



SLOVENSKI STANDARD

SIST EN 50242:2001

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Electric dishwashers for household use - Test methods for measuring the performance

Electric dishwashers for household use - Test methods for measuring the performance

Elektrische Geschirrspülmaschinen für den Hausgebrauch - Messverfahren für Gebrauchseigenschaften

Lave-vaisselle électriques pour usage domestique - Méthodes d'essai pour la mesure de l'aptitude à la fonction

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EUROPEAN STANDARD
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Descriptors: Household electrical appliances, dishwashers, performance, measurements, comparative tests

English version

**Electric dishwashers for household use
Test methods for measuring the performance**

Lave-vaisselle électriques pour usage
domestique - Méthodes d'essai pour la
mesure de l'aptitude à la fonction

Elektrische Geschirrspüler für den
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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

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

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

This European Standard was prepared by the Technical Committee CENELEC TC 59X, Consumer information related to household electrical appliances.

The text of the draft was submitted to the formal vote and was approved by CENELEC as EN 50242 on 1998-08-01.

This European Standard supersedes HD 378 S1:1978.

Significant technical differences include the introduction of:

- a) a reference dishwashing machine;
- b) a new test method for cleaning performance;
- c) a revised calculation for determining the cleaning and drying performance indexes;
- d) tolerances;
- e) a new (phosphate free) reference detergent.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1999-08-01
- latest date by which national standards conflicting with the EN have to be withdrawn (dow) 2001-08-01

In accordance with the decision of CLC/TC 59X, taken at the meeting in Paris on 12th April 1995 this standard was drawn up as a self-contained CENELEC document. It follows, as far as possible, the structure of the present IEC 60436:1981.

This European Standard has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association and covers essential requirements of EC Directive 92/75/EEC on "Indication by labelling and standard product information of the consumption of energy and other resources by household appliances".

Test results obtained according to this standard are for direct comparison and in conjunction with the reference machine considered sufficiently reproducible within given limits for the purpose of energy labelling according to the Commission Directive on energy labelling and standard product information.

Annexes designated "normative" are part of the body of the standard.

Annexes designated "informative" are given for information only.

In this standard, annexes A, B, C, D and E are normative and annexes F and G are informative.



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1 Scope

This standard is applicable to electric dishwashers for household use that are intended to be supplied with cold water and incorporate an electrical heating system.

It is not applicable to dishwashers supplied with hot water or hot and cold water. It is applicable to dishwashers intended to be supplied by hot or cold water when supplied with cold water only.

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

Safety aspects for electric household dishwashers are dealt with by EN 60335-2-5.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 60335-2-5		Safety of household and similar electrical appliances – Part 2: Particular requirements for dishwashers [IEC 60335-2-5, modified]
EN 60704-2-3		Test code for the determination of airborne acoustical noise emitted by household and similar electrical appliances Part 2: Particular requirements for dishwashers [IEC 60704-2-3, modified]
EN 60704-3		Part 3: Procedure for determining and verifying declared noise emission values [IEC 60704-3]
EN 60705	https://www.standards.it/en/50242-2001	Methods for measuring the performance of microwave ovens for household and similar purposes [IEC 60705]
EN 60734		Hard water to be used for testing the performance of some household electrical appliances [IEC 60734]
IEC 60436	1981	Methods for measuring the performance of electric dishwashers
ISO 607		Surface active agents and detergents - Methods of sample division
DIN 6164-1	1980	DIN-Farbenkarte - Teil 1: System der DIN-Farbenkarte für den 2-Normalbeobachter (DIN colour chart - Part 1: System based on the 2° standard colorimetric observer)

3 Definitions

For the purpose of this European Standard, the following definitions apply:

3.1 Definitions related to the appliance

3.1.1 dishwasher: A machine which cleans, rinses and dries dishware, glassware, cutlery and, in some cases cooking utensils by chemical, mechanical and electric means. [IEC 60436:1981, 3.1]

3.1.2 rated dishwasher capacity: The number of place settings together with the service pieces (see annex A) stated by the manufacturer, when the dishwasher loaded in accordance with the manufacturer's instructions. [IEC 60436:1981, 4.1]

3.1.3 cycle: The sequence of events occurring in the dishwasher during the cleaning, rinsing and drying process. [IEC 60436:1981, 4.2]

3.1.4 dispenser

automatic dispenser: A device activated automatically which injects or dispenses detergent, rinse agent, etc., one or more times into the dishwasher at predetermined intervals throughout the dishwasher cycle.

non-automatic dispenser: A 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. The dispenser is emptied when the dishwasher door or cover is closed, or requires water circulation to flush the detergent from the dispenser. [IEC 60436:1981, 4.3; modified]

3.1.5 water softener: A device which reduces the hardness of water. [IEC 60436:1981, 4.4]

3.2 Definitions related to the methods for measuring the performance

3.2.1 cutlery basket: Container for holding cutlery in the dishwasher. [IEC 60436:1981, 5.1]

3.2.2 rack: Support for holding dishware and glassware in the dishwasher. [IEC 60436:1981, 5.2]

3.2.3 detergent: A cleaning agent in powder, granular or liquid form, manufactured for use in household electric dishwashers to aid in the removal of food soils by chemical means. [IEC 60436:1981, 5.3]

3.2.4 rinse agent: A chemical agent sometimes added to the last rinsing water to improve the drying effect and reduce water marks. [IEC 60436:1981, 5.4]

3.2.5 place setting: A unit of standardized cutlery, crockery and glassware.

NOTE: It represents the needs of one person.

3.2.6 serving pieces: A unit of standardized cutlery and crockery used in addition to the place settings.

NOTE : It represents the additional items used for serving a meal.

4 List of measurements

For the purposes of this standard the performance of the dishwasher is determined by the following measurements.

- Cleaning performance according to clause 6;
- Drying performance according to clause 7;
- Energy and water consumption according to clause 8;
- Airborne acoustical noise according to clause 9.

5 Conditions of measurement

5.1 General

The dishwasher manufacturer's instructions regarding installation and use of the dishwasher shall be followed.

Dishwashers designed to be built-in shall be installed using the test enclosure as described in annex D. The front edge of the housing of the dishwasher (except 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 or enclosure, these means shall be used accordingly. If such means are not provided, the gap(s) are left open.

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

Moreover 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 D. If no instructions are given by the manufacturer a skirting board as described above shall be pressed against the skirting board of the appliance. [EN 60704-2-3, 6.5.5, modified]

NOTE 1: Appliances to be integrated are understood as built-in appliances which shall be completed at the door usually by a board identical with the doors of the kitchen furniture and by a plinth identical with the plinth of the kitchen furniture. Both pieces must be ordered from the manufacturer of the kitchen furniture.

Performance tests according to this standard shall be carried out with a reference machine running parallel with the machine(s) under test, i.e. at the same time under the same conditions. The reference machine shall be in accordance with the description given in annex C.

NOTE 2: The reference machine is always installed as a free-standing machine independent of the type of the machine under test (e.g. built-in, under table).

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

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

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

First step: Before conducting the performance tests, the dishwasher shall be operated in the test laboratory for two or maximum three complete cycles using detergent (specified in 5.7) and a clean load and no rinse agent. No additional cycles shall be carried out on the machine under test between the sequential steps of the test procedure.

NOTE 1: The first step and the compliance with the given sequence is necessary for better reproducibility, i.e. to avoid differences of drying performance due to ageing processes of the plastic parts in the dishwasher (e.g. baskets).

NOTE 2: Cycles carried out during the production are ignored.

Second step: Testing the cleaning performance and measuring the energy and water consumption according to clauses 6 and 8.

Third step: Testing the drying performance according to clause 7.

5.3 *Electricity supply*

5.3.1 *Frequency*

The supply frequency shall be maintained at the rated frequency $\pm 1\%$.

5.3.2 *Voltage*

The supply voltage shall be maintained at 230 V $\pm 1\%$.

The supply voltage measured during the tests shall be recorded.

5.4 Test cycle

The programme recommended by the manufacturer for normal use, using normal table ware, excluding cooking utensils, shall be used.

If no recommendation is available the programme indicated by the instructions for use for the most difficult soil for normally soiled table ware, excluding cooking utensils, shall be used.

The same test cycle shall be used for measuring the cleaning performance according to clause 6, the drying performance according to clause 7 and the energy and water consumption according to clause 8.

Additional measurements may only be made for other programmes after the third step (see 5.2).

5.5 Ambient conditions

The following ambient conditions shall be maintained throughout the measurements:

- ambient temperature of the room: $(23 \pm 2) ^\circ\text{C}$;
- relative humidity: $(55 \pm 10) \%$.

The ambient temperature and the relative humidity measured during the tests shall be recorded.

5.6 Water supply

5.6.1 General

The actual water temperature, hardness, and pressure, maintained during the tests shall be recorded.

5.6.2 Temperature

The temperature of the water supply shall be $(15 \pm 2) ^\circ\text{C}$.

5.6.3 Hardness

The hardness of the tap water shall be between 0,9 and 3,0 mmol/l (Ca + Mg).

If the appliance is not equipped with a water softener the hardest water which is permitted by the manufacturer's instructions shall be used

5.6.4 Water pressure

The pressure shall be within the range indicated by the manufacturer.

5.7 Detergent

The reference detergent B, as described in annex B, shall be used. The quantity shall be as recommended by the manufacturer. But 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 quantity of detergent, in g/place setting, used during the tests shall be recorded.

If a dispenser is incorporated in the dishwasher it shall be used. In the absence of manufacturer's recommendations, the detergent shall be placed in the main compartment of the dispenser.

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 and within one month of opening. Before using the detergent shall be homogenized in accordance with ISO 607.

5.8 Rinse agent

The rinse agent (Formula III) as described in annex B shall be used.

For dishwashers with an adjustable automatic dispenser, the setting used shall be as recommended by the manufacturer. In absence of such an indication, the setting shall be used which gives the lowest quantity of rinse aid.

NOTE: Any recommendation by the manufacturer to adjust manually the initial setting based on experience is disregarded.

For machines without automatic dispensers, the rinse agent shall be added manually if so recommended by the manufacturer and in accordance with his instructions.

6 Cleaning performance

6.1 General

The purpose of this test is to measure how well the appliance cleans normally soiled tableware.

The test is carried out in conjunction with the reference machine specified in annex C. Soiling of the test loads shall be prepared in parallel.

Detergents and rinsing agents are used according to 5.7 and 5.8.

The sequence of the test procedure as specified in 5.2 shall be taken into account.

NOTE: A videotape, giving an introduction to the test procedure, is available from Miele (see annex C).

6.2 Load

The test load shall consist of a whole number of complete place settings plus the corresponding serving pieces (see annex A) which together comprise the manufacturer's rated capacity (see 3.1.2).

All pieces shall be thoroughly clean and dry before soiling.

6.3 Soiling agents

The following soiling agents are required:

ultra heat treated (U.H.T.) milk:	10 ml/ place setting + 250 ml for preparation of porridge;
tea:	6 g/l \cong 12 place settings;
minced meat:	1,5 g/place setting + 4 g for large serving bowl;
egg:	2 g egg yolk/place setting + eggs for preparation of minced meat;
oat flakes:	50 g for preparation of porridge (enough for about 48 place settings);
spinach:	3 g/place setting;
margarine:	1 g/place setting.

6.4 Preparation and application of soiling agents

Unless specifically stated otherwise, all soiling agents are to be prepared afresh for each test cycle. The whole amount of each soiling agent needed for the test (g/setting x number of place settings) shall be weighed out, divided into portions as necessary and prepared for application.

It is then recommended to start by pre-heating the microwave oven for the milk soiling. During this time prepare the tea soiling. During the pre-drying period for the tea apply the rest of the soiling agents.

6.4.1 Milk

6.4.1.1 Items required for preparation

- any U.H.T. milk with a fat content from 1,5 % to 2 %. It should have a validity of at least 45 days;
- microwave oven with a glass turntable as specified in annex E.
- laboratory glasses without drain (250 ml capacity) with dimensions:
 - height: 115 mm
 - diameter: 60 mm;
- pipette (10 ml).

6.4.1.2 Conversion

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

$$t_{u,1} = \frac{780 \text{ W} \times 4 \text{ min}}{P_{u,1}} \quad (1a)$$

$$t_{u,2} = \frac{150 \text{ W} \times 10 \text{ min}}{P_{u,2}} \quad (1b)$$

where

- $P_{u,1}$ is the actual max. power level used in W (measured according to EN 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 (2)];
- $t_{u,2}$ is the corresponding actual heating time to be used in min.

$$P_{u,2} = \frac{P_{u,1}}{t_p} \times (t_{on} - 1,6 \text{ s}) \quad (2)$$

where

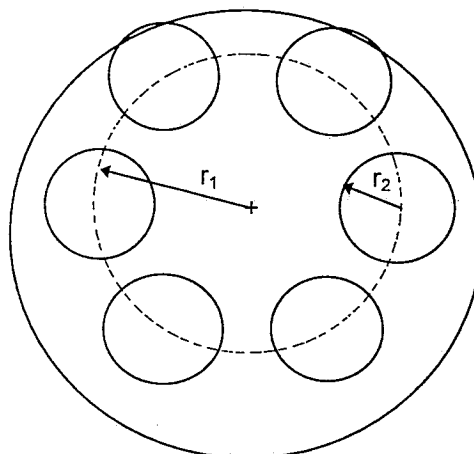
- t_p is the time of the elementary period of the magnetron in the microwave oven at the reduced power level in s;
- t_{on} is the time the microwave oven is on within the elementary period in s.

NOTE: Use levels, which are close to the rated levels.

6.4.1.3 Pre-heating of microwave oven

Before burning the milk on the glasses, pre-heat the microwave oven as follows:

- place six glasses each with 50 ml of water in the microwave oven;
- place the glasses symmetrically on a circumference with a radius of between 95 mm and 100 mm (centre of the circle = centre of the glass turntable). It would be helpful to mark the position of the glasses with a pencil (see figure 1);
- switch on the microwave oven for 4 min on a power setting of 780 W and then 10 min on a power setting of 150 W;
- after heating take the glasses out of the microwave oven.



$$r_1 = 95 \text{ mm to } 100 \text{ mm}$$

$$r_2 = 30 \text{ mm}$$

Figure 1 - Position of the glasses on the glass-turnstile

6.4.1.4 Application

After removal from the refrigerator the milk has to be shaken well for approximately 30 s. before each application. Straight after the shaking pour 10 ml into each 250 ml laboratory glass by using a pipette. The glasses have to be filled with cold milk just before heating.

The milk shall be put back into the refrigerator after the filling of each set of six glasses.

Always place six glasses with milk (10 ml/glass) in the preheated microwave oven and cook the glasses continuously under the same conditions, i.e. for 4 min at 780 W and 10 min at 150 W. The heating times have to be the times t_u according to 6.4.1.2, if necessary.

NOTE: For example where only 10 glasses are required prepare 12 and discard two.
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At the end of the drying period of 6.5 the browning of the milk soiling shall be compared with the colour charts DIN 6164-1. At the bottom of the glasses the colour shall correspond to the colour chart 2:3:1. Single pieces of the milk skin shall not be darker than colour chart 2:5:1.

If the conditions above are not met the heating time in the microwave oven shall be adjusted accordingly.

6.4.2 Tea

Use black tea as described in annex F.

6.4.2.1 Preparation

Pour 1 l boiling water over 6 g black tea and allow to stand in a closed container for a period of 5 min. Afterwards stir and pour the tea through a sieve (mesh aperture 1 mm) into a second container. The hardness of the water shall be $(2,5 \pm 0,2)$ mmol/l. If the hardness needs to be adjusted it shall be prepared according to EN 60734 - Method B.

6.4.2.2 Application

Pre-heat the thermal cabinet (see annex E) to 80 °C.

Half-fill the cups and saucers with black tea, ensure even distribution over cups/saucers respectively. Place the cups and saucers in the thermal cabinet as fast as possible. Ensure that the cups and saucers are not placed too closely together. They shall remain in the thermal cabinet for a period of 1 h at a temperature of 80 °C (the pre-drying period). Then empty out the tea and immediately replace the cups and saucers in the thermal cabinet in accordance with 6.5.