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colour inside

Electric dishwashers for household use – Methods for measuring the performance

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

This consolidated version of IEC 60436 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 therefore identical to the base edition and its amendments and has been prepared for user convenience.

It bears the edition number 3.2.

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

This third edition cancels and replaces the second edition published in 1981 and constitutes a technical revision. Major changes introduced in the second 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 uprated 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 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.

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

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 publication using a colour printer.

INTRODUCTION

In 1996, IEC subcommittee 59A charged its Working Group 2 with the revision of the second edition of IEC 60436 to make it suitable for the international needs and to make it suitable for the current levels of dishwasher performance and technology.

The second edition was published in 1981 and has not been significantly updated.

SC59A instructed the WG2 to take the Cenelec draft standard EN 50242 as the basis for the third edition.

An important reason for the third edition was the need to take into account the needs of all countries such as varying voltages and frequencies, different water supply temperatures and water hardness and availability of specified soils in in the various countries.

To meet the goal the following significant technical changes were made:

- The repeatability and reproducibility of the test results have been improved by the introduction of the same model reference dishwasher specified for all locations.
- The soils have been changed to reflect the modern dishwasher's capability.
- The preparation of the soils has been improved to enhance repeatability and reproducibility by the introduction of new drying methods.
- The standard also recognizes various supply voltages and frequencies,cold or hot water supply, an alternate Aham load, the evaluation of dishwasher filter systems.
- The standard has updated the formulation of the detergent and rinse agents to reflect the producs on the market today.
- The standard has increased the sensitivity of the grading scale from two to five points to improve repeatability and reproducibility.
- Ambient conditions have been brought closer to harmonization.
- More detailed instructions have been provided for the installation of the various designs of dishwashers.
- Correction formulae have been provided for the correction of energy consumption measurements for varying water supply temperature.

INTRODUCTION
(to amendment 2)

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.

ELECTRIC DISHWASHERS FOR HOUSEHOLD USE – METHODS FOR MEASURING THE PERFORMANCE

1 Scope

This international standard 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.

IEC 60350, *Electric cooking ranges, hobs, ovens and grills for household use – Methods for measuring performance*

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

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

IEC 60734, *Household electrical appliances – Performance – Hard water for testing*

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

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

AHAM DW-1:2003: *Performance testing methods for household electric dishwashers*

3 Terms and definitions

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.

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.

4 List of measurements

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

– cleaning performance according to Clause 6;
– drying performance according to 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.

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.

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). Dishwashers that can be installed as either free standing or built-in/integrated shall be tested as free standing.

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 3 complete cycles using a clean load with reference detergent (specified in 5.7) and without rinse agent. The following cycle(s) can be a noise test according to Clause 9. No additional cycles shall be carried out on the machine under test between the sequential steps specified in the following procedure.

The tests shall be performed in the following order: cleaning performance (Clause 6) then drying performance (Clause 7). The determination of energy, water and cycle/program time (Clause 8) shall be done in conjunction with a wash performance test (Clause 6).

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 test voltage shall be set at the rated voltage of the machine and maintained within the range of ±2 % throughout the test. If a voltage range is indicated, then the test voltage shall be set at the nominal voltage of the country in which the appliance is intended to be used. The measured voltage shall be reported.

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 ±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 ±2 % 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 ±1 % throughout the test. The measured frequency shall be reported.

5.4 Test programme

The first programme to be tested shall be the one recommended by the manufacturer for a normally soiled load.

NOTE In some countries the manufacturer has to declare the programme to be used, for the purpose of energy labelling (which may not be for a normally soiled load), in which case this programme shall be the one tested first.

The same programme shall be used for measuring the cleaning performance according to Clause 6, the drying performance according to Clause 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.