

BS EN 50242:2016
BS EN 60436:2016



BSI Standards Publication

Electric dishwashers for household use — Methods for measuring the performance (IEC 60436:2004, modified + A1:2009, modified + A2:2012, modified)



National foreword

This British Standard is the UK implementation of EN 50242:2016 (dual numbered as EN 60436:2016). It is derived from IEC 60436:2004 incorporating amendment 1:2009 and amendment 2:2012. It supersedes BS EN 60436:2008+A11:2012 which will be withdrawn on 11 April 2018.

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 **Ⓒ** **Ⓒ**.

The UK participation in its preparation was entrusted by Technical Committee CPL/59, Performance of household electrical appliances, to Subcommittee CPL/59/1, Dishwashers and washing machines.

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

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EUROPEAN STANDARD
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EN 60436

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English Version

**Electric dishwashers for household use -
Methods for measuring the performance
(IEC 60436:2004 , modified + A1:2009 , modified
+ A2:2012 , modified)**

Lave-vaisselle électriques à usage domestique -
Méthodes de mesure de l'aptitude à la fonction
(IEC 60436:2004 , modifiée + A1:2009 , modifiée
+ A2:2012 , modifiée)

Elektrische Geschirrspüler für den Hausgebrauch -
Messverfahren für Gebrauchseigenschaften
(IEC 60436:2004 , modifiziert + A1:2009 , modifiziert
+ A2:2012 , modifiziert)

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

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European foreword

This document (EN 50242:2016 / EN 60436:2016) consists of the text of IEC 60436:2004, IEC 60436:2004/A1:2009 and IEC 60436:2004/A2:2012 prepared by SC 59A "Electric dishwashers" of IEC/TC 59 "Performance of household and similar electrical appliances", together with the common modifications prepared by 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 (dop) 2017-04-11
at national level by publication of an identical
national standard or by endorsement
- latest date by which the national standards conflicting (dow) 2018-04-11
with this document have to be withdrawn

This document supersedes EN 50242:2008 / EN 60436:2008.

EN 50242:2016 / EN 60436:2016 includes the following significant technical changes with respect to EN 50242:2008 / EN 60436:2008:

- a) introduction of new combined cleaning and drying performance assessment (Clause 7);
- b) new data on expanded measurement uncertainty (Annex ZB);
- c) new Annexes ZZA, ZZB and ZZC.

Clauses, subclauses, notes, tables, figures and annexes which are additional to those in IEC 60436:2004, IEC 60436:2004/A1:2009 and IEC 60436:2004/A2:2012 are prefixed "Z".

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This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For the relationship with Regulations (EU) No 1059/2010, (EU) No 1016/2010 and (EC) No 1275/2008, see informative Annexes ZZA, ZZB and ZZC, which are integral parts of this document.

Endorsement notice

The text of the International Standard IEC 60436:2004, IEC 60436:2004/A1:2009 and IEC 60436:2004/A2:2012 was approved by CENELEC as a European Standard with agreed common modifications.

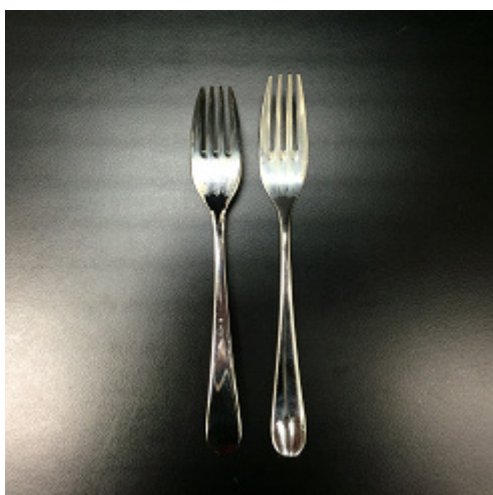
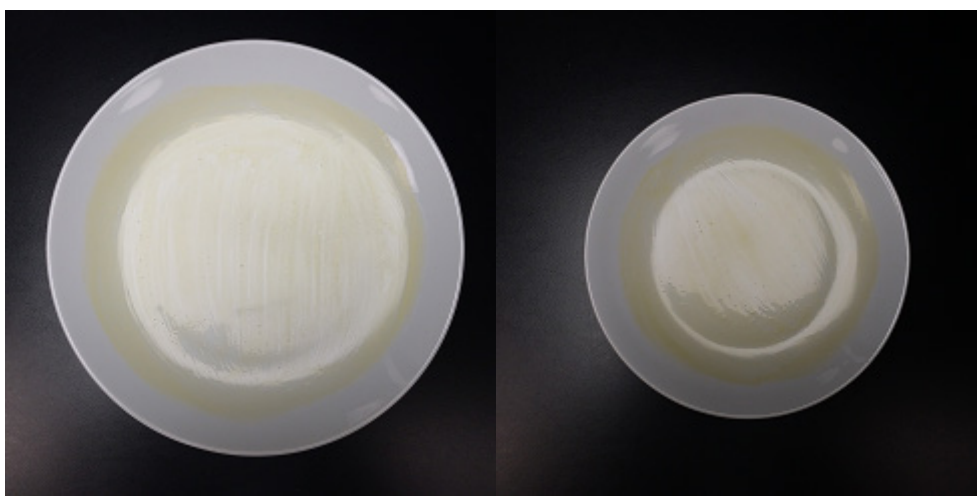
Annex ZA (informative)

Pictures of the soiled items

Minced meat: Half of total number of dinner plates and the large serving bowl



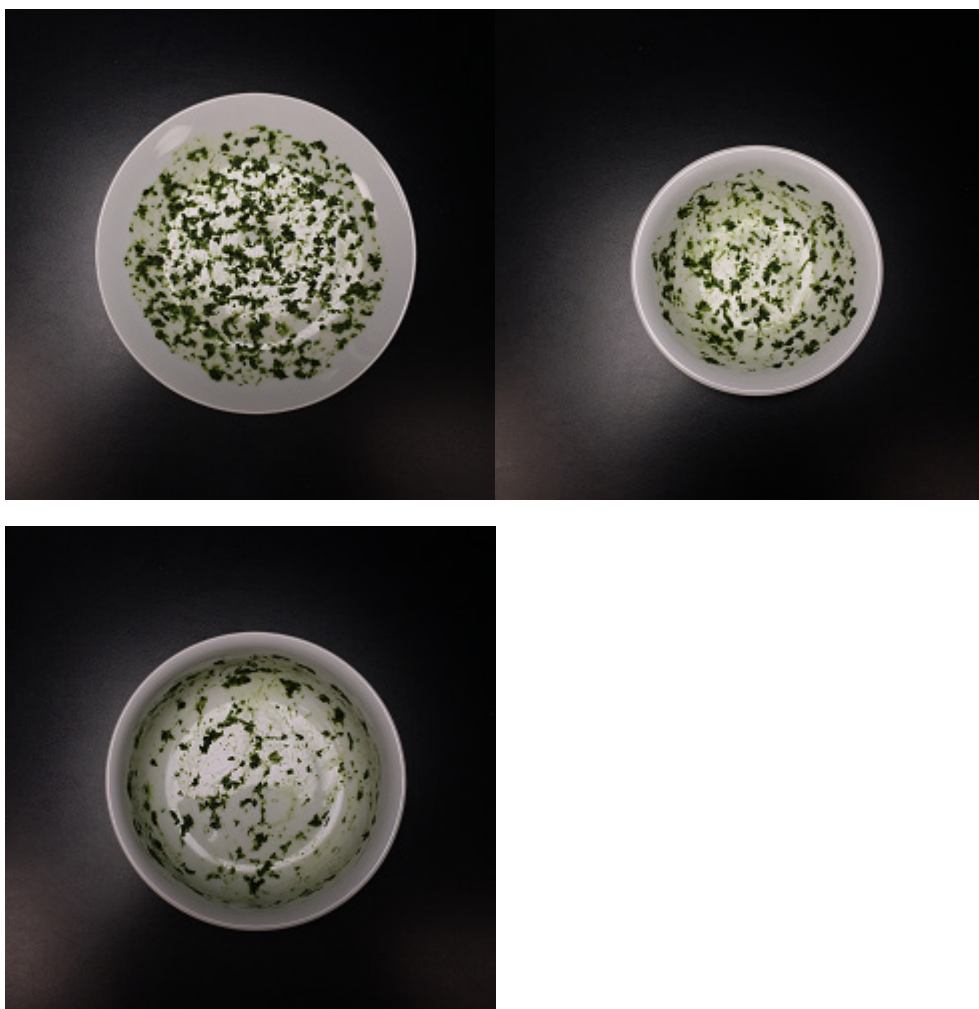
Egg yolk: All forks, half of total number of dinner plates and dessert plates



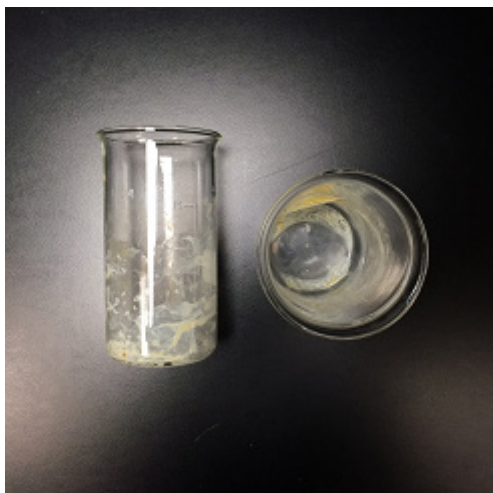
Oat flakes: All soup spoons and all soup plates (pictures were made after oven drying)



Spinach: Half of the total number of dessert plates, the dessert bowl and the medium serving bowl



Milk: All glasses



Tea: Cup and saucer
(pictures were made after oven drying)



Margarine: Oval platter



Annex ZB (informative)

Uncertainty of measurements

Following IEC/TR 61923 “Household electrical appliances – Method of measuring performance – Assessment of repeatability and reproducibility”, the following expanded uncertainties for measurements according to this European Standard may be assumed.

In 2014, a round robin test was performed with 17 laboratories participating from all over Europe. One of the objectives was to check the robustness and precision of the Combined Cleaning and Drying Evaluation. Four samples of two types of automatic dishwashers were tested in two different cleaning cycles. These machines under test were calibrated to be as identical to each other as possible and delivered to all participating laboratories.

Results were analysed by CLC/TC 59X/WG 2, and expanded uncertainties were calculated as shown in Table ZB.1.

Table ZB.1 – Relative expanded uncertainty ^a of measured values of this European Standard

Measured parameter	Relative expanded uncertainty of measured value ^b ($k = 2$)
Cleaning performance index I_C	16 %
Drying performance index I_D	10 %
Total energy consumption	5 %
Total water consumption	4 %
Total programme time	2 %
Low power mode energy consumption	^c
Noise (in re 1 pW)	^c
^a The expanded uncertainty only describes the uncertainty of the measuring method while the variance of the product is not included. ^b These values are the average of measurement figures taken from a low and a high end machine. ^c Not measured in this ring test.	

Annex ZC
(informative)

Tolerances and control procedures

The tolerances and control procedures are given in the relevant annexes of the Commission Delegated Regulation (EU) No 1059/2010 of 28 September 2010 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling of household dishwashers and in accordance with the Commission Regulation (EU) No 1016/2010 of 10 November 2010 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for household dishwashers.

Annex ZD
(informative)

Template for test report

Table ZD.1 – Test report template

Test - Template			
Test Number:		Date:	
Dishwasher Details			
<u>Test Machine</u>		<u>Reference Machine</u>	
	<i>Manufacturer:</i>		
	<i>Brand:</i>		
	<i>Model:</i>		
	<i>Serial No.:</i>		
	<i>Rated Voltage (V):</i>		
	<i>Rated Frequency (Hz):</i>		
	<i>Manufacturing date:</i>		
	<i>Name of test program:</i>		
	<i>Rinse aid settings:</i>		
	<i>Water softener settings:</i>		
	<i>Detergent:</i>		
	<i>Batch of Detergent:</i>		
	<i>Quantity of Detergent for prewash/mainwash (g):</i>		
	<i>Rinse agent:</i>		
	<i>Batch of Rinse agent:</i>		
	<i>Salt (Type and Brand):</i>		
Label Description:			
<i>Energy Class:</i>		<i>Drying Class:</i>	
<i>Energy consumption (AE_c=kWh/a):</i>		<i>Place Settings (ps):</i>	
<i>Water consumption (AW_c=l/a):</i>		<i>Noise emission (dB):</i>	

Test Results									
	Number of tests n≥5								
	1	2	3	4	5		Ø	yearly	Index
Energy ($E_t=kWh$):									
Water (l):									
Programme time ($T_t=min.$):									
Max water temp. Cleaning ($^{\circ}C$):									
Max water temp. Rinsing ($^{\circ}C$):									
Cleaning Test ($C_{T,i}$):									
Cleaning Ref. ($C_{R,i}$):									
Cleaning Index (I_C):									
Cleaning Confidence Interval ($ln W_C$):									
Drying Test ($D_{T,i}$):									
Drying Ref. ($D_{R,i}$):									
Drying Index (I_D):									
Drying Confidence Interval ($ln W_D$):									
Off-Mode ($P_0=W$):									
Left-On-Mode ($P_l=W$):									
Duration of Left-On-Mode ($T_l=min.$):									
Noise emission (dB(A) re 1pW):									
Laboratory Details									
Lab Name:						Test Officer(s):			
Test Date:									
Test Conditions									
	Tolerance		Test Value						
Test Voltage (V):	230 V ± 1 %								
Frequency (Hz):	50 Hz ± 1 %								
Crest Factor:	1,34 < CF < 1,49								
Distortion factor (%):	< 2 %								
Ambiente Temperature ($^{\circ}C$):	23 $^{\circ}C$ ± 2 K								
Relative Humidity (%):	55 % ± 5 %								
Water Supply ($^{\circ}C$):	15 $^{\circ}C$ ± 2 K								
Flow rate pressure (bar):	240 kPa ± 20 kPa								
Water Hardness [mmol / l (Ca+Mg)]:	2,5 mmol / l ± 0,5 mmol / l								

NOTE If completed and correctly filled out, the test template in Table ZD.1 contains all relevant requirements of Regulations (EU) No 1059/2010, (EU) No 1016/2010 and (EC) No 1275/2008.

Annex ZZA (informative)

Relationship between this European Standard and the energy labelling requirements of Commission Delegated Regulation (EU) No 1059/2010 aimed to be covered

This European Standard has been prepared under a Commission's standardization request M/481 'Mandate to CEN, CENELEC and ETSI for standardization in the field of household dishwashers' to provide one voluntary means of conforming to the energy labelling requirements of *Commission Delegated Regulation (EU) No 1059/2010 of 28 September 2010 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling of household dishwashers* [OJ L 314, 30.11.2010].

Once this standard is cited in the Official Journal of the European Union under that Regulation, compliance with the normative clauses of this standard given in Table ZZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding energy labelling requirements of that Regulation and associated EFTA regulations.

Table ZZA.1 – Correspondence between this European Standard and Commission Delegated Regulation (EU) No 1059/2010 of 28 September 2010 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling of household dishwashers [OJ L 314, 30.11.2010] and Commission's standardization request M/481

Energy labelling requirements of Regulation (EU) No 1059/2010 [OJ L 314, 30.11.2010]	Clause(s) / sub-clause(s) of this EN	Remarks / Notes
Determination of the energy efficiency class, annual energy consumption	1 Scope 2 Normative references 3 Definitions related to the appliance 5 General conditions for measurements 8 Energy consumption, water consumption and time Annex O Additional aspects of the energy consumption of dishwashers	
Determination of annual water consumption	8 Energy consumption, water consumption and time	
Determination of the drying efficiency index	6 Combined cleaning and drying performance tests 7 Combined cleaning and drying performance assessment 7.3 Determination of the drying performance	
Determination of the programme time	8 Energy consumption, water consumption and time	
Determination of acoustical noise emission	9 Airborne acoustical noise	

WARNING 1 — Presumption of conformity stays valid only as long as a reference to this European Standard is maintained in the list published in the Official Journal of the European Union. Users of this standard should consult frequently the latest list published in the Official Journal of the European Union.

WARNING 2 — Other Union legislation may be applicable to the products falling within the scope of this standard.

Annex ZZB (informative)

Relationship between this European Standard and the ecodesign requirements of Commission Regulation (EU) No 1016/2010 aimed to be covered

This European Standard has been prepared under a Commission's standardization request M/481 'Mandate to CEN, CENELEC and ETSI for standardization in the field of household dishwashers' to provide one voluntary means of conforming to the ecodesign requirements of *Commission Regulation (EU) No 1016/2010 of 10 November 2010 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for household dishwashers* [OJ L 293, 11.11.2010].

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Table ZZB.1 – Correspondence between this European Standard and Commission Regulation (EU) No 1016/2010 of 10 November 2010 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for household dishwashers [OJ L 293, 11.11.2010] and Commission's standardization request M/481

Ecodesign requirements of Regulation (EU) No 1016/2010 [OJ L 293, 11.11.2010]	Clause(s) and sub-clause(s) of this EN	Remarks / Notes
Determination of the energy efficiency index	1 Scope 2 Normative references 3 Definitions related to the appliance 5 General conditions for measurements 8 Energy consumption, water consumption and time Annex O Additional aspects of the energy consumption of dishwashers	
Determination of the cleaning efficiency index	6 Combined cleaning and drying performance tests 7 Combined cleaning and drying performance assessment 7.4 Determination of the cleaning performance	
Determination of the drying efficiency index	6 Combined cleaning and drying performance tests 7 Combined cleaning and drying performance assessment 7.3 Determination of the drying performance	
Determination of the programme time	8 Energy consumption, water consumption and time	
Determination of power consumption in off-mode and left-on mode, duration of left-on mode	Annex O Additional aspects of the energy consumption of dishwashers	

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Annex ZZC (informative)

Relationship between this European Standard and the ecodesign requirements of Commission Regulation (EC) No 1275/2008 aimed to be covered

This European Standard has been prepared under a Commission's standardization request M/439 'Mandate to CEN, CENELEC and ETSI for standardization in the field of standby and off modes power consumption measurement for energy using products (EuPs)' to provide one voluntary means of conforming to the ecodesign requirements of *Commission Regulation (EC) No 1275/2008 of 17 December 2008 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for standby and off mode electric power consumption of electrical and electronic household and office equipment* [OJ L 339, 18.12.2008].

Once this standard is cited in the Official Journal of the European Union under that Regulation, compliance with the normative clauses of this standard given in Table ZZC.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding ecodesign requirements of that Regulation and associated EFTA regulations.

Table ZZC.1 – Correspondence between this European Standard and Commission Regulation (EC) No 1275/2008 of 17 December 2008 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for standby and off mode electric power consumption of electrical and electronic household and office equipment [OJ L 339, 18.12.2008] and Commission's standardization request M/481

Ecodesign requirements of Regulation (EC) No 1275/2008 [OJ L 339, 18.12.2008]	Clause(s) / sub-clause(s) of this EN	Remarks / Notes
Power consumption requirements for standby- and off-mode	Annex O Additional aspects of the energy consumption of dishwashers	

WARNING 1 — Presumption of conformity stays valid only as long as a reference to this European Standard is maintained in the list published in the Official Journal of the European Union. Users of this standard should consult frequently the latest list published in the Official Journal of the European Union.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRIC DISHWASHERS FOR HOUSEHOLD USE – METHODS FOR MEASURING THE PERFORMANCE

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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This Consolidated version of IEC 60436 bears the edition number 3.2. It consists of the third edition (2004) [documents 59A/114A/FDIS and 59A/116/RVD], its amendment 1 (2009) [documents 59A/138/CDV and 59A/139/RVC] and its amendment 2 (2012) [documents 59A/152/CDV and 59A/160/RVC]. The technical content is identical to the base edition and its amendments.

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendments 1 and 2. Additions and deletions are displayed in red, with deletions being struck through. A separate Final version with all changes accepted is available in this publication.

This publication has been prepared for user convenience.

International Standard IEC 60436 has been prepared by subcommittee 59A: Electric dishwashers, of IEC technical committee 59: Performance of household electrical appliances.

This bilingual version (2013-07) corresponds to the monolingual English version, published in 2012-04.

Major changes introduced in this edition include

- changes made to the soils used in the standard;
- the use of an oven and microwave oven to dry the soils;
- the alternate 15 to 18 hour air dry method to dry the soils;
- the addition of a reference dishwasher;
- the recognition of alternate supply voltages and frequencies;
- the recognition of a cold or hot water supply to the dishwasher;
- the detergent and rinse aid compositions have been updated to reflect current technology;
- the addition of the Aham load;
- the evaluation of the filter systems;
- the modification of the scoring system from 2 to 5 grades;
- the definition of program and cycle time;
- the temperature correction for energy testing;
- harmonization of ambient conditions.

The French versions of this standard and its amendment 1 and 2 have not been voted upon.

The committee has decided that the contents of the base publication and its amendments 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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

Ⓒ This new edition of EN 50242 / EN 60436 has been developed based on the mandate M/481 to CEN, CENELEC and ETSI for standardisation in the field of household dishwashers, which relates to Directive 2009/125/EC of the European Parliament and of the Council and to Directive 2010/30/EU of the European Parliament and of the Council.

Mandate M/481, issued by the European Commission, includes the standardization task to develop measures in testing household dishwashers, which ensure “that the prospective harmonised standard(s) includes a procedure that avoids an appliance being programmed to recognize the test cycles, and reacting specifically to them, with the exclusion of test cycle recognition that is active only during the manufacturing of the appliance”.

CLC/TC 59X/WG 2 has identified the deviating test conditions in the previous edition of this standard for the cleaning performance assessment (soiled test load), including relevant energy and water consumption measurements, and the drying performance assessment (unsoiled test load), excluding energy and water consumption measurements, to be the main potential source for an appliance being programmed to recognize the test cycle, and reacting specifically to them. Therefore, the Combined Cleaning and Drying evaluation (CCD) has been established to repeal former deviating test conditions, and to improve alignment with common real life household conditions.

This document submits all common modifications necessary for the application of IEC 60436:2004/A1:2009 and IEC 60436:2004/A2:2012 in Europe. Accordingly, it incorporates the changes made in EN 50242:2008/A11:2012 / EN 60436:2008/A11:2012.

In addition, this document submits modifications to Annex O “Additional aspects of the energy consumption of dishwashers” based on the FDIS draft of IEC 60436 4th Edition prepared by SC 59A “Electric dishwashers” of IEC/TC 59 “Performance of household and similar electrical appliances”. Ⓒ

ELECTRIC DISHWASHERS FOR HOUSEHOLD USE – METHODS FOR MEASURING THE PERFORMANCE

1 Scope

This [C] European standard [C] applies to electric dishwashers for household use that are supplied with hot and/or cold water.

The object is to state and define the principal performance characteristics of electric dishwashers for household use and to describe the standard methods of measuring these characteristics.

This standard is concerned neither with safety nor with performance requirements.

2 Normative references

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.

[C] EN 60350 series, *Household electric cooking appliances* (IEC 60350 series)

EN 60704-2-3, *Household and similar electrical appliances – Test code for the determination of airborne acoustical noise – Part 2-3: Particular requirements for dishwashers* (IEC 60704-2-3)

EN 60704-3, *Household and similar electrical appliances – Test code for the determination of airborne acoustical noise – Part 3: Procedure for determining and verifying declared noise emission values* (IEC 60704-3)

EN 60705, *Household microwave ovens – Methods for measuring performance* (IEC 60705)

EN 60734, *Household electrical appliances – Performance – Hard water for testing* (IEC 60734) [C]

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

ISO 607, *Surface active agents and detergents – Methods of sample division*

[C] AHAM DW-1, *Performance testing methods for household electric dishwashers*

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

EN ISO 80000-1:2013, *Quantities and units – Part 1: General* (ISO 80000-1:2009 + Cor 1:2011)

ISO 3310 series, *Test sieves – Technical requirements and testing* [C]

3 [C] Definitions related to the appliance [C]

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

3.1

dishwasher

machine which cleans, rinses, and dries dishware, glassware, cutlery, and, in some cases, cooking utensils by chemical, mechanical, thermal, and electric means. A dishwasher may or may not have a specific drying operation at the end of the program

3.2

rated dishwasher capacity

whole number of place settings together with the serving pieces (see Annexes A & B) stated by the manufacturer, which can be cleaned and dried when loaded in accordance with the manufacturer's instructions

3.3

operation

each event that occurs during the dishwasher programme such as cleaning, rinsing or drying

3.4

programme

series of operations which are pre-defined within the dishwasher and which are declared as suitable for specified levels of soil and/or type of load and together form a complete cycle

3.5

cycle

complete washing, rinsing, and drying process, as defined by the programme selected, consisting of a series of operations

3.6

programme time

programme time is measured from the initiation of the programme (excluding any user programmed delay) until an end of programme indicator. If there is no end of programme indicator, the programme time is equal to the cycle time

3.7

cycle time

cycle time is measured from the initiation of the programme (excluding any user programmed delay) until all activity ceases (i.e. the end of the cycle)

3.8

automatic dispenser

device activated automatically which injects or dispenses detergent, rinse agent, etc., one or more times into the dishwasher at predetermined points in the dishwasher cycle

3.9

non-automatic dispenser

device, usually a fixed cup or cavity on the dishwasher door, cover, or dish rack, which deposits a previously measured amount of detergent, rinse agent, etc., into the dishwasher at the beginning of the dishwasher cycle

3.10

water softener

device which reduces the hardness of water

3.11

rack

support for holding dishware, cutlery, and/or glassware in the dishwasher

3.12

detergent

cleaning agent in powder, granular, tablet or liquid form, manufactured for use in household electric dishwashers to aid in the removal of food soils by chemical means

NOTE A reference detergent in powder form is specified for use in this standard (see 5.7).

3.13

rinse agent

chemical agent added to the water in the last rinsing operation to improve the drying effect and reduce water marks

NOTE Two reference rinse agents are specified for use in this standard (see 5.8).

3.14

serving pieces

defined set of crockery and cutlery for serving (see Annexes A and B)

3.15

place settings

defined set of crockery, glass and cutlery for use by one person (see Annexes A and B)

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.

 Text deleted 

3.17

left on mode

 the lowest power consumption mode that may persist for an indefinite time after the completion of the programme, opened and unlatched door 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

 Text deleted 

3.Z1

left on mode duration

time for the dishwasher to revert automatically to off mode after the end of the programme with the door unlatched and opened; mode applies if the test dishwasher is equipped with a power management system

Note 1 to entry: The left on mode duration is declared by the manufacturer.

Note 2 to entry: End of programme is reached when end of programme indicator is activated or when all activities cease if there is no end of programme indicator (according to 3.6 and 3.7).

3.Z2

power management system

system within the test dishwasher which allows it to revert automatically to off mode 

4 List of measurements

Standard methods of measuring the performance characteristics are determined as follows:

-  *the combined cleaning and drying performance according to Clause 6 and Clause 7;* 
- energy, water consumption and time according to Clause 8;
- airborne acoustical noise according to Clause 9.

5 General conditions for measurements

5.1 General

The dishwasher manufacturer's instructions regarding installation and use of the dishwasher shall be followed, except where there is a conflict, in which case this standard shall prevail.

Performance tests according to this standard shall be generally carried out on a new machine, with a reference machine running parallel with the machine(s) under test, i.e., at the same time under the same conditions using soil prepared at the same time from the same batch.  The reference machine shall be in accordance with the description given in Annex E or Annex N respectively. 

The reference machine shall always be installed as a free standing machine independent of the type of machine under test.

Before commencing measurements, the dishwasher and the reference machine shall be checked to ensure that they are operating properly.

All tests shall be started with the appliances at the ambient temperature according to 5.5.

 Rounding shall only be applied to reported values in Clause Z1, Clause Z2 and Annex L. If numbers have to be rounded, they shall be rounded to the nearest number according to EN ISO 80000-1:2013, B.3 Rule B. If the rounding takes place to the right of the comma, the omitted places shall not be filled with zeros. 

5.1.1 Free standing dishwashers

Dishwashers shall be tested as free standing except where they are designated as built-in or integrated (refer to 5.1.2).  The dishwasher manufacturer's instructions regarding installation and use of the dishwasher shall be followed. 

5.1.2 Built in and integrated dishwashers

Built-in dishwashers have to be installed in an enclosure. See Figure I.1.

The front edge of the housing of the dishwasher (except the door) shall be 20 mm to 25 mm behind the front edge of the test enclosure. If required by the manufacturer's instructions, the enclosure shall be provided with ventilation openings accordingly.

If an appliance is provided with spacers, strips or other special means of solid or resilient material for closing the gap(s) between the contours of the appliance and the cabinet enclosure, these means shall be used accordingly. If such means are not provided, the gap(s) shall be left open.

Appliances to be integrated shall be installed under the same conditions as built-in appliances. In addition, the door of the dishwasher shall be equipped, in accordance with the manufacturer's instruction, with a board of the maximum size allowed by the manufacturer and of the same material and thickness as the test enclosure; see Annex I.

Moreover, for integrated types, the test enclosure shall be provided, in accordance with the manufacturer's instructions, at its lower front side with a skirting board of the maximum height which corresponds with the size of the board on the door of the appliance and of the same material and thickness as the test enclosure, see Annex I. If no instructions are given by the manufacturer, a skirting board as described above shall be pressed against the skirting board of the appliance.

5.2 Conditioning of the machine under test and sequence of test procedures

- Ⓒ Before conducting the performance tests, the dishwasher shall be operated for at least three complete cycles using no load or a clean load with reference detergent (specified in 5.7) and with rinse agent (specified in 5.8). If noise measurements should be done, they should be carried out before any performance measurements and in accordance to Clause 8. No additional cycles shall be carried out on the machine under test between the sequential steps specified in the following procedure.

The tests of cleaning performance and drying performance shall be performed simultaneously. The determination of energy, water and cycle/programme time (Clause 8) shall be done in conjunction with the combined cleaning and drying performance (Clauses 6 and 7) tests. Ⓒ

NOTE 1 The above sequence is necessary for better reproducibility, i.e. to avoid differences in drying performance due to the ageing process of the plastic parts in the dishwasher (for example, racks).

NOTE 2 Any cycles or operations performed on the appliance during the manufacture of the product are ignored.

NOTE 3 Noise tests require that the test should be carried out before the rinse aid dispenser is filled for the first time.

5.3 Electricity supply for machines

5.3.1 Electricity supply for test machine

5.3.1.1 Voltage

- Ⓒ The supply voltage shall be maintained at $230\text{ V} \pm 1\%$.

The supply voltage measured during the tests shall be recorded. Ⓒ

NOTE If the rated voltage of the machine differs from the system voltage of the country of intended use, measurements should be carried out at the nominal voltage of the country of intended use.

5.3.1.2 Frequency

The supply frequency shall be set at the rated frequency of the machine and maintained within the range $\pm 1\%$ throughout the test. If a frequency range is indicated, then the testing shall be carried out at the nominal frequency of the country in which the appliance is intended to be used. The measured frequency shall be reported.

NOTE If the rated frequency of the machine differs from the system frequency of the country of intended use, measurements should be carried out at the nominal frequency of the country of intended use.

5.3.2 Electricity supply for the reference machine

5.3.2.1 Voltage

The supply voltage shall be set at 230 V a.c. and maintained within $\pm 1\%$ throughout the test. The measured voltage shall be reported.

5.3.2.2 Frequency

The supply frequency shall be set at 50 Hz and maintained within $\pm 1\%$ throughout the test. The measured frequency shall be reported.

5.4 Test programme

- ☐ For energy labelling and / or ecodesign purposes, the programme to be tested shall be the cycle which cleans normally soiled tableware (standard cleaning and drying cycle) and shall be named “eco”. The name “eco” shall be used once and exclusively for this standard test programme. The only other additional information which could be combined with the term “eco” is temperature.

NOTE The formatting of the phrase “eco” is not restricted in terms of font, font size, case sensitivity, colour or accentuations like the usage of italic letter or underlining etc.

The same programme shall be used for measuring the combined cleaning and drying performance according to Clauses 6 and 7, the energy and water consumption and time according to Clause 8, and the noise according to Clause 9, if tested. ☐

Additional programmes may then be tested.

5.5 Ambient conditions

The following ambient conditions shall be maintained throughout the measurements.

Oven drying method

- Ambient temperature of the room: ☐ $(23 \pm 2) ^\circ\text{C}$ ☐
- Relative humidity: ☐ $(55 \pm 5) \% \text{ RH}$ ☐

Air dry method

- Ambient temperature of the room: ☐ $(23 \pm 2) ^\circ\text{C}$ ☐
- Relative humidity: $(65 \pm 10) \% \text{ RH}$

The ambient temperature and the relative humidity measured during the tests shall be reported in the test report.

- ☐ For energy labelling and/or ecodesign purposes, the air-dry method is not permitted. ☐

5.6 Water supply

5.6.1 General

The actual water conditions (temperature, hardness, and pressure) maintained during the tests shall be reported in the test report.

NOTE Some countries specify a hot water temperature for regulatory purposes, in which case this water temperature should be used for testing.

5.6.2 Water supply – Temperature

The temperature of the supply water shall be

- cold water feed temperature:
 - $(15 \pm 2) ^\circ\text{C}$.
- hot water feed temperature:
 - temperature indicated by the manufacturer $\pm 2 ^\circ\text{C}$, or
 - where a range is specified which does include $60 ^\circ\text{C}$, $(60 \pm 2) ^\circ\text{C}$, or
 - where a range is specified which does not include $60 ^\circ\text{C}$, the value nearest to $60 ^\circ\text{C} \pm 2 ^\circ\text{C}$, or
 - $(60 \pm 2) ^\circ\text{C}$, if instructions are not given.

- Ⓒ The volume of the water pipe after the measurement device for temperature up to the connection point to the water inlet hose of the test dishwasher shall not exceed 250 ml.

If a bypass to drain water is installed at each connection to the water inlet hose(s) of the dishwasher the bypass shall be opened before starting tests until the water inlet temperature is in the required range. If the temperature is measured in the circulation loop, the volume of the spur taking the water from the circulation loop shall not exceed 250 ml.

For energy labelling and / or ecodesign purposes, the use of hot water is not permitted. Ⓒ

5.6.3 Hardness

A water hardness of $(2,5 \pm 0,5)$ mmol/l for hard water areas or $\leq 0,7$ mmol/l for soft water areas shall be used. If water hardness needs to be adjusted to meet these specifications, it shall be prepared according to Ⓒ EN 60734 Ⓒ – Method C. The measured water hardness shall be reported. The water hardness used in the test shall be the one most applicable to the country of intended use.

- Ⓒ For energy labelling and / or ecodesign purposes, if the appliance is not equipped with a water softener, the hardest water which is permitted by the manufacturer's instructions shall be used, otherwise only water of $(2,5 \pm 0,5)$ mmol/l shall be used. Ⓒ

NOTE The impact of water hardness variation between 0,0 mmol/l to 0,7 mmol/l is still under investigation.

5.6.4 Water pressure

The pressure of the water supply at each water inlet shall be set at 240 kPa and shall be maintained within the range ± 20 kPa, including during all fills. The measured water pressure shall be reported. Where the manufacturer specifies a range of water pressure that does not include $240 \text{ kPa} \pm 20 \text{ kPa}$, the water pressure shall be set at the end of the pressure range closest to $240 \text{ kPa} \pm 20 \text{ kPa}$.

5.7 Detergent

- Ⓒ For energy labelling and / or ecodesign purposes, the reference detergent B, as described in Annex D, shall be used.

The quantity shall be as recommended by the manufacturer, but it shall not be more than

- 2,5 g/place setting for dishwashers with a capacity of ≥ 10 place settings;
- 3,0 g/place setting for dishwashers with a capacity of < 10 place settings.

If no recommendation is given by the manufacturer, use

- 2,0 g/place setting for dishwashers with a capacity of ≥ 10 place settings;
- 2,5 g/place setting for dishwashers with a capacity of < 10 place settings.

The total quantity of detergent, in grams, used for main wash and pre-wash during the tests shall be recorded.

The detergent shall be placed in the dishwasher immediately prior to starting the programme. If a dispenser is incorporated in the dishwasher, it shall be used. The dispenser shall be clean and dry prior to the placement of detergent. In the absence of manufacturer's recommendations, the detergent shall be placed in the main compartment of the dispenser.

Detergent from the same batch shall be used for the dishwasher under test and for the reference dishwasher.

The detergent shall be stored in waterproof bags in quantities of no more than 1 kg in a cool and dry atmosphere. It shall be used within six months after production and within one month of opening. Ⓒ