

INTERNATIONAL STANDARD



AMENDMENT 2

Electric dishwashers for household use – Methods for measuring the performance



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IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

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FOREWORD

This amendment has been prepared by subcommittee 59A: Electric dishwashers, of IEC technical committee 59: Performance of household and similar electrical appliances.

The text of this amendment is based on the following documents:

CDV	Report on voting
59A/152/CDV	59A/160/RVC

The decision, given in the report on voting indicated in the above table, was modified at the SC59A meeting held in Melbourne, Australia on 21 October 2011. In point 8 of the minutes of the meeting, document 59A/162/RM, the decision 1/11 was given to move this amendment directly to publication without passing through the FDIS document stage.

Full information on the voting for the approval of this amendment can be found in the report on voting indicated in the above table.

The committee has decided that the contents of this amendment and the base publication will remain unchanged until the stability 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- withdrawn,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.

A bilingual version of this publication may be issued at a later date.

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INTRODUCTION

This second amendment to the third edition of IEC 60436 (2004) covers the five following issues:

- An illustration for the through-circulation thermal cabinet to indicate the position of temperature sensors and a new position for the basket to prevent partial blockage of the inlet air path which will improve the consistency of the oven drying results. Furthermore an improved calibration procedure of the oven temperatures is included. It applies to Annex G of IEC 60436:2004.
- Revised small bowl specification – the current bowl (named “small serving bowl” as well as “fruit bowl”) is out of production and will become unavailable as the existing stock is depleted. This alternate bowl is necessary. This bowl (“dessert bowl”) has been tested and found to be acceptable. Throughout the standard the names “small serving bowl” and the “fruit bowl” have been changed to “dessert bowl”. This applies to Clause 6, Annex A and Annex B of IEC 60436:2004.
- The inclusion of standby power to cover the relevant low power modes for dishwashers as a new Annex O which references IEC 62301 for the measurement method. This Annex O is based on Annex L of draft 59D/343/CDV for washing machines and has been modified to be suitable for dishwashers.
- A more detailed description on how to calibrate and work with the new microwave oven was introduced with IEC 60436, Amendment 1:2009.
- Alternative replacement cutlery items for Annex A are described in A.2 and A.3.

2 Normative references

Add the following new reference:

IEC 62301, *Household electrical appliances – Measurement of standby power*

3 Terms and definitions

Add the following new definitions:

3.16

off mode

mode where the product is switched off using appliance controls or switches that are accessible and intended for operation by the user during normal use to attain the lowest power consumption that may persist for an indefinite time while connected to a mains power source, and used in accordance with the manufacturer's instructions

NOTE 1 Where there are no controls, the dishwasher is left to revert to a steady state power consumption of its own accord.

NOTE 2 Where the dishwasher has no power switch intended for the user to activate off mode, then off mode is effectively the same as left on mode.

3.17

left on mode

the lowest power consumption mode that may persist for an indefinite time after the completion of the programme and unloading of the machine without any further intervention of the user

NOTE In some products, this mode may be an equivalent power to off mode.

3.18

delay start mode

the average power consumption of the mode where the user has selected a specified delay to the commencement of the programme. This mode is only applicable to dishwashers that provide a delay start function for the user

NOTE Delay start mode is a short duration (temporary) mode so the duration should always be stated with the power or energy consumption. The frequency of use and the duration selected will depend on a number of factors and may vary considerably across individual users.

6.4.1.2 Conversion

Replace the contents of the subclause by the following:

If the power levels of the microwave oven used are not equal to the rated values (780 W and 150 W) according to Annex G but within the given tolerances the heating times shall be corrected as follows:

BOSCH¹ model HMT752F

Approved microwave
oven for tests

$$t_{u,1} = \frac{P_1 \cdot t_1}{P_{u,1}} \quad t_{u,1} = \frac{P_1 \cdot Z}{P_{u,1}} \quad (Z.1)$$

$$t_{u,2} = \frac{P_2 \cdot t_2}{P_{u,2}} \quad t_{u,2} = \frac{P_2 \cdot t_2}{P_{u,2}} \quad (Z.2)$$

where

P_1 is 780 W

P_2 is 150 W

t_1 is 4 min

t_2 is 10 min

Z is the recommended time setting in min in the attached data sheet which will be delivered together with the microwave oven as described in G.1

$P_{u,1}$ is the actual max. power level used in W (measured according to IEC 60705)

$t_{u,1}$ is the corresponding heating time to be used in min

$P_{u,2}$ is the actual reduced power level used in W [determined by Equation (Z.3)]

$t_{u,2}$ is the corresponding actual heating time to be used in min.

$$P_{u,2} = \frac{P_{u,1}}{t_p} (t_{on} - t_{up}) \quad (Z.3)$$

where

t_p is the time of the elementary period of the magnetron in the microwave oven at the reduced power level in s;

¹ "Bosch HMT752F" is the trade name of a product supplied by Bosch. This information is provided for the convenience of users of this international standard and does not constitute an endorsement by the IEC of this trademark. Items of the similar specification may be used if they can be shown to lead to equivalent results.

t_{on} is the time the microwave oven is on within the elementary period in s.

t_{up} is 1,6 s, which is the magnetron filament heating-up time

Use levels, which are close to the rated levels.

6.4.1.3 Pre-heating the microwave oven

Replace the contents of the subclause by the following:

Before cooking the milk in the glasses, heat up the microwave oven as follows:

Place six glasses, each filled with 50 ml of water, in the microwave oven;

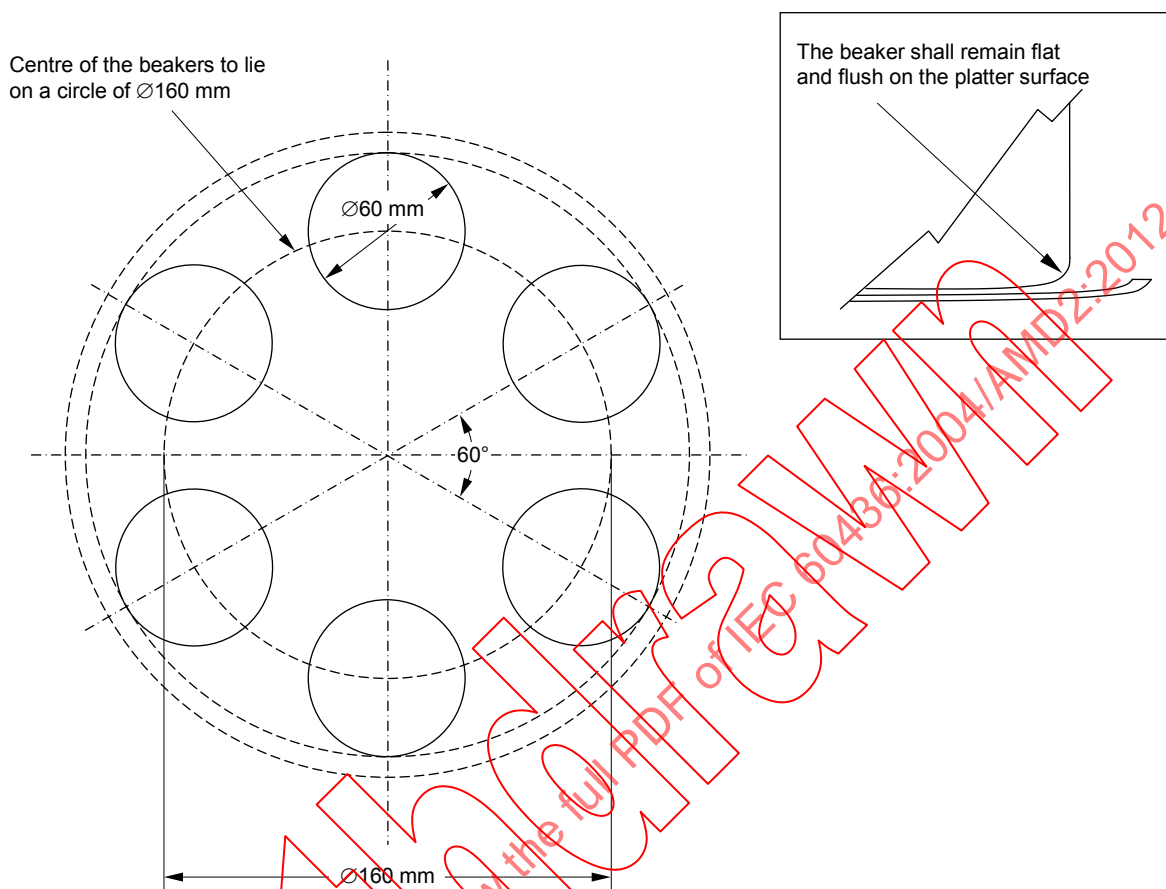
Place the glasses symmetrically in a circle of 160 mm diameter (centre of the circle = centre of the glass turntable). See Figure 1.

Operate the microwave oven for 4 or respectively Z min depending on the oven type (see above) at a power level of 780 W and then for 10 min at a power level of 150 W, or at the corrected cooking times calculated above for the power level used. The time Z can be found in the technical instructions for the particular microwave.

After pre-cooking, take the water-filled glasses out of the microwave oven.

Figure 1 – Position of the glasses on the microwave turntable

Replace Figure 1 as follows:



IEC 214/12

A.2 Place setting specifications

In the table, replace rows 7 to 11 with the following new rows:

7	Fork	188 mm	WMF "Signum"	Dessert Fork "1900"	
8	Soup spoon	190 mm	WMF "Signum"	Dessert Spoon "1900"	
9	Knife	209 mm	WMF "Gastro"	Table Knife 18/10 "0800"	
10	Teaspoon	136 mm	WMF "Signum"	Tea / Coffee Spoon "1900"	
11	Dessert spoon	156 mm	WMF "Signum"	Coffee / Tea Spoon "1900"	

Replace the second dashed item after the table by the following:

- Cutlery: approximately 213 g

A.3 Serving piece specifications

A.3.1

In the table, replace row 14 with the following new row:

14	Dessert bowl	130 mm.	Corning #6003899	Corelle®	Winter Frost White
----	--------------	---------	------------------	----------	--------------------

In the table, replace rows 15 to 17 with the following new rows:

15	Two serving spoons	260 mm	WMF "Supplement"	Chafing Dish Spoon	
16	Serving fork	190 mm	WMF "Supplement"	Serving Fork	
17	Gravy ladle	180 mm	WMF "Supplement"	Gravy Ladle	

Replace the first and second dashed items after the table by the following:

- Crockery: 1 310 g $\pm$ 30 g
- Cutlery: approximately 233 g

Add the following note:

NOTE "Corelle" is a trademark. This information is provided for the convenience of users of this international standard and does not constitute an endorsement by the IEC of this trademark. Items of similar specification may be used if they can be shown to lead to equivalent results.

A 3.2

Replace the first and second dashed items after the table by the following:

- Crockery: 1 950 g $\pm$ 50 g
- Cutlery: approximately 233 g

B.2 Place setting specifications

In the table, replace row 2 with the following new row:

2	Dessert bowl	130 mm	Corning #6003899	Corelle®	Winter Frost White
---	--------------	--------	------------------	----------	--------------------

Replace the first dashed item after the table by the following:

- Crockery + glass: 1 060 g $\pm$ 30 g

B.3.1

In the table, replace row 14 by the following new row:

14	Dessert bowl	130 mm	Corning #6003899	Corelle®	Winter Frost White
----	--------------	--------	------------------	----------	--------------------

Replace the first dashed item after the table by the following:

- Crockery: 980 g ± 25 g

B.3.2

In the second paragraph, replace the first dashed item by the following:

- Crockery: 1 605 g ± 40 g

B.4 Concordance with load items in Annex A

In the table, replace rows 2 and 14 by the following new rows:

2	Soup Plate	2	Dessert Bowl
14	Dessert Bowl	14	Dessert Bowl (same as 2)

F.8

Modify as follows:

A through-circulation thermal cabinet that complies with the specification in G.2 may be obtained from:

Memmert GmbH + Co. KG
Postfach 1720
D – 91126 SCHWABACH
Germany

Tel: + 49 9122 9250
Fax: + 49 9122 14 585
sales@memmert.com

F.9

Modify as follows:

A microwave oven that complies with the specification in G.1 may be obtained from:

Bosch-Siemens-Hausgeraete GmbH
Mr. Kleiber, Abt. FDG/MWD
Robert-Bosch-Str. 16
D – 89407 DILLINGEN/DONAU
Germany

Fax: +49 9071 52 1503
werner.kleiber@bshg.com

G.1 Microwave oven

Replace the first sentence between brackets by the following:

Examples of products that comply with this specification are BOSCH HMT 752 F and BOSCH HMT 742 C.

G.2 Through-circulation thermal cabinet

Replace the contents of the clause by the following:

(An example of a product that complies with this specification is Memmert UFP 800-DW-D1 [see F.8])

This includes the necessary loading set.

The through-circulation thermal cabinet shall guarantee that the sample of test soil is uniformly dried.

Temperatures shall be recorded during the calibration run.

NOTE 1 All thermal cabinets with a high heating and circulating capacity fulfil these requirements.

NOTE 2 Thermal cabinets with a low heating and circulating output will still meet these requirements if they are filled with fewer items. A reduction of the heating-up period may be taken into consideration.

NOTE 3 “Bosch” and “Mettler” are trade marks. This information is provided for the convenience of users of this international standard and does not constitute an endorsement by the IEC of this trade mark. Items of the similar specification may be used if they can be shown to lead to equivalent results.

The air flow rate shall be provided with internal circulation only and any outside air vents shall be closed. Air flow rate shall be switched onto the setting “max”.

The oven shall have a volume of 750 l.

Oven shall have eight wire shelves with a dimension of 1030 mm × 530 mm for loading of 24 place settings.

Performance requirements (to be conducted with unsoiled dishes prior to actual testing; this confirmation should be conducted every 6 months):

Load 24 place settings into the oven as outlined in Figure G.2;

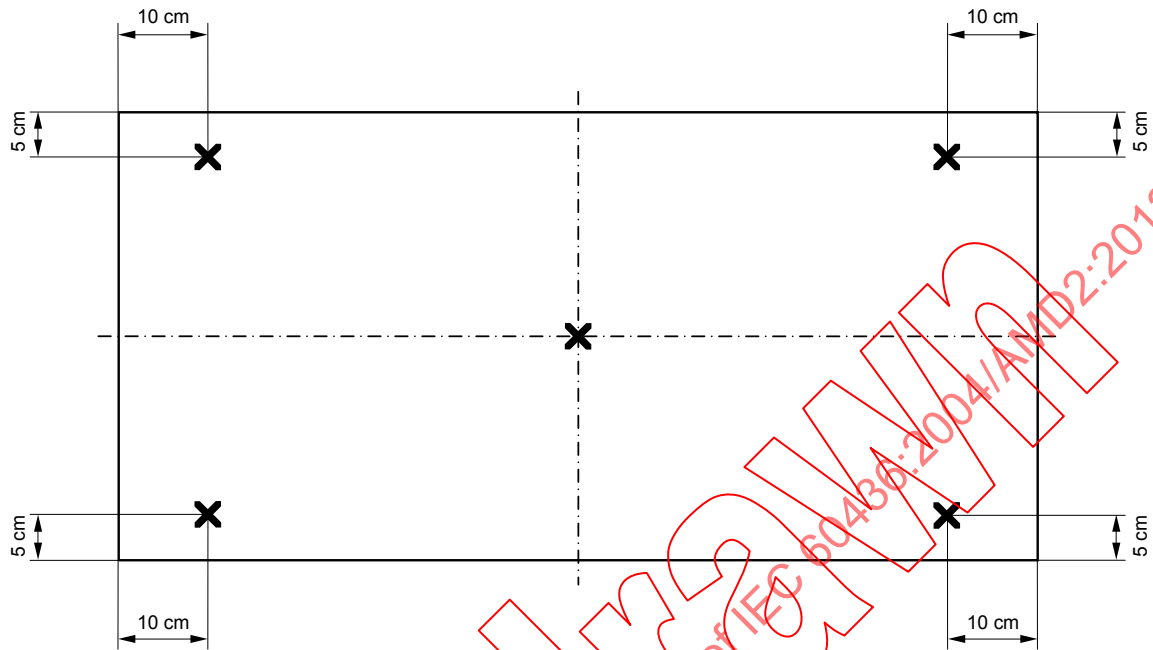
In order to determine if the oven is heating properly, place temperature sensor as outlined in Figures G.1 and G.2.

With a starting temperature of $23\text{ °C} \pm 2\text{ K}$, the oven should reach at each temperature sensor location a temperature of $80\text{ °C} - 10\text{ K}$ for the first time at 60 min after the start.

During the heat rise, the difference between thermocouples at each temperature sensor location shall be within $\pm 5\text{ K}$.

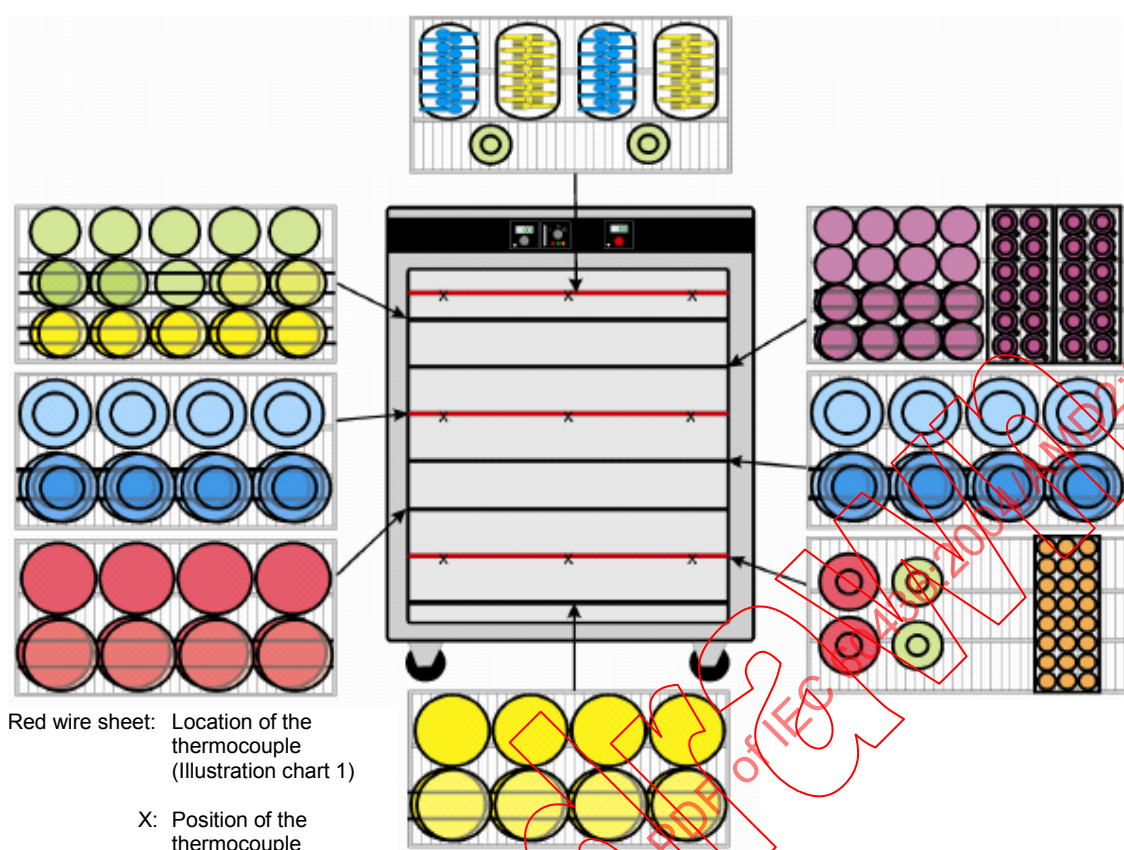
At any time after 90 min the temperature at all measuring points shall be $80\text{ °C} \pm 2\text{ K}$.

Add the following new Figures G.1 and G.2:



IEC 215/12

Figure G.1 – Illustration chart 1: Location of the thermocouple on upper, intermediate and lower wire sheet



IEC 216/12

Key:

soil	colour
milk	orange
tea	violet
minced meat	red
egg	yellow
oat flakes	blue
spinach	green

Figure G.2 – Illustration chart 2: The thermal cabinet filled with dishes (pictures of the soiled items)

Add the following new Annex O:

Annex O (normative)

Additional aspects of the energy consumption of dishwashers **[based on 59D/343/CDV]**

O.1 General

This annex sets out the determination of off mode power, left on mode power and delay start mode power. The first two are steady state modes that can persist for an indefinite period while delay start mode is a short duration mode associated with active mode (selection and use of a particular programme). These are the only three low power modes specified in this International Standard. Other low power modes may exist in some products, but for the current designs of dishwashers, these are not considered important in terms of duration and energy consumption.

This annex also provides some general information about other aspects of power consumption for dishwashers when they are not performing their main function (see O.5).

O.2 Determination of off mode power

Where off mode power is determined, it shall be determined in accordance with this clause.

The dishwasher is operated through a performance assessment in accordance with Clauses 7 and 8. At the completion of the programme the dishwasher is unloaded as specified in Clause 8. For determination of this mode, the dishwasher is then switched off in accordance with the manufacturers' instructions and left to revert to a steady state power consumption of its own accord. Where there is no power switch, the dishwasher is left to revert to a steady state power consumption of its own accord.

NOTE 1 Normally, this mode can be determined in conjunction with a performance test run to this International Standard. However, if separate measurement of this mode is required, operating the test dishwasher through any selected programme using any soiled load washed and a suitable programme is likely to provide an accurate result. Where the dishwasher has no power switch intended for the user to activate off mode, then off mode is effectively the same as left on mode.

Ensure that the following conditions remain relevant for the duration of the measurement:

- appliance connected to mains power for the duration of the test;
- no adverse warning indicators (including rinse aid and salt indicators, where applicable) are present (normally no lights or indicators are active in this mode);
- laboratory supply water is left on at the specified pressure;
- no network is connected to the product;
- where no network is present, the manufacturer's instructions regarding configuration are followed.

At the completion of the programme and after unloading of the dishwasher, the door remains unlatched unless the manufacturer recommends that the door remains latched when the appliance is not in use. Power measurements in off mode shall then be determined for a period of not less than 30 min once the appliance has reached a steady state condition. Off mode measurements shall only be determined where it is certain that the power level measured persists in a steady state condition for an indefinite period without user intervention. Power measurements for this mode shall be in accordance with the requirements of IEC 62301.

NOTE 2 In some products, some short term duration operations may be present for a period after off mode is initiated or after the power supply is initially connected. The position of the door can affect this mode in some products. If the manufacturer recommendations are unclear, a reading with the door open and closed should be taken. For a dishwasher, the term latched means that the door is closed and the door interlock is engaged so that the product could operate if required. Unlatched means that the door is at least partially open so that the interlock is not engaged. Care is required if a light activates when the door opens.

From these measurements, determine the average off mode power.

Manufacturers or suppliers may have information on the design and operation of their dishwashers which would allow an accurate determination of this mode through methods other than the method specified above. For the purposes of declaration, a manufacturer or supplier may use any method which gives an equivalent result to the method specified above. For verification purposes, the method specified above has precedence over any other determination.

O.3 Determination of left on mode power

Where left on mode power is determined, it shall be determined in accordance with this clause.

The dishwasher is operated through a performance assessment in accordance with Clauses 7 and 8. At the completion of the programme the dishwasher is unloaded as specified in Clause 8. For determination of this mode, no action is taken by the operator to switch off the dishwasher (i.e. do not initiate off mode) after it has been unloaded. The dishwasher is left to revert to a steady state power consumption of its own accord.

NOTE 1 Normally, this mode can be determined in conjunction with a performance test run to this International Standard. However, if separate measurement of this mode is required, operating the test dishwasher through any selected programme using any soiled load washed and a suitable programme is likely to provide an accurate result. This mode is not applicable where the user has to turn the product off to unload it.

Ensure that the following conditions remain relevant for the duration of the measurement:

- appliance connected to mains power for the duration of the test;
- no adverse warning indicators (including rinse aid and salt indicators, where applicable) are present (some lights or indicators may be active in this mode);
- laboratory supply water is left on at the specified pressure;
- no network is connected to the product;
- where no network is present, the manufacturer's instructions regarding configuration are followed.

At the completion of the programme and after unloading of the dishwasher, the door remains unlatched unless the manufacturer recommends that the door remains latched when the appliance is not in use. Power measurements in left on mode shall then be determined for a period of not less than 30 min once the appliance has reached a steady state condition. Left on mode measurements shall only be determined where it is certain that the power level measured persists in a steady state condition for an indefinite period without user intervention. Power measurements for this mode shall be in accordance with the requirements of IEC 62301.

NOTE 2 In some products, some short term duration operations may occur after the completion of the programme. In some products, this mode may revert to a state which is equivalent to off mode (where there is an auto off). The position of the door can affect this mode in some products. If the manufacturer recommendations are unclear, a reading with the door open and closed should be taken. For a dishwasher, the term latched means that the door is closed and the door interlock is engaged so that the product could operate if required. Unlatched means that the door is at least partially open so the interlock is not engaged. Care is required if a light activates when the door opens.

From these measurements determine the average left on mode power.

Manufacturers or suppliers may have information on the design and operation of their dishwashers which would allow an accurate determination of this mode through methods other than the method specified above. For the purposes of declaration, a manufacturer or supplier may use any method which gives an equivalent result to the method specified above. For verification purposes, the method specified above has precedence over any other determination.

O.4 Determination of delay start mode power

Where delay start mode power is determined, it shall be determined in accordance with this clause. This mode is only applicable to dishwashers with a built-in delay start function.

The dishwasher is loaded with a test load ready for operation. For determination of this mode, a programme is selected and a user programmed delay of 3 hours is selected by the operator. The average power consumption during this period is determined.

NOTE There may be some small differences in the measured power consumption for different programmes. In this case, the programme name measured shall be stated with the measured power value. Where the display changes during the timer countdown, there may be some small variations in power consumption during this mode. This mode is not applicable where a user programmed delay start option is not available. For this measurement, the test load may be clean.

Ensure that the following conditions remain relevant for the duration of the measurement:

- appliance connected to mains power for the duration of the test;
- no adverse warning indicators (including rinse aid and salt indicators, where applicable) are present (some lights or indicators are normally active in this mode);
- laboratory supply water is left on at the specified pressure;
- no network is connected to the product;
- where no network is present, the manufacturer's instructions regarding configuration are followed.

Once the dishwasher is loaded, latch the door and keep it latched for the duration of the test. For a dishwasher, the term "latched" means that the door is closed and the door interlock is engaged so that the product could operate if required. Unlatched means that the door is at least partially open so the interlock is not engaged. Care is recommended if a light activates when the door opens. Select the programme to be measured (programme recommended for normal daily use as a default) and programme a delay start period of 3 hours (or as close as possible to 3 hours if 3 hours cannot be selected). Power measurements in delay start mode shall commence from the moment the delay start mode is activated and shall continue until the program starts (or within 5 min of the programme start). Power measurements for this mode shall be in accordance with the requirements of IEC 62301.

From these measurements determine the average delay start mode power. The duration of the period used to determine that delay start mode power shall also be stated with power or energy consumption for this mode.

Manufacturers or suppliers may have information on the design and operation of their dishwashers which would allow an accurate determination of this mode through methods other than the method specified above. For the purposes of declaration, a manufacturer or supplier may use any method which gives an equivalent result to the method specified above. For verification purposes, the method specified above has precedence over any other determination.