| 5 | Auxiliary fan | 11 | Range hood with external blower for outside use |

NOTE A duct having a overall length of 5 times the diameter of the air-outlet of the range hood is fitted between the chamber and the range hood. A length of 1 times the diameter should remain inside the compensation chamber.

Figure 1 – Measurement of air flow



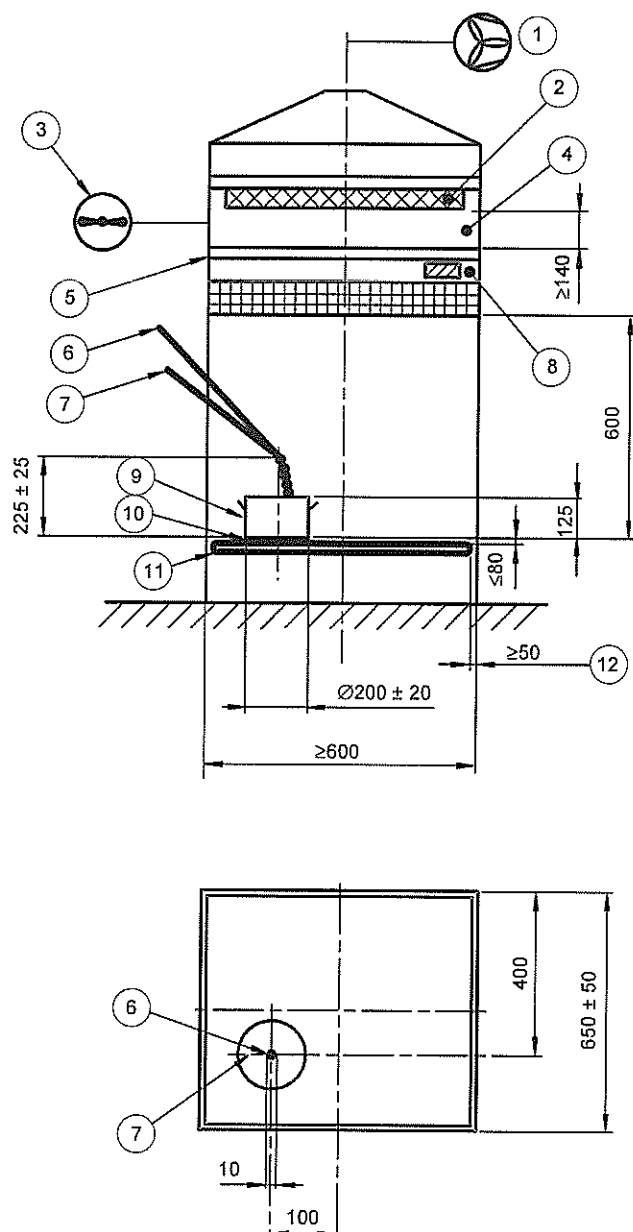
IEC 1815/05

Key

- X Pressure (Pa)
- Y Air flow m³ / h
- 1 Typical curve for range hood
- 2 Theoretical pressure air flow curve for the pressure × (air flow)²
- 3 Working points

NOTE For testing large range hoods (e.g. island range hoods) the dimensions of the test compartment are adjusted to the dimensions of the product.

Figure 2 – Pressure/air flow curve



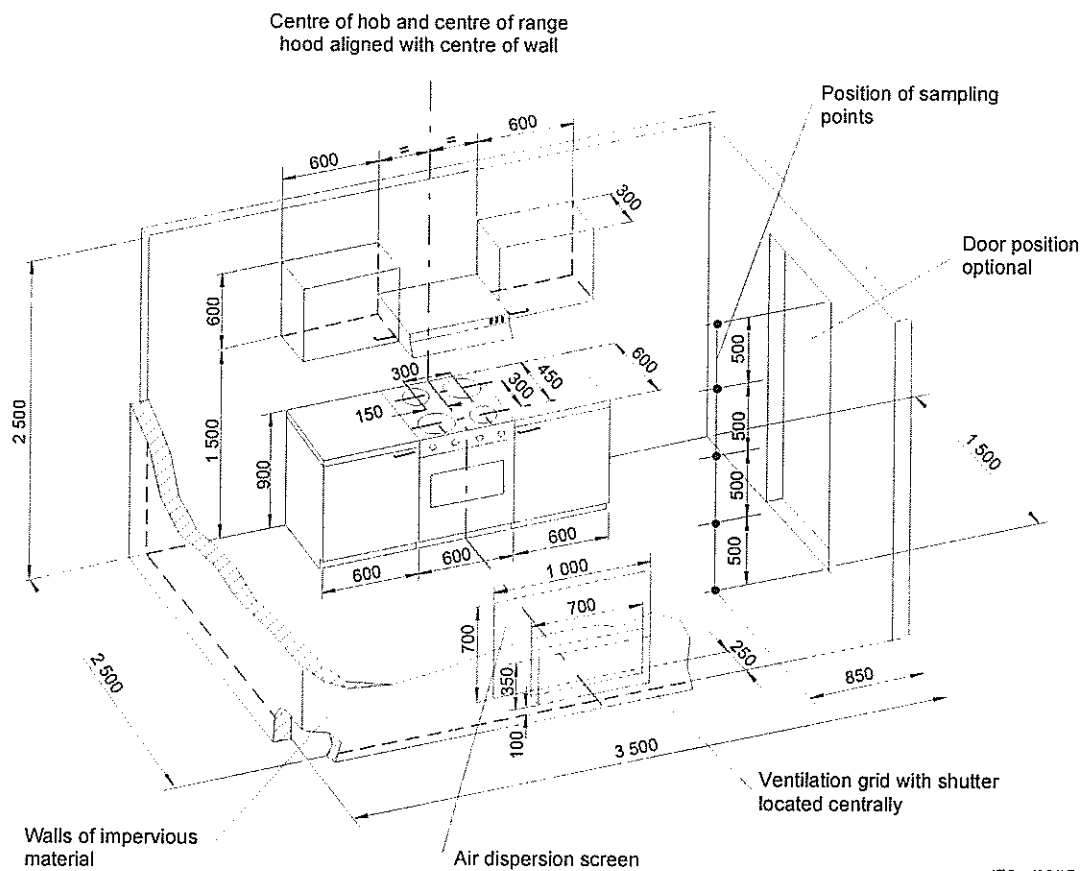
IEC 1816/05

Key

(Dimensions in millimetres)

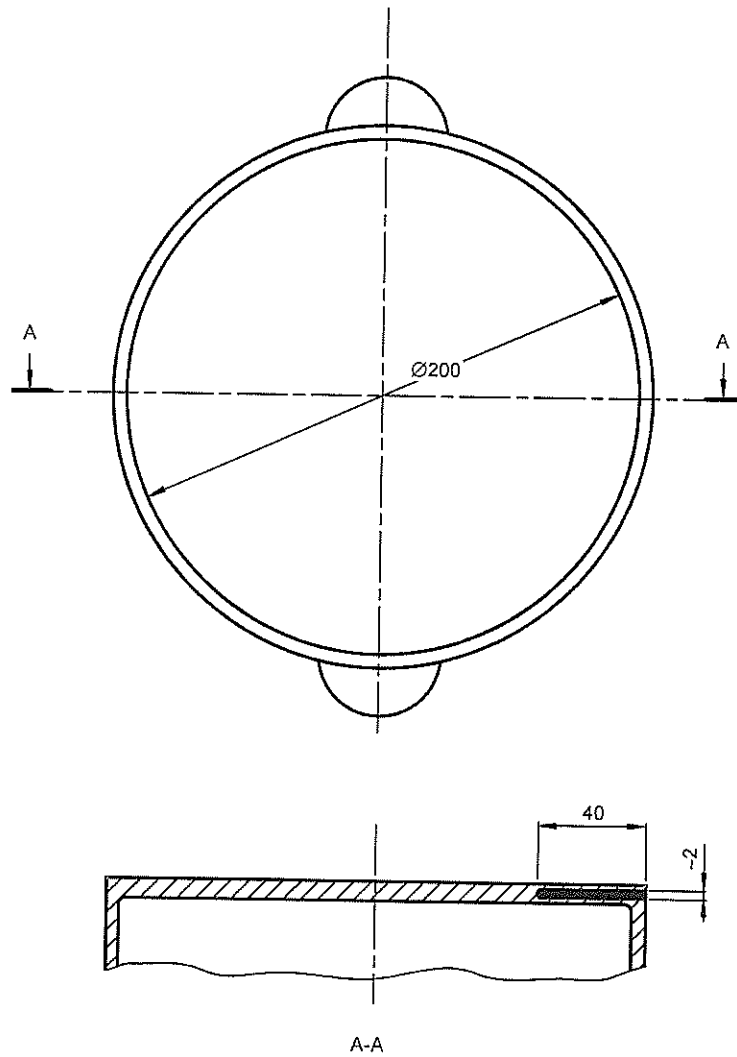
- | | |
|--|--|
| 1 Variable auxiliary fan | 7 Dosing pump for adding drops of corn oil |
| 2 Absolute filter with removable filter insert | 8 Range hood |
| 3 Pressure gauge | 9 Pan |
| 4 Compensation chamber | 10 Hob |
| 5 Intermediate shelf with openings according to the outlet of the hood | 11 Vertically adjustable table |
| 6 Dosing pump for adding drops of distilled water | 12 Minimum 50 mm revolving |

Figure 3 – Arrangement for the grease absorption test



IEC 493/97

Figure 4 – Example of a test room



IEC 1817/05

Figure 5 – Pan used for the test