BS EN 60661:2014

BSI Standards Publication

Methods for measuring the performance of electric household coffee makers

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National foreword

This British Standard is the UK implementation of EN 60661:2014. It is identical to IEC 60661:1999, incorporating amendment 1:2003 and amendment 2:2005. It supersedes BS EN 60661:2001 which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to IEC text carry the number of the IEC amendment. For example, text altered by IEC amendment 2 is indicated by [A2] ⟨A2⟩.

The CENELEC common modifications have been implemented at the appropriate places in the text. The start and finish of each common modification is indicated in the text by tags [C] ⟨C⟩.

The UK participation in its preparation was entrusted to Technical Committee CPL/59, Performance of household electrical appliances.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 60661

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English Version

Methods for measuring the performance of electric household coffee makers (IEC 60661:1999 , modified + A1:2003 , modified + A2:2005 , modified)

Méthodes de mesure de l'aptitude à la fonction des cafetières électriques à usage domestique (CEI 60661:1999 , modifiée + A1:2003 , modifiée + A2:2005 , modifi)

Verfahren zur Messung der Gebrauchseigenschaften elektrischer Haushalt-Kaffeebereiter (IEC 60661:1999 , modifiziert + A1:2003 , modifiziert + A2:2005 , modifiziert)

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

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Foreword

This document (EN 60661:2014) consists of the text of IEC 60661:1999 + A1:2003 + A2:2005 prepared by IEC/SC 59G "Small kitchen appliances" (merged in IEC/SC 59L) and IEC/SC 59L "Small household appliances" of IEC TC 59 "Performance of household and similar electrical appliances", together with the common modifications prepared by working group CLC/TC 59X/WG 15 "Coffee makers" of CLC/TC 59X "Performance of household and similar electrical appliances".

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2015-05-02
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2016-11-25

Clauses, subclauses, notes, tables, figures and annexes which are additional to those in IEC 60661:1999 + A1:2003 + A2:2005 are prefixed “Z”.

This document supersedes EN 60661:2001 + A1:2003 + A2:2005.

EN 60661:2014 includes the following significant technical changes with respect to EN 60661:2001 and its amendments: EN 60661:2014 now takes into account Mandate M/495 "Standardisation mandate to CEN, CENELEC and ETSI under Directive 2009/125/EC relating to harmonised standards in the field of Ecodesign" and its Annex A.

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Endorsement notice

The text of the International Standard IEC 60661:1999 + A1:2003 + A2:2005 was approved by CENELEC as a European Standard with agreed common modifications.

〈C〉 Annex ZA
(normative)

Specification of cups

ZA.1 General

Standardization of coffee cups for 0,12 l coffee and 0,04 l espresso is necessary in order to minimise the influence of the used cup on energy measurement for coffee appliances. The main factor of influence is the in-cup temperature measurement. The critical parameters influencing the in-cup temperature are the cup geometry, the cup mass and the cup material. Therefore, cups complying with ZA.2 to ZA.4 shall be used.

ZA.2 Cup geometry

Regular cups shall be as in Figure ZA.1.

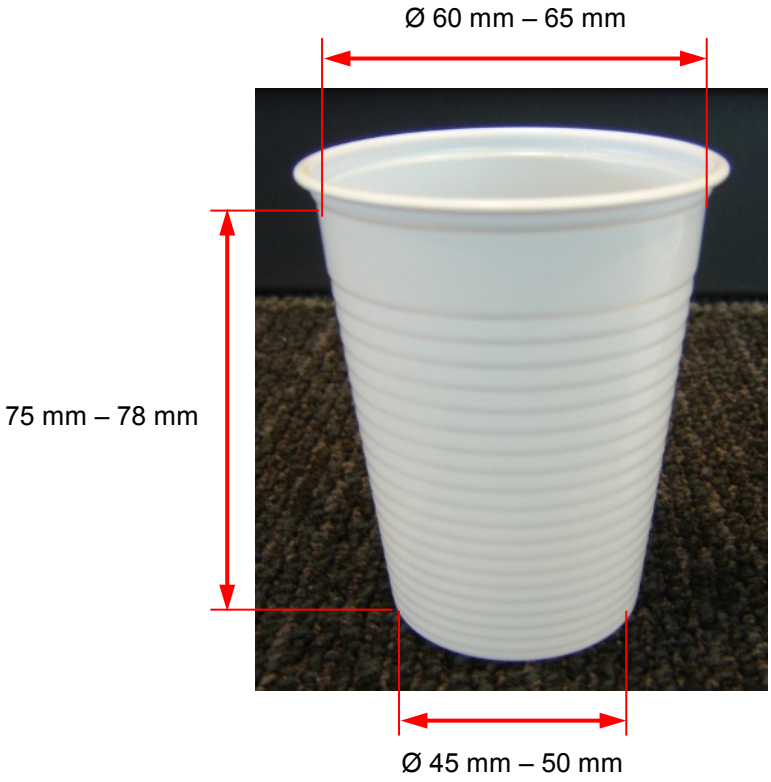

Figure ZA.1 — Regular cup 〈C〉

〈C〉 Expresso cups shall be as in Figure ZA.2.

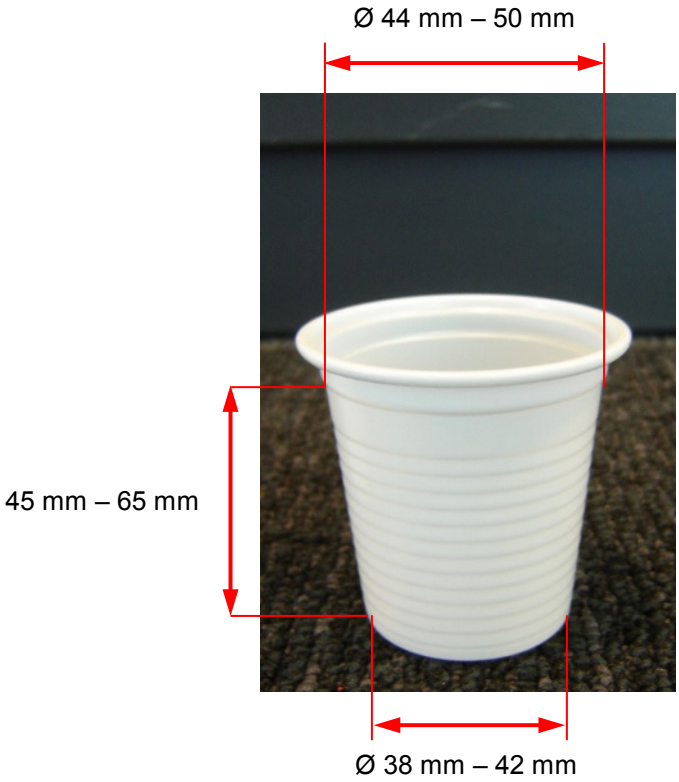

Figure ZA.2 — Expresso cup

NOTE Width on top measured just below collar, on bottom just above radius, height at same points.

ZA.3 Cup mass

Regular cup: 0,12 l, 2,5 g – 4,0 g,

Espresso cup: 0,04 l, 1,5 g – 2,5 g.

ZA.4 Cup material

Polystyrene >PS< 〈C〉

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

METHODS FOR MEASURING THE PERFORMANCE OF ELECTRIC HOUSEHOLD COFFEE MAKERS

FOREWORD

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International Standard IEC 60661 has been prepared by subcommittee 59G: Small kitchen appliances, of IEC technical committee 59: Performance of household electrical appliances.

This consolidated version of IEC 60661 is based on the second edition (1999) [documents 59G/99/FDIS and 59G/105/RVD], its amendment 1 (2003) [documents 59G/128/FDIS and 59G/130/RVD] and its amendment 2 (2005) [documents 59L/21/FDIS and 59L/23/RVD].

It bears the edition number 2.2.

A vertical line in the margin shows where the base publication has been modified by amendments 1 and 2.

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.

〈C〉 Introduction

IEC 60661:2006-02 (consolidated edition of IEC 60661:1999 + A1:2003 + A2:2005) focuses mainly on filter coffee makers; capsule & pad makers are completely missing, and many clauses cannot be applied to them. Therefore, a complete reworking of the standard could solve that inadequate status; this will be done later. 〈C〉

METHODS FOR MEASURING THE PERFORMANCE OF ELECTRIC HOUSEHOLD COFFEE MAKERS

1 Scope and object

This International standard applies to electric coffee makers for household and similar use. It does not apply to appliances designed exclusively for commercial or industrial use.

The object of this standard is to state and to define the main performance characteristics, which are of interest to the user and to describe the standard methods for measuring these characteristics.

This standard is concerned neither with safety nor performance requirements.

Taking into account the degree of accuracy and repeatability, due to variations in time and origin of test materials and ingredients and the influence of the subjective judgement of test operators, the described test methods may be applied more reliably for comparative testing of a number of appliances at approximately the same time, in the same laboratory, by the same operator and with the same utensils, rather than for testing single appliances in different laboratories.

NOTE 1 Similar use denotes use in premises other than household, for example offices, where the appliance is used in a similar way to normal household use.

NOTE 2 The measuring methods of this standard are specific to coffee makers with a view to the following types of coffee percolator, filter type coffee makers and espresso coffee makers 〚C〉 and capsule and pod/pad makers 〈C〛; they may, however, be used for coffee makers having other systems, as far as this is reasonable.

2 Normative references

〚C〉 The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 50564:2011, *Electrical and electronic household and office equipment – Measurement of low power consumption (IEC 62301:2011, mod.)*

EN 60584-2, *Thermocouples – Part 2: Tolerances (IEC 60584-2)*

EN ISO 3696:1995, *Water for analytical laboratory use – Specification and test methods (ISO 3696:1987)*

ISO 3972:1991, *Sensory analysis – Methodology – Methods of investigating sensitivity of taste*

ISO 4121:1987, *Sensory analysis – Methodology – Evaluation of food products by methods using scales* 〈C〛

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[1] To be published.

3 Definitions

For the purpose of this standard the following definitions apply:

3.1
coffee maker
appliance to prepare coffee

3.2
coffee percolator
coffee maker with a liquid container and a strainer or basket for holding ground coffee through which the heated water ascends in a rising pipe and falls passing through the ground coffee into the container in a continuous process

NOTE In some countries, this type of coffee maker is named “coffee brewer”.

3.3
filter coffee maker
coffee maker with separate containers for water and for the coffee brewed and with a filter arranged above the coffee container. The heated water passes once through a filter containing ground coffee into a container

〚C〛 **3.Z1**
pressure coffee maker
coffee maker with water heated and forced through ground coffee and filter by steam pressure or mechanical pump

3.Z1.1
espresso coffee maker
coffee maker with heated water that is forced through ground coffee and filter by steam pressure, manual piston drive or mechanical pump, with a mechanical pump pressure equal to or higher than 10 bar

3.Z1.2
low pressure coffee maker
coffee maker with heated water that is forced through ground coffee and filter by steam pressure, manual piston drive or mechanical pump, with mechanical pump pressure lower than 10 bar

Note 1 to entry: Electrical "moka pot" coffee maker with water heated and forced through ground coffee and filter by steam pressure is a low pressure coffee maker. 〚C〛

4 Grinding degrees

For the purpose of performance testing of coffee makers, the grinding degrees are defined as follows.

a) COARSE more than 50 % of the grounds are larger than 0,71 mm;

b) MEDIUM more than 50 % of the grounds are larger than 0,355 mm but smaller than 0,71 mm;

c) FINE more than 50 % of the grounds are smaller than 0,355 mm.

Test sieves

Mesh size of sieve mm
0,71
0,355

NOTE The mesh sizes are based on ISO/DIS 3310-1.

5 List of measurements and assessment of performance

– Overall dimensions (clause 7)
– Mass (clause 8)
– Length of flexible cord (clause 9)
– Operating elements (clause 10)
– Capacities (clause 11)
– Maintenance of the coffee maker and exchange of wearing parts (clause 12)
– Cleaning (clause 13)
– Instructions (clause 14)
– Quantity of coffee produced with maximum quantity of cold water (clause 15)
– Quantity of coffee produced with minimum quantity of cold water (clause 16)
– Time to prepare maximum quantity of coffee (clause 17)
– Time to prepare minimum quantity of coffee (clause 18)
– Temperature of the coffee (clause 19)
– Measurement with maximum quantity of ground coffee (clause 20)
– Residual water (clause 21)
– Pouring out of the coffee (proper handling) clause 22)
– Quality of the coffee (clause 23)
– Additional tests for espresso coffee makers (clause 24)
– Descaling test (clause 25)
[A2] – Energy consumption (Clause 26)
– Steam function to froth-up milk and to heat-up water (Clause 27). [/A2]

6 General conditions for the measurements

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

– ambient temperature: 20 °C ± 5 °C;
– cold water temperature: 15 °C ± 2 °C;

NOTE In Japan the cold water temperature is 20 °C ± 3 °C.

– input: rated power input ±1 %;
– frequency: ±1 %;
– test room: substantially draught-free;
– during the test the ambient temperature shall be kept at a constant level, with admissible deviations ±2 °C;
– placing of the appliance: on a matt black painted wooden support, projecting beyond the appliance by at least 50 mm on all sides and at least 300 mm from the walls.

7 Overall dimensions

The overall dimensions of the appliance, length, height, width or diameter, including any controls, handles, control knobs or other protrusions, the cord guard of any flexible cord and the appliance connector of any cord set supplied with the appliance, shall be measured and indicated in millimetres.

For espresso coffee makers, filter boxes and steam tubes are not taken into account.

8 Mass

The mass of the empty appliance with flexible cord is measured and indicated in kilograms to the nearest 0,05 kg.

The mass is measured with the appliance fitted with all supplied accessories and ready for use.

9 Length of flexible cord

The distance between the entry points to the appliance and the plug, including any guard, is measured and indicated in metres rounded downwards to 0,05 m.

The existence of a cord storage or cord chamber for the flexible supply cord is noted.

10 Operating elements

An inspection is made with regard to the arrangement, accessibility and markings of all the operating elements including the methods of operation and controls.

The results of this inspection are noted.

11 Capacities

The maximum capacity of the reservoir or the container is measured and noted. The level markers on the reservoir or container are noted. The positions of the filling marks for the ground coffee are noted.

12 Maintenance of the coffee maker and exchange of wearing parts

The ease of maintenance and exchange of parts requiring replacement by the user, following the manufacturer’s instructions, are checked and noted.

13 Cleaning

After the tests of clauses 15 to 20, a visual inspection shall be made to assess the level of difficulty of cleaning the appliance and the components made dirty by water and coffee, taking into account aspects such as (listed in decreasing order of importance):

– dismantling (time needed and difficulty);
– easy accessibility to filter holder;
– easy removal of water tank and tray container for dirty water and residues of ground coffee;
– dishwasher resistance of components (e.g. jug, filter, container, water tank, etc.);
– presence of special cleaning features or indication of special cleaning operations given in the manufacturer’s instructions.

The overall results of these inspections shall be noted.

For espresso coffee makers this evaluation shall be made after five brewing cycles as stated in clause 24.

14 Instructions

It is noted if there are instructions for use and if they include the following;

– a list of parts that are suitable for use in the dishwasher;

– instructions relating to the disposal of any residual water that could remain for long periods in the appliance;

– information on the amount of water for one cup of filtered coffee and for one cup of espresso coffee.

NOTE 1 It should be noted if in the instruction there is information that a cup size corresponds to 0,125 l for filter coffee and 0,035 l for espresso coffee.

NOTE 2 In Japan the amount of 0,12 l is normally used for one cup of filtered coffee.

– special instructions for the preparation of a minimum amount of coffee;

– the method and frequency of descaling.

15 Quantity of coffee produced with maximum quantity of cold water

The water container is filled with the maximum quantity of cold water as assigned to the appliance by markings, labels or similar instructions of the manufacturer. In the absence of such instructions, the water container is filled with the maximum quantity of cold water.

The maximum quantity of cold water is determined and recorded in litres, rounded off to 0,05 l.

The ground coffee container is filled according to the instructions. In the absence of such instructions it is filled with 50 g per litre of water.

The size of filter paper, its positioning and filling are according to the manufacturer’s instructions.

NOTE 1 Not applicable for espresso coffee makers.

NOTE 2 For this test, a representative type of coffee that is normally used in that country is taken.

For the purpose of this test medium ground coffee as specified in clause 4 is used, unless otherwise stated in the manufacturer’s instructions.

The coffee machine is operated with any controls that it may contain set at the position that produces the strongest coffee, until:

– in the case of filter types, the moment at which the period between two drops falling consecutively into the coffee container is approximately 2 s;

– in the case of percolators with strength control, this device operates up to the moment at which the period between two drops falling consecutively into the coffee container is approximately 2 s;

– in the case of other percolators, the appliance is disconnected from the supply 8 min after percolation has started and then left up to the moment at which the period between two drops falling consecutively into the coffee container is approximately 2 s;

– in the case when drops of coffee are not visible at the end of the brewing time, the appliance is left for 1 min after the last water has come out of the hot water outlet.

The quantity of coffee produced is measured and indicated in litres, rounded off to 0,05 l.

The loss of water during the preparation of coffee shall be noted.

16 Quantity of coffee produced with minimum quantity of cold water

A further test is made under the conditions of clause 15, but with the minimum quantity of water as stated in the manufacturer's instructions, and the corresponding quantity of ground coffee. In the absence of instructions, the test is made with 0,3 l water.

It shall be stated whether the coffee maker functions properly under these conditions. The quantity of coffee produced is measured and indicated in litres, rounded off to 0,01 l.

NOTE Not applicable for espresso coffee makers.

17 Time to prepare maximum quantity of coffee

During the test of clause 15 the total operation time is measured and indicated in minutes and seconds, rounded off to the nearest 10 s. This should be compared with any indications in the manufacturer's instructions and noted.

NOTE Not applicable for espresso coffee makers.

18 Time to prepare minimum quantity of coffee

During the test of clause 16 the total operation time is measured and indicated in minutes and seconds, rounded to the nearest 10 s.

NOTE Not applicable for espresso coffee makers.

19 Temperature of the coffee

On completion of the test according to clause 15 the temperature of the coffee produced is measured in the centre of the lower half of the liquid by means of a watertight thermocouple or equivalent device.

In the case of coffee makers with provisions to keep coffee hot, half of the quantity is then poured out as quickly as possible.

In the case of filter-type coffee makers, the filter with the coffee residues is removed and replaced by a lid, if supplied.

The coffee container is put on the warming device again. The temperature of the liquid is measured again after 30 min and after 60 min. The three temperatures measured are indicated in degrees Celsius with the corresponding times.

In the case of a thermostatically controlled warming device the temperature in the centre of the coffee is recorded during 60 min and the average temperature in degrees Celsius, is indicated.

The temperature required to keep the coffee hot should be noted.

NOTE For testing of espresso coffee makers, see clause 24.

20 Measurement with the maximum quantity of ground coffee

The test of clause 15 is repeated using the maximum quantity of ground coffee possible, according to manufacturer's instructions.

It is determined and stated, if the ground coffee container (filter) can hold this maximum quantity, whether it has overflowed or if the filter paper has been perforated.

NOTE Not applicable for espresso coffee makers.

21 Residual water

After the machine has cooled down to room temperature, it shall be determined whether residual water remains in the coffee maker. The amount remaining shall be indicated in millilitres rounded up to the nearest millilitre.

22 Pouring out of the coffee (proper handling)

The pouring of coffee into cups, based on coffee made using the maximum amount of cold water, shall be observed and noted.

If possible, the pouring out shall be tested with and without a lid, unless otherwise indicated by the manufacturer.

Coffee shall be poured out of the coffee maker or collecting receptacle into a cup, as in normal practice, with any soiling of the machine and its surroundings noted.

23 Quality of the coffee

23.1 Brewing temperature of the coffee

The brewing temperature is a criterion of the coffee flavour for the tasting.

The measurement shall be carried out during the test according to clause 15 in the centre of the coffee filter at 20 mm from the bottom, when a stabilised temperature has been reached.

NOTE 1 Not applicable for espresso coffee makers.

NOTE 2 The brewing temperature should not be less than 88 °C and not more than 96 °C.

23.2 Taste of the coffee

A high quality of coffee with a major market share should be used for test purposes. It is also possible to use coffee which is available in ground form. The type of coffee used is noted.

In accordance with the conditions of clause 15, the coffee shall be prepared with water of medium hardness complying with grade 3 of ▌C〉EN ISO 3696〈C▐, free from chlorine and other foreign flavours. After the termination of the coffee preparation, the coffee shall be stirred in the container with a spoon that is free of taste, and then poured into cups. Each cup should contain 0,125 l of coffee. The cup shall be coded.

As soon as the coffee in the cups has cooled down to 55 °C ± 5 °C, the coffee is tasted by slurping.

A descriptive test according to ISO 4121 shall be carried out by 10 non-professional coffee tasters. The tasting can also be carried out by at least 5 professional coffee tasters.

The qualifications of the professional coffee tasters shall be determined according to ISO 3972.

Separate indications for the individual cups are made by each person for the following characteristics:

– the richness (strength, bitter substances),
– the taste (acid);
– the off-taste.

The assessment should be graded as follows:

– poor;
– little;
– mild;
– rich;
– strong.

The average assessment shall be recorded.

Any undissolved matter or off-taste, such as the taste of plastic, metal etc., in the coffee which is noticeable shall be recorded.

24 Additional tests of espresso coffee makers

24.1 The coffee is prepared according to the manufacturer's instructions. If the manufacturer does not specify the quantify of ground to be used, 7 g of ground coffee per cup shall be used for espresso coffee.

The manufacturer's instructions shall be followed.

For this test a representative type of espresso coffee which is normally used in that country is used and recorded.

The porcelain cup shall have a capacity of 0,070 – 0,100 l and a wall thickness of 5 mm – 7 mm.

24.2 The temperature of the freshly prepared coffee shall be measured in the middle of the cup, during the first and second run-through, based upon a cup volume of 0,035 l. The cups shall be preheated according to the manufacturer's instructions, if any.

The average value of the measured temperature shall be indicated.

24.3 If two cups of coffee can be filled at the same time, it shall be noted if these cups have been filled equally. This test is carried out at least 10 times. The differences should be recorded and expressed in millilitres.

24.4 The taste shall be determined as in the case of coffee makers (23.2).

In addition the visual impression of the crema has to be assessed using the following rating scale:

5 thick covering all over;
4 all covered with little holes;
3 patchy covering all over;
2 sparsely covered;
1 none.

The espresso coffee maker shall be operated with a one-cup capacity as well as with the maximum cup capacity.

25 Descaling test

This test shall be carried out with a filter, but without ground coffee and with a normal coffee container. The water that is run through shall be drained off and discarded.

〖C〗*Text deleted*〖C〗

The test shall be carried out using fresh water having a general hardness of approximately 3,0 mmol/l.

The coffee maker shall be filled with the maximum amount of cold water according to clause 15, a collecting device inserted and the coffee maker switched on. When the water has run through it is discarded and the coffee machine is left switched on and allowed to run dry. The coffee maker shall remain switched on for 15 min and then switched off and allowed to cool for 15 min.

The above cycle shall be carried out 500 times. This test shall be repeated 500 times using the minimum amount of cold water.

During this test, a descaling process shall be carried out according to the instructions of the manufacturer. If there are no instructions, the descaling process is carried out when the brewing time has increased by 20 %. It shall be recorded if the instructions include sufficient information concerning descaling and how the descaling agent can be poured in and removed at the end of the descaling process.

If the instructions do not include any or include insufficient information, descaling agents for electric domestic appliances usually available in the trade are used according to the instructions of the manufacturer of the descaling agent.

At the end of the descaling process, the appliance shall be inspected and the test according to clause 17 shall be repeated. The change of preparation time shall be recorded.

The following shall be recorded:

– the change in preparation time compared with the time noted in clause 17;
– if the coffee maker withstands the tests without affecting its features and functions for use;
– if the manufacturer's instructions include sufficient information on descaling, including how the descaling agent is poured in and is removed at the end of the descaling process;
– the ease of handling.

26 Energy consumption

〖C〗26.Z1 Special conditions and measurement accuracy

26.Z1.1 Ambient temperature

Ambient temperature condition for energy consumption measurements shall be 23 °C ± 2 °C.

26.Z1.2 Storage of appliances

Appliances are stored at ambient temperature for at least 6 h before measurements. 〖C〗

〚C〛 26.Z1.3 Energy measurement accuracy

a) The energy measurements shall be accurate to ± 1,5 %.

b) The resolution of energy measurements shall be 1 Wh or better.

c) Standby and off mode are measured according to EN 50564:2011.

For energy measurements during active modes, a) and b) are applicable.

For appliances connected to more than one phase, the power measurement instrument shall be equipped to measure total power of all phases connected.

26.Z1.4 Weighing accuracy

The uncertainty of the balance for weighing filter coffee shall be less than or equal to 1,0 g.

The uncertainty of the balance for weighing the mass of brewed coffees and steaming water for pressure coffee makers shall be less than or equal to 0,1 g.

26.Z1.5 Temperature measurement accuracy

The uncertainty of the temperature measurements relevant for energy measurements – ambient and water or coffee – shall be less than or equal to ± 1,5 K.

Temperature measurement shall be conducted in line with EN 60584-2.

26.Z2 Pressure coffee makers

26.Z2.1 Categories and designations

Categories and designations of coffee makers that are to be measured as "pressure coffee makers" are fully automatics, capsule, pod or pad makers, and makers with manual piston drive. "Moka pot" espresso coffee makers are not in the scope.

26.Z2.2 Coffee period

26.Z2.2.1 Preparations

All features (such as auto-power-down, heating systems, grinding, brewing, rinsing, etc.) are to be set in factory default mode except the amount of coffee used per cup.

The coffee beans used shall be 100 % Arabica.

The capsules/pods/pads used are according to manufacturer’s instruction and shall be specified in the measurement report.

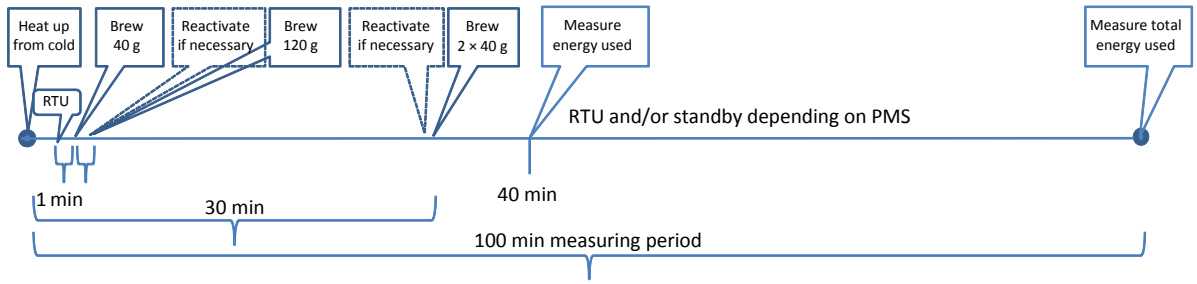
The beakers used shall be as described in Annex ZA.

Water temperature (T_w) in the reservoir shall be 23 °C ± 1 ºC. 〚C〛

〚C〛 Water temperature (T_w) and ambient temperature (T_A) are measured before start and reported.

If the amount of coffee used per cup can be adjusted, the settings shall be as close to 40 g and 120 g as possible. The chosen settings shall be reported.

26.Z2.2.2 Procedure



Key

RTU ready to use
PMS power management system

Figure Z1 – Coffee period, pressure makers

If refilling water or emptying the (used) coffee grounds is needed during the measurement, this should be done in a waiting period. The temperature of the water shall be 23 °C ± 1 °C.

The appliance is switched on and the energy consumption measurement starts and continues for 100 min ± 2 s.

The temperature of the coffee is measured within 5 s after serving and a short stirring in the middle of the plastic beaker, with a rod of negligible heat capacity.

The first brewing cycle starts 60 s ± 2 s after the maker is ready for brewing. This is a 40 g coffee, and temperature (T_{C1}) and mass of coffee (M_{C1}) are measured and to be reported.

In case the temperature does not reach 76 °C, a correction of the energy is made as described in 26.Z2.6.2.

In case the actual coffee mass deviates from the nominal, a correction is made as described in 26.Z2.6.2.

The second brewing cycle is done 60 s ± 2 s after the maker has finished the first brewing cycle. If needed, the maker is to be re-activated. This is a 120 g coffee, and temperature (T_{C2}) and mass of coffee (M_{C2}) are measured and to be reported. For makers where there is no possibility to change the cup size, two cups of same size are brewed, irrespectively of size. After that, the energy measurement shall continue without any further interaction until minute 30.

30 min ± 2 s from start, the third brewing is made, a 2 x 40 g coffee is made. If needed, the maker is to be re-activated. The mass of coffee (M_{C3}) is measured and to be reported. After that, the energy measurement shall continue without any further interaction. 〚C〛

In case the maker can only make single coffees, the double coffees are replaced by 2 singles of the same weight to be made immediately in sequence. The mass of both coffees is measured and to be reported.

40 min ± 2 s from start, the accumulated energy consumption is measured and to be reported (E_{40}).

100 min ± 2 s from start, the accumulated energy consumption is measured and to be reported (E_{100}).

26.Z2.3 Steam function

26.Z2.3.1 Preparations

The beaker used shall be as described in Annex ZA.

The water temperature at the start in the beaker (T_S) shall be 15 °C ± 2 °C.

100 g ± 1 g water is heated up to 55 °C ± 2 ºC in the beaker.

26.Z2.3.2 Procedure

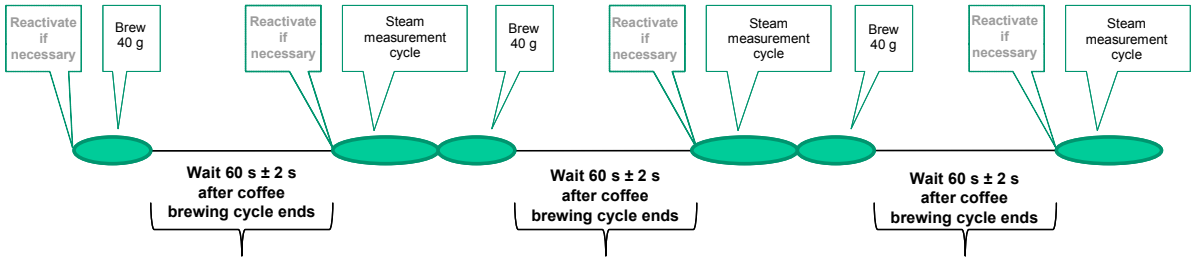


Figure Z2 — Steaming, pressure makers

The steam function is started 60 s ± 2 s after a coffee brewing cycle has ended and the maker is ready to be used. The energy is measured from the moment the steam function is activated by pre-selection of steaming, opening the steam valve or pushing the steam button, until the moment the required water temperature in the beaker has been obtained.

This cycle is done three times and the energy is measured ($E_{S1,}$ $E_{S2,}$ E_{S3}) for each cycle.

The water temperature at the start in the beaker (T_S) shall be reported for each cycle.

The temperature in the beaker shall be monitored continuously until the required temperature is reached. When the required temperature is reached, steaming is stopped and immediately the final temperature (T_F) is measured in the middle of the beaker, after a short stirring, and to be reported.

Each of the 3 steam cycles shall be started 60 s ± 2 s after a coffee brewing cycle.

The initial water temperature in the beaker is measured and to be reported (T_{S1}, T_{S2}, T_{S3}).

The final water temperature in the beaker is measured and to be reported (T_{F1}, T_{F2}, T_{F3}).

Where it is not possible to start coffee brewing immediately after steaming, the manual's instructions shall be followed.

In case of a milk-frothing device based on a venturi principle, the same procedure as above is followed. The air inlet at the venturi tube shall be blocked, if possible.

〈C〉 In case no steam tube exists, the following procedure is used. The milk jug (container) is filled with water of 15 °C ± 2 °C. The process is started and continued until a mass of 110 g ± 1 g is in the beaker.

NOTE The 10 g extra compensate for the condensed steam amount.

26.Z2.4 Standby mode

The power or energy measurement is started immediately after the maker has switched into its standby mode and according to EN 50564:2011. The value of Power in standby mode ($P_{standby}$) over 1 h is to be recorded as Energy ($E_{standby}$).

If a maker does not have a power management system including automatically switching to standby mode or off mode, the value of $E_{100} - E_{40}$ shall be used as standby mode energy consumption for 1 h.

If the maker has a power management system that switches the maker to off mode, the off mode power consumption is taken as standby power.

26.Z2.5 Off mode

The power or energy consumption in the off mode is measured according to EN 50564:2011. The value of Power in off position (P_{off}) over 1 h is to be recorded as Energy in off position (E_{off}).

If the maker does not have any off mode, the standby mode value is used for this value.

26.Z2.6 Calculation of relative energy consumption

26.Z2.6.1 Introduction

The energy rating is calculated as a relation between the weighted sum of the measured values for functions as given in Table Z1 and the weighted sum of the benchmark energy values based. Weighting factors are set to represent the energy consumption during 24 h.

26.Z2.6.2 Benchmark for coffee period

Average weight (g) of brewed coffee:

$$M_{coffee} = \frac{\sum_{n=1}^{3} M_{C,n}}{3} \quad (1)$$

Actual temperature (°C) of brewed coffee:

$$T_{act} = \frac{T_{C1} + T_{C2}}{2} \quad (2)$$

If T_{act} is higher than 76 °C, (T_{act} - T_w) shall be set to 53 °C. When T_{act} is below 76 °C, the measured value T_{c1} + T_{c2} shall be used. 〈C〉

〈C〉 Corrected benchmark energy (Wh) for coffee period:

$$B_{coffee} = B_{brew} \cdot \frac{M_{coffee}}{80} \cdot \frac{T_{act} - T_W}{76 - 23} + B_{hu\&ready} \quad (3)$$

B_{brew} is to be used as energy benchmark for the brewings, $B_{hu\&ready}$ is to be used as energy benchmark for heating up and ready mode.

Benchmark values B_{brew} = 27,9 Wh, $B_{hu\&ready}$ = 43,5 Wh.

26.Z2.6.3 Benchmark for steaming

Average measured energy (Wh) for steaming:

$$E_{steam} = \frac{\sum_{n=1}^{3} E_{S,n}}{3} \quad (4)$$

Average temperature rise (°C):

$$\Delta T_{steam} = \frac{\sum_{n=1}^{3} T_{F,n} - \sum_{n=1}^{3} T_{S,n}}{3} \quad (5)$$

Corrected benchmark energy (Wh) for steaming:

$$B_{steam} = 15 \cdot \frac{\Delta T_{steam}}{40} \quad (6)$$

NOTE The value of 15 Wh for steaming of 100 g water over ΔT 40 K has been found empirically.

26.Z2.6.4 Relative energy consumption value

W_i = Weighting factor based on use frequency for function i

EB_i = Benchmark energy value for function i

P_i = Function i available (yes=1, no=0)

NOTE 1 P_i coefficient is used with steaming, rinsing and grinding. For other functions, P_i coefficient is set to 1.

E_i = Measured energy for function i

NOTE 2 The theoretical energy content to heat up 100 g water from 15 °C to 55 °C is: 4,651 Wh + heating up thermoblock (e.g. 6,86 Wh + Losses (e.g. 30 W for 5' = 2,5 Wh)) = 14 Wh. During tests, 15 Wh has been found empirically. Therefore, 15 Wh is used as benchmark for steaming. 〈C〉

〚C〛 Table Z1 — Relative energy consumption values for functions of pressure coffee makers

Index	Function	Subclause	W_i	EB_i Wh	E_i
1	Coffee period	26.Z2.2	3	B_{coffee}	E_{100}
2	Steam function	26.Z2.3	1	B_{steam}	E_{steam}
3	Standby mode	26.Z2.4	11	1	$E_{standby}$
4	Off mode	26.Z2.5	8	0,5	E_{off}
5	Rinsing	-	1	3	0 [a]
6	Grinding	-	1	2	0 [b]

[a] Measured as a part of the heat up function.

[b] Measured as a part of the coffee period.

The energy consumption value is given by:

$$E_{rating} = \frac{\sum_{i=1}^{6} W_i \cdot E_i}{\sum_{i=1}^{6} P_i \cdot W_i \cdot B_i} \cdot 100\ (\%) \qquad (7)$$

26.Z3 Filter coffee makers

26.Z3.1 Preparation

All features (such as auto-power-down, heating systems, etc.) are to be set in factory default mode.

Accessories, e.g. (thermos) jugs are to be used according to user's manual.

26.Z3.2 Coffee period

26.Z3.2.1 Preparations

Measurements are performed without coffee powder and paper filter. In case of filter coffee makers with integrated coffee grinder, the grinder function shall not be part of the energy measurement procedure.

If the maker provides a plastic or metal filter, this filter shall not be used unless necessary for the function of the appliance. 〚C〛

〈C〉 The rated amount of water (check mark, "max.", etc.) is filled into the reservoir.

Energy consumption is corrected to a nominal amount of brewed coffee as described in 26.Z3.5.5.

Water temperature (T_w) shall be 15 °C ± 2 °C.

The mass of the jug is weighed and to be reported.

Water temperature (T_w) is measured before start and to be reported.

26.Z3.2.2 Procedure

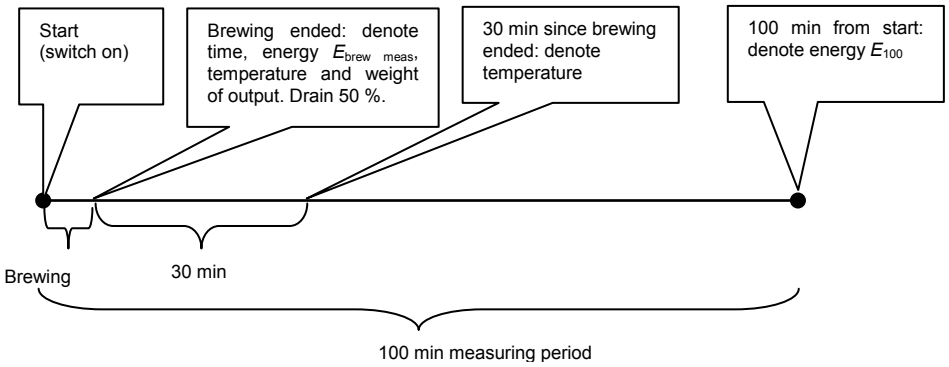


Figure Z3 — Coffee period, filter makers

The appliance is switched on and the energy consumption measurement starts and continues for 100 min ± 2 s.

Brewing ends when the power measurement show a drastic drop in used power. Ending time and energy consumption $E_{brew\text{-}meas}$ is to be reported. The temperature of the processed (brewed) water T_{B1} is measured within 10 s, after stirring with a rod of negligible heat capacity, in the middle of the jug at approximately 1 cm from the bottom. Temperature T_{B1} is to be reported.

The amount of brewed (processed) water M_{brew} is determined by weighing the jug and subtracting its empty weight. M_{brew} is to be reported.

50 % ± 1 % of the processed water M_{brew} is drained. If there is a lid supplied with the appliance to replace the filter with the coffee residues, it is now placed. The jug is placed back into the appliance within 30 s since brewing ended.

30 min ± 10 s since brewing ended, temperature of the water in the jug (T_{B2}) is measured, after a short stirring with a rod of negligible heat capacity, in the middle of the jug and is to be reported.

Ambient temperature (T_A) is measured and to be reported.

Benchmark temperature values of brewed coffee and after 30 min are 80 °C and 76 °C, respectively. If measured values (referred to T_W = 15 °C) are below, a correction is made as described in 26.Z3.5.2.

Energy measurement is continued until 100 min ± 2 s from start and total energy consumption of the coffee period E_{100} is to be reported.

26.Z3.3 Standby mode

The power or energy measurement is started immediately after the coffee period has ended, and according to EN 50564:2011. The value of $P_{standby}$ over 1 h is to be recorded as $E_{standby}$. 〈C〉

〈C〉 If a maker does not have a power management system including automatically switching to standby mode or off mode, the average of the power consumption during keeping hot shall be used as standby mode energy consumption for 1 h.

If the maker has a power management system that switches the maker to off mode, the off mode power consumption is taken as standby power.

26.Z3.4 Off mode

The power or energy consumption in the off mode is measured according to EN 50564:2011. The value of P_{off} over 1 h is to be recorded as E_{off}.

If the maker does not have any off mode, the standby mode value is used for this value.

26.Z3.5 Calculation of energy rating

26.Z3.5.1 General

The energy rating is calculated as a relation between the weighted sum of the measured values for functions as given in Table Z2 and the weighted sum of the benchmark energy values based on the current available technology. Weighting factors are set to represent the energy consumption during 24 h.

26.Z3.5.2 Temperature correction of brewing energy

If after brewing, the temperature difference ($T_{B1} – T_W$) is below 65 °C, the brewing energy is corrected:

$$E_{brew} = E_{brew\text{-}meas} * (80 – 15) / (T_{B1} – T_W)$$

NOTE 1 80 °C is judged to be the minimal coffee temperature of filter coffee to allow an optimal filtering process. The relevant temperature increase by brewing is 80 °C – 15 °C = 65 °C. If the temperature difference after brewing ($T_{B1} – T_W$) is 65 °C or higher, no correction is made, i.e. $E_{brew} = E_{brew\text{-}meas}$.

NOTE 2 Real filter coffee preparation (with coffee powder) yields about 11 % higher brewing energy consumption, according to the amount of hot moist coffee powder remaining in the filter.

26.Z3.5.3 Temperature correction of keeping hot energy

The measured energy consumption $E_{khot\ meas}$ to keep 50 % of the brewed coffee (for test: of the processed water) hot is:

$$E_{khot\text{-}meas} = E_{100} – E_{brew\text{-}meas}$$

NOTE 1 Filter coffee makers with thermos jug do not need active heating energy for keeping hot. In that case, $E_{khot\ meas}$ represents the standby or off mode energy consumption of the rest of the coffee period after brewing. Penalisation of too low keeping hot temperature of thermos jugs is based on brewing energy, see Note 3 below.

If the temperature difference of coffee (water) to ambient ($T_{B2} – T_A$) after 30 min is below 53 °C, the keeping hot energy is corrected:

a) For makers with active heating to keep hot

$$E_{khot} = E_{khot-meas} \cdot \frac{76 – 23}{T_{B2} – T_A} \qquad \text{(See Note 2 below)} \qquad (8)$$ 〈C〉

〈C〉 b) For makers with thermos jug

$$E_{khot} = E_{brew} \cdot \left(\frac{76 - 23}{T_{B2} - T_A} - 1 \right) \qquad \text{(See Notes 2 and 3 below)} \qquad (9)$$

NOTE 2 76 °C is the minimal coffee temperature value, the same as used for the correction of pressure coffee makers. At 23 °C nominal ambient temperature, the difference is 53 °C. If (T_{B2} – T_A) is 53 °C or higher, no correction is made, i.e. E_{khot} = $E_{khot\text{-}meas}$.

NOTE 3 Thermos jug makers: Penalisation by the relative temperature loss times the brewing energy instead of the actual energy content presumes a keeping hot efficiency below 100 %. The energy necessary to cover the losses of common jugs by common heating elements is much greater.

If no correction is made for thermos jug makers, E_{khot} is equal to the standby or off mode energy consumption since brewing ended.

26.Z3.5.4 Temperature corrected energy for coffee period

E_{cp} (Wh) = E_{brew} + E_{khot}

26.Z3.5.5 Benchmark energy for coffee period

Benchmark energy for the coffee period (B_{coffee}) is calculated from the basic value E_{cp900}, which is the value for nominal capacity of 900 g of processed water and comprises also the energy consumption for active keeping hot.

NOTE The basic benchmark energy (Wh) for coffee period represents the state of technology.

E_{cp900} = 125 Wh

Benchmark energy (Wh) for coffee period:

$$B_{coffee} = E_{cp900} \cdot \frac{M_{brew}}{900} \qquad (10)$$

26.Z3.5.6 Relative energy consumption value

W_i = Weighting factor based on use frequency for function i

EB_i = Benchmark energy value for function i

P_i = Function i available (yes=1, no=0)

NOTE P_i coefficient is used with steaming, rinsing and grinding. For other functions, P_i coefficient is set to 1.

E_i = Measured energy for function i 〈C〉

〈C〉 Table Z2 — Energy rating values for functions of filter coffee makers

Index	Function	Subclause	W_i	EB_i Wh	E_i
1	Coffee period	26.Z3.2	2	B_{coffee}	E_{cp}
2	Standby mode	26.Z3.3	12,67	0,5	$E_{standby}$
3	Off mode	26.Z3.4	8	0,5	E_{off}

Test on sieve-machines should be done with only one coffee filling for the entire process.

The energy rating value is given by:

$$E_{rating} = \frac{\sum_{i=1}^{3} W_i \cdot E_i}{\sum_{i=1}^{3} P_i \cdot W_i \cdot B_i} \cdot 100\ (\%) \qquad (11)\ \langle C \rangle$$

〈A2〉 27 Steam function to froth-up milk and to heat-up water

The test procedure is considered as applicable for reproducible testing.

27.1 Steam function to froth-up milk

A glass container with a thickness of about 2 mm having an inner diameter of 80 mm ± 2 mm and a height of 75 mm ± 2 mm is placed perpendicular and centered below the steam tube of the appliance.

The distance of the outlet of the steam tube to the inner bottom of the container shall be 10 mm ± 1 mm.

An amount of 0,1 l ± 0,001 l of water is put into the glass container, and the water level is marked as level 1. An additional amount of 0,05 l ± 0,001 l is then put into the glass container, and the water level is marked as level 2. An extra amount of 0,05 l + 0,001 l is added on top of level 2 and that level is marked as level 3 (for water levels, see Figure 1). A supporting surface having a thermal isolation may be used (see Figure 2).

〈C〉 NOTE 1 〈C〉 Varying steam tubes with different steam nozzles may cause differences in levels 1, 2 and 3 〈A2〉

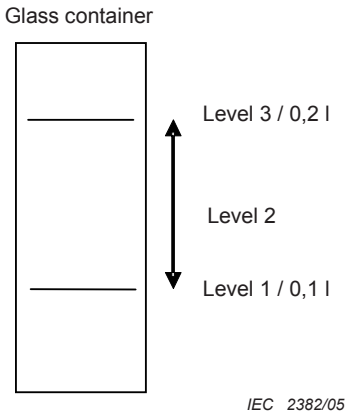


Figure 1 – Markings for levels 1, 2, 3

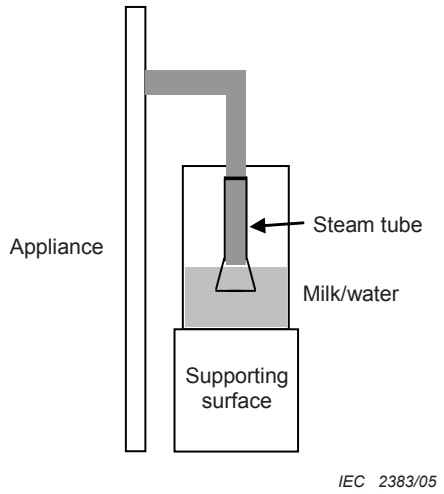


Figure 2 – Test assembly steam function

After that the glass container is emptied and dried.

The water container of the appliance is then filled with the maximum quantity of cold water as assigned by markings, labels or similar instructions of the manufacturer. In case of absence of such instructions, the water container is filled with the maximum quantity of cold water.

In order to avoid residual water in the steam valve, the steam function has to be operated before the test at least three times for about 5 s.

The glass container is then filled with 0,1 l ± 0,001 l of homogenized milk with a fat content of approximately 3,5 % at a temperature of 8 °C ± 1 °C.

A watertight thermocouple of class 1 according to EN 60587-4-2, accurate to ±1,5 K and having a nominal diameter of 0,25 mm is placed beside the steam tube and approximately 5 mm away and 10 mm below the marking for level 2 of the glass container.

[A2] The mass M_{L1} of the glass container including the milk shall be determined on a balance having an accuracy of at least 0,1 g and recorded.

The mass M_{L1} is expressed in grams.

After that the glass container is placed in the same way as described for the marking procedure (see Figure 2).

The appliance is operated with any controls at the positions specified by the manufacturer. In absence of such instructions, the steam function is operated at the max. setting of the steam function.

The steam function of the appliance is then operated until the upper level of the frothed-up milk reaches the marked level 3.

The time t_F to froth-up the milk to level 3 (double volume) shall be determined and noted.

The froth-up time t_F is expressed in seconds and rounded off to the next second.

The temperature T to the froth-up the milk to level 3 is measured with a temperature-recording instrument (accurate to ±3 K) and is noted.

Immediately after the frothing-up procedure the decomposition time t_{L2} of the frothed-up milk is determined and noted.

t_{L2} is the time taken for the volume of frothed-up milk to reduce to level 2 by natural loss of gas (air) and returning partly into liquid state.

The decomposition time t_{L2} is expressed in seconds and rounded off to the next second.

The time t_{L2} is determined while retaining the glass container at the same position as used for the frothing-up procedure.

[C] NOTE 2 [C] This test is carried out to assess the quality of the frothing-up process and the stability of the frothed-up milk relating to bubble size and stability time.

The mass M_{L3} of the glass container with the frothed-up milk shall be determined on a balance having an accuracy of at least [C] 0,1 g [C] and noted.

The mass M_{L3} is expressed in grams.

[C] NOTE 3 [C] Special care has to be taken collect any dripping milk after the test The measurement of the mass of the milk, including water from the steam function, has to be made after the dripping from the steam tube has finished.

The water absorption M_W of the frothed-up milk shall be determined and noted.

The water absorption M_W of the frothed-up milk is calculated as follows:

$$M_W = M_{L3} - M_{L1}$$

The result of the test is the water absorption M_W of the frothed-up milk and is expressed in grams per 0,1 l of milk and rounded off to [C] 0,1 g [C]. [A2]

[A2] 27.2 Steam function to heat-up water

A glass container as described in 27.1 is filled with 0,2 l ± 0,001 l of water at a temperature T_W of 15 °C ± 1 °C.

The mass M_{L4} of the glass container including the cold water shall be determined on a balance having an accuracy of at least 0,1 g and recorded.

The mass M_{L4} is expressed in grams.

After that the glass container is placed in the same way as described for the marking procedure.

In order to avoid residual water in the steam valve the steam function has to be operated before the test at least three times for about 5 s, before the glass container is placed in position.

A watertight thermocouple of class 1 according to [C] EN 60587-4-2 [C], accurate to ±1,5 K and having a nominal diameter of 0,25 mm is placed beside the steam tube and approximately 5 mm away and 20 mm below the marking for level 2 of the glass container.

The steam function of the appliance is then operated under the same conditions described in 27.1 for 120 s.

The temperature T_{120} of the heated-up water shall be measured with a temperature-recording instrument. The measurement shall be accurate to ±3 K.

The rise in temperature ΔT shall be determined and noted.

The rise in temperature ΔT is calculated as follows:

$$\Delta T = T_{120} - T_W$$

The result of the test is the rise in temperature ΔT for the heated-up water expressed in K rounded off to 1 K.

The mass M_{L5} of the glass container with the heated-up water including absorbed water from the steam function shall be determined on a balance having an accuracy of at least 0,1g and noted.

The mass M_{L5} is expressed in grams.

[C] NOTE 1 [C] Special care has to be taken to collect any dripping water after the test. The measurement of the mass of the water, including water from the steam function, has to be made after the dripping from the steam tube has finished.

The steam (water) absorption M_{ST} of the heated-up water shall be determined and noted.

The steam (water) absorption M_{ST} of the heated-up water is calculated as follows:

$$M_{ST} = M_{L5} - M_{L4}$$

The result of the test is the steam (water) absorption M_{ST} of the heated-up water and is expressed in grams per 0,2 l of water and rounded off to [C] 0,1 g [C].

[C] NOTE 2 [C] If the manufacturer does not describe the steam function to heat-up water this test is not carried out. [A2]

〚C〛 Bibliography

ISO/NP 3310-1, *Test sieves -- Technical requirements and testing -- Part 1: Test sieves of metal wire cloth*[1)] 〚C〛

1) Under development.

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