



BSI Standards Publication

Electric dishwashers for household use — Methods for measuring the performance

National foreword

This British Standard is the UK implementation of EN IEC 60436:2025+A11:2025. It is derived from IEC 60436:2025. It supersedes BS EN 60436:2020+A12:2022, which will be withdrawn on 30 September 2026.

The start and finish of text introduced or altered by amendment A11 is indicated in the text by tags. Tags indicating changes to text carry the number of the CENELEC amendment. For example, text altered by CENELEC amendment A11 is indicated by A11 A11.

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Electric dishwashers for household use - Methods for measuring
the performance
(IEC 60436:2025)

Lave-vaisselle électriques à usage domestique - Méthodes
de mesure de l'aptitude à la fonction
(IEC 60436:2025)

Elektrische Geschirrspüler für den Hausgebrauch -
Messverfahren für Gebrauchseigenschaften
(IEC 60436:2025)

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European foreword

The text of document 59A/273/FDIS, future edition of IEC 60436, prepared by SC 59A "Electric dishwashers" of IEC/TC 59 "Performance of household and similar electrical appliances" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 60436:2025.

The following dates are fixed:

- latest date by which the document has to be implemented at national (dop) 2026-09-30 level by publication of an identical national standard or by endorsement
- latest date by which the national standards conflicting with the (dow) 2026-09-30 document have to be withdrawn

This document supersedes EN 60436:2020 and all of its amendments and corrigenda (if any).

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This document is read in conjunction with EN IEC 60436:2025/A11:2025.

This document has been prepared under a standardization request addressed to CENELEC by the European Commission. The Standing Committee of the EFTA States subsequently approves these requests for its Member States.

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Endorsement notice

The text of the International Standard IEC 60436:2025 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated:

IEC 60704-3:2019 NOTE Approved as EN 60704-3:2019

European foreword to Amendment A11

This document (EN IEC 60436:2025/A11:2025) has been prepared by CLC/TC 59X "Performance of household and similar electrical appliances".

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- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2026-09-30

This document modifies EN IEC 60436:2025.

EN IEC 60436:2025 includes the following significant technical changes with respect to EN 60436:2020:

- Implementation of a new reference machine, which better reflects modern dishwasher energy and water saving technologies. Its ability to function as a reference machine for the cleaning assessment was assessed in a Round Robin Test.
- Implementation of the new reference detergent type E, which better reflects market detergents formulations. It includes upgraded enzymes and a lower content of silicates to reduce the alkalinity which simplifies the worldwide transportation by avoiding dangerous goods labelling and therefore improves the usage all over the world.
- Implementation of an alignment factor for the cleaning performance assessment as proposed in a scientific study done by a university to align test results of the previous version to the new version of this standard with the new reference system described above.
- Introduction of alternatives for the oven pan and knives as the production of the current load items were stopped.
- Improvement of the control of the room temperature due to a temperature measurement inside the dishwasher prior to the start of the test programme.
- Update of the weight of different load items and the specified ranges to anneal the requirements in the standard to the actual weight of the items.
- New requirements for the loading and handling instructions for test institutes.
- Update of supplier information annex.
- Update of Annex ZC Test report template and ZD Uncertainty of measurement.

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A11 Annex ZA (normative)

Normative references to international publications with their corresponding European publications

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
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	EN IEC 60704-2-3	2025
IEC 60705	-	Household microwave ovens – Methods for measuring performance	EN IEC 60705	2024
IEC 60734	2012	Household electrical appliances – Performance – Water for testing	EN 60734	2012
IEC 62301	2011	Household electrical appliances – Measurement of standby power	EN 50564	2011
IEC 63474	-	Electrical and electronic household and office equipment - Measurement of low power consumption	EN IEC 63474	2023
ISO 607	1980	Surface active agents and detergents – Methods of sample division	-	-
ISO 80000-1	2022	Quantities and Units – Part 1: General	EN ISO 80000-1	2022

Annex ZC (informative)

Template for test report

Table ZC.1 — Example of a test report that covers all relevant parameters for combined cleaning and drying performance and airborne acoustical noise (Clause 5 – Clause 9)

	Test report		EN 60436:2024
	Test number	Date	
Dishwasher details:			
Test machine			Reference machine
	Manufacturer:		
	Brand:		
	Model:		
	Serial No.:		
	Rated voltage (V):		
	Rated frequency (Hz):		
	Manufacturing date:		
	Name of test programme:		
	Rinse aid settings:		
	Water softener settings:		
	Detergent:		
	Batch of detergent:		
	Homogenization process of detergent:		
	Quantity of detergent for prewash/mainwash (g):		
	Rinse agent:		
	Salt (type and brand):		
Energy label data			
Energy efficiency class:		Rated capacity (in PS):	
Eco programme energy consumption (EPEC x 100 cycles in kWh/100):		Airborne acoustical noise emission (in dB(A) re 1pW):	
Eco programme water consumption (EPWC in l/c):		Airborne acoustical noise emission class:	
Duration of the eco programme (T in h:min):			

Measured test results										
	Number of tests $n \geq 5$								Ø	Index
	1	2	3	4	5	6	7	8		
Min. temp. inside test machine before start (°C):										
Max. temp. inside test machine before start (°C):										
Did the test run include a regeneration operation in line with manufacturer's instructions (Yes/ No)?										
Was the test machine disconnected from power supply (Yes/No)?										
Energy consumption (EPEC in kWh):										
Standard programme energy consumption (SPEC in kWh):										
Energy efficiency index (EEI):										
Water consumption (EPWC in l):										
Programme duration (T_t in min; $T \text{ } \emptyset$ h:min):										
Max. water temp. cleaning (°C):										
Max. water temp. rinsing (°C):										
Cleaning score test machine ($C_{T,i}$):										
Cleaning score reference machine ($C_{R,i}$):										
Cleaning performance index (P_C)										
Cleaning confidence interval ($\ln W_C$)										
Drying score test machine ($D_{T,i}$):										
Drying score reference machine ($D_{R,i}$):										
Drying performance index (P_D):										
Drying confidence interval ($\ln W_D$):										
Airborne acoustical noise emissions (in dB(A) re 1pW)										
Laboratory details:										
Laboratory name:					Test officer(s):					
Test date:										
Test conditions:										
	Tolerance:				Test Value:					
Voltage (V):	230 V ²²									
Frequency (Hz):	50 Hz ²³									
Ambient temperature (°C):	23 °C $\pm$ 2 °C									

²² maintained within the range of ± 1 % throughout the test

²³ maintained within the range of ± 1 % throughout the test

Relative humidity (%):	55 % ± 5 %	
Water temperature (°C):	15 °C ± 2 °C	
Water hardness (mmol / l [Ca+Mg]):	2,5 mmol / l ± 0,5 mmol / l	
Water pressure (kPa):	240 kPa ± 20 kPa	

Annex ZD (informative)

Uncertainty of measurement

Following IEC/TR 61923:1997 “Household electrical appliances – Method of measuring performance – Assessment of repeatability and reproducibility”, the below mentioned expanded uncertainties for measurements according to this document were evaluated.

Expanded uncertainties have been assessed based on the 2022/2023 **dishwasher** round-robin test (RRT), where 19 laboratories from Europe and other regions of the world have participated. Even though the main objective of the RRT was the qualification of the new reference system (G 7332 SC or G 1222 SC with **detergent E**) it was also foreseen to verify the robustness and precision of this document.

In this RRT one household **dishwasher** and both **reference machines** were assessed concerning their performance and consumption values. Before being tested in the participating laboratories all test units were specifically checked for stable performance to reduce the impact of manufacturing variance.

Calculations of repeatability and reproducibility per measure were performed excluding statistically identified outliers per specific parameter. Reproducibility values were used to calculate expanded uncertainties, which are expressed as relative and/or absolute values (Table ZD.1).

Table ZD.1 — Relative and absolute expanded uncertainty of measured values of this European Standard

Measured parameter	Relative expanded uncertainty ^a of measured value	Absolute expanded uncertainty of measured value ^b
Cleaning performance index I_C	10 %	n.a.
Drying performance index I_D	6 %	n.a.
Total energy consumption (kWh) ^d	5 %	0,04 kWh
Total water consumption (l) ^d	3 %	0,3 L
Total programme time (min) ^d	2 %	4 min
Off mode (W)	24 %	0,06 W
Standby mode (W)	18 %	0,04 W
Delay start mode (W)	7 %	0,2 W
standby mode in condition of networked standby (W)	24 %	0,4 W
Noise (in re 1 pW)	c	c
^a The expanded uncertainty only describes the uncertainty of the measuring method while the variance of the product is not included. ^b Absolute expanded uncertainty was assessed based on a benchmark model with a rated capacity of 14 ps, energy consumption per cycle of 670 Wh, water consumption per cycle of 9,9 l and a programme duration of 222 min. Low power modes are assumed as follows: 0,22 W (Off mode), 0,21 W (Standby mode), 2,85 W (Delay start mode), and 1,64 W (Standby mode in condition of networked standby). ^c Not assessed in this RRT. ^d Refer to the last paragraph of this annex.		

As long as the relative expanded uncertainty values cover unavoidable variations of measured consumption values due to tolerances in test conditions given by the standard (e.g. ambient conditions, temperature of water for testing, etc.), the approach of applying percentage values is appropriate. With increasing energy and water

efficiency of tested appliances measured consumption values are decreasing and therefore the application of absolute expanded uncertainty may be more suitable to cover the allowed variations in test conditions. Thus, a representation of expanded uncertainties either in relative or in absolute values or as a combination of both were considered by CLC/TC 59X/WG 2 following the analysis of the RRT test results.

The following expanded uncertainties were found to best represent the allowed variation of the test conditions in the standard:

- Expanded uncertainty for the energy consumption: 0,04 kWh for an energy consumption < 0,800 kWh and 5 % for an energy consumption $\geq 0,800$ kWh;
- Expanded uncertainty for the water consumption: 0,3 L for water consumptions < 10 l and 3 % for water consumptions ≥ 10 l;
- Expanded uncertainty for the **programme** duration: 4 min for a duration < 200 min and 2 % for a duration ≥ 200 min;
- Expanded uncertainty for low power modes: 0,10 W if power $\leq 1,0$ W and 10 % if power > 1,0 W. A11

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

Electric dishwashers for household use - Methods for measuring the performance

FOREWORD

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

This fifth edition cancels and replaces the fourth edition published in 2015, and Amendment 1:2020. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) Implementation of a new reference machine, which better reflects modern dishwasher energy and water saving technologies. Its ability to function as a reference machine for the cleaning assessment was assessed in a Round Robin Test.
- b) Implementation of the new reference detergent type E, which better reflects market detergents formulations. It includes upgraded enzymes and a lower content of silicates to reduce the alkalinity which simplifies the world wide transportation by avoiding dangerous goods labelling and therefore improves the usage all over the world.
- c) Implementation of an alignment factor for the cleaning performance assessment as proposed in a scientific study done by an university to align test results of the previous version to the new version of this document with the new reference system described above.
- d) Introduction of replacements and alternatives for the pan and knives as the production of the current ones was stopped.
- e) Improvement of the room temperature control by a temperature measurement inside the dishwasher directly prior to the start of the test programme.
- f) Update of the weight of different load items and the specified ranges to anneal the requirements in the document to the actual weight of the items.
- g) Introduction of an updated method to assess low power modes providing a step-by-step measurement description and including new modes, e.g. network standby which are of increased importance for dishwasher offering additional services via internet connection. Additionally, reactions to different interactions with the appliance can be assessed in a better way and learnings of Round Robin Test are included.
- h) Inclusion of additional method for dishwasher testing which allows the assessment of variations of dishwasher units from one model.
- i) New requirements for the loading and handling instructions for tests institutes.
- j) Implementation of testing methodology for multi-compartment dishwashers.
- k) Improvement of ballast soil preparation process in Annex V.

The text of this International Standard is based on the following documents:

Draft	Report on voting
59A/273/FDIS	59A/276/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of the base publication and its amendment 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, or
- revised.

INTRODUCTION

The history of this fifth edition of IEC 60436 is provided as follows:

- Discussion began in fourth quarter of 2021 during one of the web conferences of Maintenance Team 2.
- A first working draft was developed and discussed during the Qingdao China meeting in September 2023.
- It was decided by SC 59A to proceed directly to CDV, skipping CD stage, due to urgency of implementation of the new [detergent \(3.1.23\)](#) E. This urgency is caused by production termination of enzymes used for [detergent \(3.1.23\)](#) D composition.
- Implementation of new reference system, the new reference [detergent \(3.1.23\)](#) and the new [reference machine \(3.1.6\)](#), is done based on data coming from Round Robin Test conducted in 2022-2023.

Further readings:

[ISO/IEC Guide 98-3:2008/Suppl 2:2011 \[1\]](#), *Uncertainty of measurement – Part 3: Guide to the expression of uncertainty in measurement (GUM:1995) – Supplement 2: Extension to any number of output quantities*

[ISO/IEC Guide 98-4:2012 \[2\]](#), *Uncertainty of measurement – Part 4: Role of measurement uncertainty in conformity assessment*

DIN 5035-6:2006 [\[3\]](#), *Beleuchtung mit künstlichem Licht – Teil 6: Messung und Bewertung ("Lighting with artificial light – Part 6: Measurements and evaluation")*

[ISO 3310-1:2016 \[4\]](#), *Test sieves – Technical requirements and testing – Part 1: Test sieves of metal wire cloth*

[EN 12665:2011 \[5\]](#), *Light and lighting – Basic terms and criteria for specifying lighting requirements*

[IEC 60704-3:2019 \[6\]](#), *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*

[ISO/IEC Guide 98-1:2024 \[7\]](#), *Guide to the expression of uncertainty in measurement — Part 1: Introduction*

[ISO/IEC Guide 98-3:2008 \[8\]](#), *Uncertainty of measurement – Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

[ISO/IEC Guide 98-3:2008/Suppl 1:2008 \[9\]](#), *Uncertainty of measurement – Part 3: Guide to the expression of uncertainty in measurement (GUM:1995) – Supplement 1: Propagation of distributions using a Monte Carlo method*

1 Scope

This document applies to electric **dishwashers** (3.1.1) for household and similar use that are supplied with hot and/or cold water.

The object of this document is to state and define the principal performance characteristics of electric **dishwashers** (3.1.1) for household and similar use and to describe the standard methods of measuring these characteristics.

This document is concerned neither with safety nor with minimum performance requirements.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 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 60705, *Household microwave ovens – Methods for measuring performance*

IEC 60734:2012, *Household electrical appliances - Performance - Water for testing*

IEC 62301:2011, *Household electrical appliances - Measurement of standby power*

IEC 63474, *Electrical and electronic household and office equipment - Measurement of networked standby power consumption of edge equipment*

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

ISO 80000-1:2022, *Quantities and units — Part 1: General*

DIN 51757, *Testing of mineral oils and related materials - Determination of density*

EN 1262, *Surface active agents - Determination of pH value of solutions or dispersions*

3 Terms, definitions and symbols

3.1 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

3.1.1

dishwasher

machine that cleans, rinses and dries **tableware** (3.1.9) by chemical, mechanical, thermal, and electric means

Note 1 to entry: A [dishwasher \(3.1.1\)](#) can have a specific drying [operation \(3.1.13\)](#) at the end of the [programme \(3.1.14\)](#).

Note 2 to entry: Different [dishwasher \(3.1.1\)](#) types are designated by manufacturers e.g. free-standing, built-in or integrated.

3.1.2

free-standing dishwasher

[dishwasher \(3.1.1\)](#) which is intended to be installed without an enclosing structure

3.1.3

built-in dishwasher

[dishwasher \(3.1.1\)](#) which is intended to be installed inside an enclosing structure such as a kitchen cupboard

3.1.4

integrated dishwasher

[built-in dishwasher \(3.1.3\)](#) which is designed to have a board fitted to the [dishwasher \(3.1.1\)](#) door

3.1.5

test machine

[dishwasher \(3.1.1\)](#) under test

3.1.6

reference machine

[dishwasher \(3.1.1\)](#) of known performance used to standardize cleaning and drying performance measurements

Note 1 to entry: Two [reference machines \(3.1.6\)](#) are specified for use in this document (see [Annex I](#) and [Annex W](#)).

3.1.7

test run

single [programme \(3.1.14\)](#) performance assessment

3.1.8

test series

set of [test runs \(3.1.7\)](#) which are collectively used to assess the performance

3.1.9

tableware

dishware, glassware, cutlery and [serving pieces \(3.1.11\)](#) used according to this document to test a [dishwasher \(3.1.1\)](#)

3.1.10

place setting

set of [tableware \(3.1.9\)](#) for the use by one person, not including [serving pieces \(3.1.11\)](#)

Note 1 to entry: A [place setting \(3.1.10\)](#) is comprised of different items used for breakfast and lunch (type A); and dessert and dinner (type B).

3.1.11

serving pieces

set of items for preparation and serving of food which can include pot and pan, serving bowls, serving cutlery and a platter

3.1.12**rated dishwasher capacity**

whole number of [place settings \(3.1.10\)](#) together with the [serving pieces \(3.1.11\)](#) which can be cleaned and dried in one [cycle \(3.1.15\)](#) when loaded in accordance with the manufacturer's instructions

Note 1 to entry: The [rated dishwasher capacity \(3.1.12\)](#) is declared by the manufacturer and expressed as a number of [place settings \(3.1.10\)](#).

3.1.13**operation**

each event that occurs during the [dishwasher \(3.1.1\) programme \(3.1.14\)](#) such as cleaning, rinsing or drying

3.1.14**programme**

series of [operations \(3.1.13\)](#) which are pre-defined within the [dishwasher \(3.1.1\)](#) and which are declared as suitable for specified levels of soil and/or type of load

Note 1 to entry: Usually, an end of [programme \(3.1.14\)](#) indicator signals the end of the [programme \(3.1.14\)](#) and the user has access to the load.

3.1.15**cycle**

complete cleaning, rinsing, and drying process, as defined by the [programme \(3.1.14\)](#) selected, consisting of a series of [operations \(3.1.13\)](#) until [all activity ceases \(3.1.39\)](#)

Note 1 to entry: The [cycle \(3.1.15\)](#) can be equal to or last longer than the [programme \(3.1.14\)](#).

3.1.16**cycle time**

length of time beginning with the initiation of the [cycle \(3.1.15\)](#) (of the selected [programme \(3.1.14\)](#)), excluding any user programmed delay, until [all activity ceases \(3.1.39\)](#)

3.1.17**programme time**

length of time beginning with the initiation of the [programme \(3.1.14\)](#), excluding any user-programmed delay, until an end of [programme \(3.1.14\)](#) indicator is activated and the user has access to the load

Note 1 to entry: If there is no end of [programme \(3.1.14\)](#) indicator, the [programme time \(3.1.17\)](#) is equal to the [cycle time \(3.1.16\)](#).

3.1.18**automatic dispenser**

device activated automatically which injects or dispenses [detergent \(3.1.23\)](#) or [rinse aid \(3.1.24\)](#), one or more times into the [dishwasher \(3.1.1\)](#) at predetermined points in the [dishwasher \(3.1.1\) cycle \(3.1.15\)](#)

3.1.19**non-automatic dispenser**

device, usually a fixed cup or cavity on the [dishwasher \(3.1.1\)](#) door, cover, or [rack \(3.1.22\)](#), which deposits a previously measured amount of [detergent \(3.1.23\)](#) or [rinse aid \(3.1.24\)](#), into the [dishwasher \(3.1.1\)](#)

3.1.20**water softener**

device which reduces the hardness of water

3.1.21**regeneration**

process by which softening capacity is restored to a [water softener \(3.1.20\)](#)

3.1.22**rack**

support for holding dishware, cutlery, and/or glassware in the [dishwasher \(3.1.1\)](#)

3.1.23**detergent**

cleaning agent for use in [dishwashers \(3.1.1\)](#) to aid in the removal of food soils by chemical means

Note 1 to entry: A reference [detergent \(3.1.23\)](#) in powder form is specified for use in this document (see [5.7](#)).

3.1.24**rinse aid**

chemical agent added to the water in the last rinsing [operation \(3.1.13\)](#) to improve the drying effect and reduce water marks

Note 1 to entry: A reference [rinse aid \(3.1.24\)](#) is specified for use in this document (see [5.8](#)).

3.1.25**void****3.1.26****left-on mode**

mode that begins as soon as the [dishwasher \(3.1.1\)](#) door has been opened and/or unlatched by the user after the completion of the [programme \(3.1.14\)](#), and continues without any further intervention from the user

Note 1 to entry: In some products, this mode can be equivalent to the [off mode \(3.1.27\)](#).

Note 2 to entry: This mode can persist indefinitely or can be of limited duration if the [dishwasher \(3.1.1\)](#) is equipped with a [power management system \(3.1.34\)](#).

3.1.27**off mode**

condition in which the test [dishwasher \(3.1.1\)](#) is connected to the mains and is not providing any function

Note 1 to entry: The following shall also be considered as [off mode \(3.1.27\)](#):

- a) conditions providing only an indication of [off mode \(3.1.27\)](#);
- b) conditions providing only functionalities intended to ensure electromagnetic compatibility

3.1.28**network**

communication infrastructure with a topology of links, an architecture, including the physical components, organizational principles, communication procedures and formats (protocols)

3.1.29**standby mode**

condition where the test [dishwasher \(3.1.1\)](#) is connected to the mains and provides only the following functions, which could persist for an indefinite time:

- a) reactivation function, or reactivation function and a mere indication of enabled reactivation function; and/or
- b) reactivation function through a connection to a [network \(3.1.28\)](#); and/or
- c) information or status display; and/or
- d) detection function for emergency measures

3.1.30**networked standby**

condition where the household [dishwasher \(3.1.1\)](#) is connected to the mains and provides only the reactivation function through a connection to a [network \(3.1.28\)](#), which can persist for an indefinite time

Note 1 to entry: This mode is only applicable to [dishwashers \(3.1.1\)](#) that provide a connection function to a [network \(3.1.28\)](#).

 Note 2 to entry: The terms “networked standby” and “standby mode in condition of networked standby” can be used synonymously. 

3.1.31**delay start mode**

condition where the user has selected a specified delay to the beginning of the selected [programme \(3.1.14\)](#)

Note 1 to entry: This mode is only applicable to [dishwashers \(3.1.1\)](#) that provide a delay start function for the user.

3.1.32

void

3.1.33**left-on mode duration**

time from the start of [left-on mode \(3.1.26\)](#) until the [dishwasher \(3.1.1\)](#) reverts automatically to [off mode \(3.1.27\)](#)

Note 1 to entry: This time span is only applicable to [dishwashers \(3.1.1\)](#) equipped with [power management systems \(3.1.34\)](#).

3.1.34**power management system**

system within the [dishwasher \(3.1.1\)](#) which allows it to revert automatically to [off mode \(3.1.27\)](#) or [standby mode \(3.1.29\)](#) after the completion of the [programme \(3.1.14\)](#)

3.1.35**refrigerate**

storage of foods at a temperature of $(4 \pm 3) ^\circ\text{C}$

3.1.36**freeze**

storage of foods at a temperature of $(-18 \pm 3) ^\circ\text{C}$

3.1.37**automatic or self-cleaning filter**

filter system which does not require frequent cleaning by the user

3.1.38**manual filter**

filter system which requires cleaning by the user after each [cycle \(3.1.15\)](#)

Note 1 to entry: The information on [manual filter \(3.1.38\)](#) shall be provided to the user.

3.1.39**all activity ceases**

power consumption decreases to a low steady state in which the power fluctuates by no more than 10 % or 0,1 W, whichever is the greater, over a period of at least 60 min

3.1.40**intermittently recurring function**

function that occurs during some, but not all, series of [operations \(3.1.13\)](#) of a specific [programme \(3.1.14\)](#) (or [programmes \(3.1.14\)](#)) and that is directly related to water-softening [operations \(3.1.13\)](#), water-reuse [operations \(3.1.13\)](#) or similar [operations \(3.1.13\)](#) and that alters water consumption, energy consumption and/or [programme time \(3.1.17\)](#)

3.2 Symbols

3.2.1 Symbols related to the application of egg (6.4.5.3)

A_t	total amount of soil to be applied to all the items to be soiled for each item type t
N_t	number of items of type t to be soiled with egg
M_t	average mass of egg to be applied to each item of type t

3.2.2 Symbols related to the calculation of the drying index (7.2.3)

N	total number of scores for all items
n	number of combined cleaning and drying test runs (3.1.7)
s_z	total number of scores per item number
$D_{R,z}$	sum of drying scores of the reference machine (3.1.6)
$D_{T,z}$	sum of drying scores of the test machine (3.1.5)
$D_{R,i}$	average drying score for one test run (3.1.7) of the reference machine (3.1.6)
$D_{T,i}$	average drying score for one test run (3.1.7) of the test machine (3.1.5)
$D_{R,t}$	is (0,82) the technically set drying score based on the target drying score of the reference machine (3.1.6)
$\ln P_{D,i}$	logarithm of the drying performance index for one test run (3.1.7) of the test machine (3.1.5)
$\ln P_D$	arithmetical average of $\ln P_{D,i}$
$\ln S_D$	drying standard deviation of the $\ln P_{D,i}$
$\ln W_D$	half range of the logarithmic drying confidence interval
$t_{f;1-\alpha/2}$	numerical factor, depending on the number $f = n - 1$ degrees of freedom for the chosen confidence level $1 - \alpha = 0,95$ with two-sided demarcation (see Table 5)
P_D	drying performance index for the test series (3.1.8)

3.2.3 Symbols related to the calculation of the cleaning index (7.3.2)

N	total number of scores for all items
n	number of combined cleaning and drying test runs (3.1.7)
s_z	total number of scores per item number
$C_{R,z}$	sum of cleaning scores of the reference machine (3.1.6)
$C_{T,z}$	sum of cleaning scores of the test machine (3.1.5)
$C_{R,i}$	average cleaning score for one test run (3.1.7) of the reference machine (3.1.6)
$C_{T,i}$	average cleaning score for one test run (3.1.7) of the test machine (3.1.5)
$\ln P_{C,i}$	logarithm of the cleaning performance index for one test run (3.1.7) of the test machine (3.1.5)
$\ln P_C$	arithmetical average of $\ln P_{C,i}$
$\ln S_C$	cleaning standard deviation of the $\ln P_{C,i}$
$\ln W_C$	half range of the logarithmic cleaning confidence interval
$t_{f;1-\alpha/2}$	numerical factor, depending on the number $f = n - 1$ degrees of freedom for the chosen confidence level $1 - \alpha = 0,95$ with two-sided demarcation (see Table 5)
P_C	cleaning performance index for the test series (3.1.8)
$AF1$	alignment factor 1 for cleaning index

AF2	alignment factor 2 for cleaning index
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3.2.4 Symbols related to the measurements (Clause 8 and Annex U)

E_e	electrical energy
E_h	hot water energy
E_c	cold water correction energy
t_h	volume-weighted average inlet temperature of all hot water
t_{hi}	temperature of each increment of hot water supplied to the test machine (3.1.5)
Q_{hi}	volume of each increment of hot water supplied to the test machine (3.1.5)
Q_h	volume of hot water supplied to the test machine (3.1.5)
Q_t	total water volume
t_c	volume-weighted average inlet temperature
t_{ci}	temperature of each increment of water supplied to the test machine (3.1.5) which is subsequently heated by the internal heater of the machine
Q_{ci}	volume of each increment of water supplied to the test machine (3.1.5) which is subsequently heated by the internal heater of the machine
Q_c	volume of the cold water supplied to the test machine (3.1.5)
$E_{\text{Regional-e}}$	estimated energy consumption for the dishwasher (3.1.1) for a cold water supply temperature of t_{nr}
$E_{\text{IEC15 } ^\circ\text{C-m}}$	measured energy for the dishwasher (3.1.1) in accordance with 8.3.2 with a cold water supply temperature of 15 °C
t_{nr}	nominal non-standard cold water temperature for the region
Q_a	cold water volume of all cold fills that occur in heated operations (3.1.13)
Q_b	cold water volume of all cold fills for non-heated operations (3.1.13), excluding any cold fills that occur after the last heated operation (3.1.13)
$E_{\text{IEC15 } ^\circ\text{C-e}}$	estimated energy for the dishwasher (3.1.1) with a cold water supply temperature of 15 °C
$E_{\text{Regional-m}}$	measured energy consumption for the dishwasher (3.1.1) for a cold water supply temperature of t_{nr} but otherwise in accordance with 8.3.2

3.2.5 Symbols related to the microwave calibration (Annex F)

$t_{u,1}$	required cooking time in min at the nominal output power P_1
P_1	nominal output power of 780 W
t_1	nominal cooking time at the nominal output power P_1 of 4 min
$P_{u,1}$	measured power output in W at the nominal output power P_1
t_c	time correction in min depending on the cleaning performance of the milk glasses
$t_{u,2}$	required cooking time in min at the nominal output power P_2
P_2	nominal output power of 150 W
t_2	nominal cooking time at the nominal output power P_2 of 10 min
$P_{u,2}$	measured power output in W at the nominal output power P_2

4 List of measurements

The standard methods of measuring the performance characteristics are determined as follows:

- combined cleaning and drying performance according to Clause 6 and Clause 7;

- energy consumption, water consumption and [programme time \(3.1.17\)](#) according to [Clause 8](#);
- airborne acoustical noise according to [Clause 9](#);
- additional aspects of energy consumption of [dishwashers \(3.1.1\)](#) (low power modes) according to [Annex K](#).

5 General conditions for measurements

5.1 General

5.1.1 General information

The [dishwasher \(3.1.1\)](#) manufacturer's instructions regarding installation and use of the [dishwasher \(3.1.1\)](#) shall be followed, except where there is a conflict with this document, in which case this document shall prevail.

A11 Refer to manufacturer's instructions concerning relevant test conditions for the **test machine**, including installation instructions, **detergent** amounts, **rinse aid** settings, **water softener** settings and any other information relevant to identifying **regeneration operations** (if applicable), filter type, and loading plans/instruction.

Loading plans/instruction provided by the manufacturer containing additional loading parts or accessories that are not intended to be applied by the user and that are not described in the user instructions shall be disregarded for testing.

Performance tests according to this document are carried out on a conditioned machine (5.2), with a **reference machine** running parallel with the **test machine(s)**, i.e. at the same time under the same conditions using soil prepared at the same time from the same batch. **A11** The [reference machine \(3.1.6\)](#) shall be in accordance with the description given in [Annex I](#) or [Annex W](#).

The [reference machine \(3.1.6\)](#) shall always be installed as a [free-standing dishwasher \(3.1.2\)](#) machine independent of the type of [test machine \(3.1.5\)](#).

The same [reference machine \(3.1.6\)](#) shall be used for entire [test series \(3.1.8\)](#).

Before commencing a [test series \(3.1.8\)](#), [reference machine \(3.1.6\)](#) and the [test machine \(3.1.5\)](#) shall be checked to ensure that they are operating properly.

Alternative test design concepts are described in [Annex Y](#).

A11 For energy labelling and ecodesign purposes, the alternative test design concepts are not relevant. **A11**

All tests shall be started with the appliances at the ambient temperature according to [5.5](#).

NOTE An appliance which has been stored for 12 h at ambient conditions is considered to be at ambient temperature.

The tolerances specified for parameters within this document, using the symbol "±", indicate the allowable limits of variation from the specified parameter outside which the test or results shall be invalid. The statement of tolerance does not permit the deliberate variation of these specified parameters.

Rounding shall not be applied to the results of intermediate calculations. If numbers have to be rounded, they shall be rounded to the nearest number according to ISO 80000-1:2022, Clause B.3 Rule B. If the digit to be rounded is five or more, it shall be rounded up. If the rounding takes place to the right of the comma, the omitted places shall not be filled with zeros.

Requirements for measurements and instrumentation and their accuracy are described in [Table T.1](#).

Guidelines for good laboratory practice are described in [Annex O](#).

5.1.2 Free-standing dishwasher (3.1.2)

Dishwashers (3.1.1) shall be tested as free-standing dishwasher (3.1.2) except where they are designated as built-in dishwasher (3.1.3) or integrated dishwasher (3.1.4) (refer to 5.1.3). Dishwashers (3.1.1) that can be installed as either free-standing dishwasher (3.1.2) or built-in (3.1.3)/integrated (3.1.4) shall be tested as free-standing dishwasher (3.1.2).

5.1.3 Built-in dishwasher (3.1.3) and integrated dishwashers (3.1.4)

Dishwashers (3.1.1) that can only be installed as built-in (3.1.3) or integrated (3.1.4), shall be installed in an enclosure according to Annex N. The enclosure is illustrated in Figure N.1.

5.1.4 Multi-compartment dishwashers (3.1.1)

Guidance for the assessment and evaluation of multi-compartment dishwashers can be found in Annex X.

5.2 Sequence of test procedures and conditioning of the test machine (3.1.5)

A11 Before conducting performance tests on a **dishwasher**, it shall be operated for at least three **cycles**, using a **programme** suitable for normally or heavily soiled **tableware**, with reference **detergent** (specified in 5.7) and with reference **rinse aid** (specified in 5.8), to remove residues; a clean load or no load may be used.

Performance of an aged and/or used dishwasher can differ from a new and/or unused machine. Tracking the history (storage, tests done, use cases, modifications to software and hardware, etc.) of the test machine is recommended. **A11**

NOTE Any **cycles** (3.1.15) or **operations** (3.1.13) performed on the appliance during the manufacture of the product are ignored.

If noise measurements should be done, they shall be carried out before any performance measurements and in accordance with Clause 9. For noise tests, the conditions of the respective standard should be fulfilled. No additional **cycles** (3.1.15) shall be carried out on the **test machine** (3.1.5) between the sequential steps specified in the following procedure.

The assessment of the drying and cleaning performance shall be performed using a soiled load (Clause 6). Drying and cleaning performance shall be both assessed consecutively on each single **test run** (3.1.7). The determination of energy consumption, water consumption and **programme time** (3.1.17) (Clause 8) shall be done concurrently with the combined cleaning and drying performance test (Clause 6 and Clause 7).

Manufacturers or suppliers can have information on the design and **operation** (3.1.13) of their **dishwashers** (3.1.1) which would allow an equivalent determination of the drying performance using an alternate method, for example, with unsoiled **tableware** (3.1.9) and in a separate test. For declaration and verification purposes according to this document, the method specified in the previous paragraph using a soiled load takes precedence over any other determination. The method used shall be reported.

Between two **test series** (3.1.8), the **reference machine** (3.1.6) and the **test machine** (3.1.5) shall be cleaned by operating for at least two **cycles** (3.1.15) in the test **programme** (3.1.14) with reference **detergent** (3.1.23) (specified in 5.7). Prior to starting a new **test series** (3.1.8), ensure that the filters and all visible areas of the machine, and areas that can be cleaned according to the manufacturer's user instructions, are clean. When checking for soil residue in the **dishwasher** (3.1.1), particular attention should be paid to accumulations in locations such as filters, sump, spray arms, door seals and **rack** (3.1.22) rails.

If recommended by the manufacturer, adjust the **water softener** (3.1.20) and add salt as per 5.9.

5.3 Electricity supply for machines

5.3.1 Electricity supply for [test machine \(3.1.5\)](#)

5.3.1.1 Voltage

A11 The supply voltage of the test machine shall be set at 230 V and maintained within the range of ± 1 % throughout the test. The supply voltage measured during the tests shall be recorded. **A11**

5.3.1.2 Frequency

A11 The supply frequency shall be set at 50 Hz and maintained within ± 1 % throughout the test. The measured frequency shall be reported. **A11**

5.3.2 Electricity supply for the [reference machine \(3.1.6\)](#)

5.3.2.1 Voltage

The supply voltage shall be set at 230 V AC and maintained within ± 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 ± 1 % throughout the test. The measured frequency shall be reported.

5.4 Test [programme \(3.1.14\)](#)

A11 For energy labelling and ecodesign purposes, the programme to be tested for performance measurements shall be the “ECO” programme which is intended to clean normally soiled tableware (standard cleaning and drying cycle).

NOTE Z1 For noise testing see Clause 9. **A11**

Additional [programmes \(3.1.14\)](#) may then be tested.

NOTE In some countries, the manufacturer must declare the [programme \(3.1.14\)](#) to be used for the purpose of energy labelling (not necessarily intended for a normally soiled load). In some countries the [programme \(3.1.14\)](#) is legislated.

The same [programme \(3.1.14\)](#) shall be used for measuring the combined cleaning and drying performance according to [Clause 6](#) and [Clause 7](#); the energy consumption, water consumption and [programme time \(3.1.17\)](#) according to [Clause 8](#); and the noise according to [Clause 9](#), if tested.

The name of the [programme \(3.1.14\)](#) tested shall be reported.

5.5 Ambient conditions

The following ambient conditions shall be maintained throughout the whole process described in [Clause 6](#) and [Clause 7](#). The conditions shall be reported.

- Ambient temperature of the room: (23 ± 2) °C.
- Relative humidity: **A11** (55 ± 5) %. **A11**

The temperature inside the [reference machine \(3.1.6\)](#) and [test machine \(3.1.5\)](#) with the [tableware \(3.1.9\)](#) items loaded shall be measured and recorded at a frequency of at least once per 10 s directly before the [programme \(3.1.14\)](#) start for a period of 5 min with a closed door. The temperature sensor in the [test machine \(3.1.5\)](#) shall be located at one of the front corners of the lowest available [rack \(3.1.22\)](#) and in accordance with information provided by the

manufacturer, if available. For position of the temperature sensor in the [reference machine \(3.1.6\)](#) refer to [I.4.6](#) or [W.4.5](#). The [programme \(3.1.14\)](#) shall not be started until the temperature inside the machine is within the limit defined for ambient temperature of the room for the 5 min period. The minimum and maximum result during the 5 min shall be reported.

Record the temperature inside the machine for the whole run.

5.6 Water

5.6.1 General

Subclause 5.6 describes the characteristics of the water supply to be connected to the [dishwasher \(3.1.1\)](#) while it is being prepared for testing and throughout the testing process. It also includes a specification for water to be used in the preparation of soil (e.g. tea according to [6.4.3](#), minced meat according to [6.4.4](#) and oat flakes according to [6.4.6](#)).

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

5.6.2 Water 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 by the manufacturer which does include $60 ^\circ\text{C}$, $(60 \pm 2) ^\circ\text{C}$, or
 - where a range is specified by the manufacturer which does not include $60 ^\circ\text{C}$, the value nearest to $(60 \pm 2) ^\circ\text{C}$, or
 - $(60 \pm 2) ^\circ\text{C}$, if instructions are not given.

For [dishwashers \(3.1.1\)](#) that include a water supply line (i.e. the water inlet hose is supplied by the manufacturer), the volume of the water pipe between the measurement device for temperature and the connection point to the water inlet hose of the test [dishwasher \(3.1.1\)](#) shall not exceed 250 ml. For [dishwashers \(3.1.1\)](#) that do not include a water supply line (i.e. the water inlet hose is not supplied by the manufacturer), the volume of the water pipe between the measurement device for temperature and the connection point to the water inlet supply valve of the test [dishwasher \(3.1.1\)](#) shall not exceed 400 ml. If a bypass is installed to flush non-circulating water to ensure water supply temperature compliance, at each connection to the water inlet hose(s), or water inlet supply valve, of the [dishwasher \(3.1.1\)](#), 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 [dishwashers \(3.1.1\)](#) that include a water supply line, or shall not exceed 400 ml for [dishwashers \(3.1.1\)](#) that do not include a water supply line.

NOTE Installation of a bypass near the point of connection of the appliances is considered good laboratory practice.

A11 For energy labelling and ecodesign purposes, the use of hot water is not permitted. **A11**

The water supply system shall be configured so that throughout the [programme \(3.1.14\)](#) the measured temperature of water entering the [dishwasher \(3.1.1\)](#) is within the specified tolerance.

5.6.3 Water hardness

If hard water is used it shall have a water hardness of $(2,5 \pm 0,5) \text{ mmol/l}$. If soft water is used, it shall have a water hardness of $\leq 0,85 \text{ mmol/l}$. If water hardness needs to be adjusted to meet these specifications, it shall be prepared according to **A11** EN 60734:2012 **A11** Methods B, C1, C2

or C3. 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.

A11 For energy labelling and 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. **A11**

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 during all fills. The measured water pressure shall be reported. Where the manufacturer specifies a range of water pressure that does not include (240 ± 20) kPa, the water pressure shall be set at the end of the pressure range closest to (240 ± 20) kPa.

5.6.5 Additional water quality parameters

Metal ions, such as iron, copper, and manganese can impact cleaning performance by influencing the bleaching intensity. Also the chloride content of water for testing can be of relevance for testing [dishwashers \(3.1.1\)](#). Therefore, it is recommended to not exceed following limits (see IEC 60734:2012, 5.2, Table 3):

- Iron (Fe) < 0,1 mg/l;
- Copper (Cu) < 0,05 mg/l;
- Manganese (Mn) < 0,05 mg/l;
- Chloride (Cl) < 4,5 mmol/l.

Regularly, and at least every six months (e.g. in conjunction with specification check of the [reference machine \(3.1.6\)](#)), a check of the additional water quality parameters shall be undertaken. The measured metal ion and chloride content shall be reported. If the water for testing exceeds any of the critical thresholds, corrective actions should be taken to minimize the impact on cleaning performance.

NOTE The technical committee preparing this document is considering making above limits mandatory in the future.

5.7 Detergent (3.1.23)

The reference [detergent \(3.1.23\)](#) E, as described in [Annex E](#), from the same batch shall be used in the [reference \(3.1.6\)](#) and [test machines \(3.1.5\)](#) throughout the whole [test series \(3.1.8\)](#). The quantity of [detergent \(3.1.23\)](#) for one [test run \(3.1.7\)](#) shall be as recommended by the manufacturer, including the dosage of [detergent \(3.1.23\)](#) in different [cycle \(3.1.15\)](#) steps (e.g. main wash or pre-wash), but not more than

$$\begin{aligned}
 & -8 \text{ g} + 0,5 \text{ g per place setting loaded for dishwashers with a capacity of} \\
 & \quad \geq 8 \text{ place setting} - 8 \text{ g} \\
 & \quad + 0,7 \text{ g per place setting loaded for dishwashers with a capacity of} \\
 & \quad < 8 \text{ place settings}
 \end{aligned} \tag{1}$$

The total amount of [detergent \(3.1.23\)](#) stated above shall be used if no recommendation is given by the manufacturer.

The manufacturer's recommendation regarding the dosage of [detergent \(3.1.23\)](#) in different operations, e.g. main wash or pre-wash can be followed if the maximum amount is not exceeded.

The quantity of [detergent \(3.1.23\)](#) used during the tests shall be reported.

Refer to [I.3.2](#) or [W.3.2](#) for the amount of [detergent \(3.1.23\)](#) used in the [reference machine \(3.1.6\)](#).

The [detergent \(3.1.23\)](#) shall be placed in the [dishwasher \(3.1.1\)](#) immediately prior to starting the [programme \(3.1.14\)](#) in the locations specified by the manufacturer. If a dispenser is fitted,

some or all of the [detergent \(3.1.23\)](#) dose shall be placed in it according to the manufacturer's instructions. All dispenser compartments shall be clean and dry prior to the placement of [detergent \(3.1.23\)](#). In the absence of manufacturer's recommendations, the total amount of [detergent \(3.1.23\)](#) shall be placed in the main compartment of the dispenser.

Before use, the [detergent \(3.1.23\)](#) shall be homogenized in accordance with [A11](#) ISO 607:1980 [A11](#) (refer to [Annex L](#) for suitable equipment). This guarantees an even distribution of the [detergent \(3.1.23\)](#) components in the prepared samples. The homogenization process shall be documented in the test report.

The [detergent \(3.1.23\)](#) shall be stored in a waterproof container in quantities of no more than 1 kg at temperatures between 1° and 25° C. After first opening of the container, it shall be stored tightly closed at ambient temperature of (23 ± 2) °C and relative humidity not exceeding 65 %. It shall be used within six months after production date.

5.8 Rinse aid (3.1.24)

The [rinse aid \(3.1.24\)](#) Formula "III", as described in [Annex E](#), shall be used.

For [dishwashers \(3.1.1\)](#) with an adjustable [automatic dispenser \(3.1.18\)](#), the setting shall be as recommended by the manufacturer. In the absence of such an indication, the setting shall be used which gives the lowest quantity of [rinse aid \(3.1.24\)](#).

Any requirement or recommendation to experiment with the setting shall be ignored.

[A11](#) For machines without **automatic dispensers**, the **rinse aid** shall be added manually, if so recommended by the manufacturer to the user and in accordance with their instructions. [A11](#)

5.9 Salt

If the [dishwasher \(3.1.1\)](#) is equipped with a [water softener \(3.1.20\)](#) that requires salt, fill the salt reservoir in accordance with the manufacturer's instructions. For specification of the salt, see [Annex E](#).

For [dishwashers \(3.1.1\)](#) with an adjustable [water softener \(3.1.20\)](#), the setting shall be as recommended by the manufacturer for the water hardness used for the test. Where there is no recommendation, use the lowest setting.

5.10 Intermittently recurring functions (3.1.40)

[A11](#) For energy labelling and ecodesign purposes, this subclause does not apply. [A11](#)

5.10.1 Provision of information

Either the manufacturer or supplier shall provide information for all [intermittently recurring functions \(3.1.40\)](#) that relate to the [programme \(3.1.14\)](#) selected for testing. This data shall include details of changes to energy consumption, water consumption and [programme \(3.1.14\)](#) duration that are caused by each [intermittently recurring function \(3.1.40\)](#). The data shall also include a description of the conditions that trigger each [intermittently recurring function \(3.1.40\)](#). An example of a format for describing [intermittently recurring functions \(3.1.40\)](#) is shown in [Table V.1](#).

If no data are provided by the manufacturer or supplier, [intermittently recurring functions \(3.1.40\)](#) can take place during valid test [cycles \(3.1.15\)](#) and, if this happens, it is likely that the measured and averaged consumption values as well as the uncertainty of measurement will be significantly higher.

The measured energy, water, and time of [intermittently recurring functions \(3.1.40\)](#) can vary. If these values differ by more than 10 % from the consumption values provided by the manufacturer, then the laboratory should seek further guidance from the manufacturer.

5.10.2 Impact of **intermittently recurring functions (3.1.40)** on reproducibility and the validity of test results

When a **dishwasher (3.1.1)** is tested over a **test series (3.1.8)** of 5 to 8 **test runs (3.1.7)**, **intermittently recurring functions (3.1.40)** can cause the results to be different to the true long-term average. For example, if the **dishwasher (3.1.1)** regenerates its softener every 3 **cycles (3.1.15)** and uses a significant amount of water to regenerate, the average water consumption for the **test series (3.1.8)** would be higher if two **regenerations (3.1.21)** occurred than if only one occurred in the **test series (3.1.8)**. Neither of these cases would give the same result as the long-term average. Reproducibility of such a test would be poor. Two options to resolve this problem are given in 5.10.3.

5.10.3 Treatment of **intermittently recurring functions (3.1.40)**

For **dishwashers (3.1.1)** with **intermittently recurring functions (3.1.40)**, testing can be conducted according to one of the following two options:

- a) Excluding consumption data from **test runs (3.1.7)** where the **intermittently recurring function (3.1.40)** takes place, from the calculation of the mean. In this case, testing shall follow the procedures in **Clause 8**. This option should give reproducible results, but the values determined will not account for the consumption associated with the **intermittently recurring function (3.1.40)(s)**.
- b) Extending the **test series (3.1.8)** as necessary to include a suitable number of **test runs (3.1.7)** where the **intermittently recurring function (3.1.40)** does not take place and a suitable number of **test runs (3.1.7)** where **intermittently recurring function (3.1.40)** does take place. From such a **test series (3.1.8)**, consumption data for each case can be combined to give an appropriately weighted average which would be representative of the long-term average. In this case, testing procedures are set out in **Clause 8** and **Annex V**. This option should give reproducible results and account for the consumption associated with the **intermittently recurring function (3.1.40)(s)**.

6 Combined cleaning and drying performance tests

6.1 General and purpose

The purpose of this test is to measure how well the appliance cleans and dries normally soiled **place settings (3.1.10)** and **serving pieces (3.1.11)**.

The tests are carried out in parallel with either the **reference machines (3.1.6)** specified in **Annex I** or **Annex W**, under conditions described in **Clause 5**. The **reference machine (3.1.6)** and the **test machine(s) (3.1.5)** shall be prepared according to **Clause 5** using a load as specified in 6.2 and soiled according to 6.4 with soils specified in 6.3. The **tableware (3.1.9)** shall be dried (using either the air drying or oven drying method) according to 6.5 and placed into the machines according to 6.6. The test results shall be evaluated according to **Clause 7**.

The sequence of the test procedure as specified in 5.2 shall be followed.

Soiling of the test loads for the **reference machine (3.1.6)** and the **test machine (3.1.5)** shall be prepared in parallel.

For a large number of test loads, it is permissible to have more than one person preparing soils, but one person shall prepare each soil type for all loads. Similarly, one person shall apply each soil type for all loads (the person preparing soils may be different to the person applying soils).

6.2 Load

6.2.1 Composition of the test load

The test load shall comprise specific numbers of each [tableware \(3.1.9\)](#) item according to the rated capacity of the [test machine \(3.1.5\)](#) as described in [Annex A](#). The physical condition of the [tableware \(3.1.9\)](#) items shall meet the description in [Annex A](#).

Alternative items in the test load shall be the same in the [reference machine \(3.1.6\)](#) and the [test machine\(s\) \(3.1.5\)](#).

6.2.2 Requirements for pre-conditioning of new [tableware \(3.1.9\)](#)

New [tableware \(3.1.9\)](#) items shall be pre-conditioned by washing them for three [cycles \(3.1.15\)](#) using [detergent \(3.1.23\)](#) (specified in [5.7](#)) and [rinse aid \(3.1.24\)](#) (specified in [5.8](#)). Use a [dishwasher \(3.1.1\)](#), other than the [test machine\(s\) \(3.1.5\)](#) or the [reference machine \(3.1.6\)\(s\)](#), with a [programme \(3.1.14\)](#) suitable for normally or heavily soiled [tableware \(3.1.9\)](#).

6.2.3 Requirements for conditioning of [tableware \(3.1.9\)](#)

All [tableware \(3.1.9\)](#) items shall be clean, dry and conditioned prior to the [test run \(3.1.7\)](#). In this case 'clean' means that an item would score 5 if assessed according to [Clause 7](#) and 'dry' means that an item would score 2 if assessed according to [Clause 7](#).

Special attention should be paid to soup plates and dessert bowls (specified in [A.2](#)) soiled with oat flakes (specified in [6.4.6.1](#)) to verify they are free of starch residue from previous tests. This can be checked by applying Lugols solution after each cleaning performance test. Lugols solution can be obtained from supplier mentioned in [L.1.15](#).

The [tableware \(3.1.9\)](#) items shall be conditioned in a [dishwasher \(3.1.1\)](#) using [detergent \(3.1.23\)](#); the type of [detergent \(3.1.23\)](#) specified in [5.7](#) is recommended but not required. The [dishwasher \(3.1.1\)](#) shall dispense [rinse aid \(3.1.24\)](#) (specified in [5.8](#)) in the final [operation \(3.1.13\)](#) prior to the next test. Use a [dishwasher \(3.1.1\)](#), other than the [test machine \(3.1.5\)](#) or the [reference machine \(3.1.6\)](#), with a [programme \(3.1.14\)](#) which has a cleaning performance equal to or better than that of the [reference machine \(3.1.6\)](#).

6.2.4 Requirements for re-conditioning [tableware \(3.1.9\)](#)

A film or scale can accumulate on the surface of the [tableware \(3.1.9\)](#) with use. If this happens and the accumulation cannot be removed by the procedure given in [6.2.3](#), apply the following procedure:

- Place the [tableware \(3.1.9\)](#) in a [dishwasher \(3.1.1\)](#) other than the [test machine\(s\) \(3.1.5\)](#) or the [reference machine\(s\) \(3.1.6\)](#).
- Run a [programme \(3.1.14\)](#) in which the [detergent \(3.1.23\)](#) is substituted with 30 g anhydrous citric acid (for the supplier see [Annex L](#)) and [rinse aid \(3.1.24\)](#) specified in [5.8](#) is dispensed as normal. Use a [programme \(3.1.14\)](#) which has a cleaning performance equal to or better than that of the [reference machine\(s\) \(3.1.6\)](#).
- Inspect and condition the [tableware \(3.1.9\)](#) according to [6.2.3](#).

6.3 Soiling agents and preparation equipment

The following soiling agents are required:

- milk;
- tea;
- minced meat;
- egg;

- oat flakes;
- spinach;
- margarine.

All food products, by the time they are used for the preparation of soiling agents to this document, shall be within the "use-by" date or before their expiry date stated on the product and shall be stored according to the supplier's instructions unless this document provides additional information. For milk (6.4.2) and eggs (6.4.5) specific additional information is provided.

Each soiling agent used for the [reference \(3.1.6\)](#) and for [test machines \(3.1.5\)](#), for one [test series \(3.1.8\)](#), shall be from the same production batch.

NOTE Details of a supplier of suitable soils from the same batch can be found in L.1.11.

If the specified product is not available, the use of a similar product which provides equivalent results is permitted. Equivalency shall be proven through testing. Refer to Clause L.2 for guidance on equivalency.

6.4 Preparation and application of soiling agents

6.4.1 General

Subclause 6.4 describes how the soiling agents are prepared and applied to the test load items.

Unless specifically stated otherwise, all soiling agents shall be freshly prepared for each test.

The final preparation and application of the soils to the [tableware \(3.1.9\)](#) items shall be done within 12 consecutive hours, with prepared soils [refrigerated \(3.1.35\)](#) in air tight containers prior to usage except where specified otherwise.

Based on the number of [place settings \(3.1.10\)](#), calculate the total weight of soil that will be needed (grams/item × number of [tableware \(3.1.9\)](#) items) to soil all the machines being run in parallel.

Start by pre-heating the microwave oven for the milk soiling. During this time, prepare the tea soiling and begin preparation and application of the remainder of other soiling agents. During the pre-drying period for the tea (1 h), complete the preparation and application of the remaining soiling agents.

For all soiling agents except milk and tea, apply the specified mass of soil to the specified load items using the specified application tool. Specific procedures for applying milk and tea are described in 6.4.2 and 6.4.3.

NOTE The correct amount of soil can be applied either by placing the item to be soiled on a balance, zeroing the balance, and adding soil until the specified mass has been applied; or by weighing slightly more than is required into a container along with the application tool, and applying soil to the load item from this container until the mass of soil missing from the container along with the application tool is equal to the specified amount to be applied to the item.

Soils shall be evenly distributed. Soil can be added or removed to ensure the exact amount until drying of soil (by appearance) begins.

Refer to [Table C.1](#) to [Table C.4](#) for an illustration of soil application and quantities.

For guidance, [Annex D](#) contains pictures showing how soiled [tableware \(3.1.9\)](#) should look.

6.4.2 Milk

6.4.2.1 General

U.H.T. milk with 1,5 % to 2 % fat content shall be used. U.H.T. milk shall not be used within 30 days of its expiry date. U.H.T. milk shall be kept [refrigerated \(3.1.35\)](#) after opening and used within 2 days of opening.

Alternatively, fresh 1,5 % to 2 % fat content homogenized milk can be used and shall be kept [refrigerated \(3.1.35\)](#) after opening and used within 2 days of opening.

UHT milk shall be used unless unavailable, then fresh milk can be used.

A11 For energy labelling and ecodesign purposes, UHT milk shall be used. **A11**

6.4.2.2 Items required for preparation

- Microwave ovens with a glass turntable as specified in [Annex F](#);
- Glasses (specified in [Annex A](#));
- Pipette (10 ml; specified in L.1.14).

6.4.2.3 Pre-heating the microwave oven

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

- Place six glasses each filled with 50 ml of water at a temperature of $(23 \pm 2) ^\circ\text{C}$, in the microwave oven; use glasses which do not belong to the test load.
- Place the glasses evenly-spaced in a circle with a radius of 160 mm (centre of the circle = centre of the glass turntable). See [Figure 1](#).
- As described in [Annex F](#), operate the microwave oven for $t_{u,1}$ min depending on the oven type at a nominal power setting of 780 W ($P_{u,1}$) and then for $t_{u,2}$ min at a nominal power setting of 150 W ($P_{u,2}$).

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

6.4.2.4 Application

- Items to be soiled:
The type A glasses shall be soiled with milk.
- Quantity of soil:
Use 10 ml of milk to soil each glass.
- Method of soiling the glasses:
Upon removal from the refrigerator, gently shake the milk for approximately 5 s before each application. Immediately after shaking, add 10 ml of milk to each glass using a pipette and immediately carry out the cooking process.

NOTE Details for a suitable pipette are given in L.1.14.

Any remaining milk shall be [refrigerated \(3.1.35\)](#) again, without delay.

6.4.2.5 Cooking process

Immediately after the pre-heating has been completed, place 6 glasses with milk in the microwave oven and cook the glasses continuously at 780 W and then at 150 W for the cooking times calculated according to [F.2](#).

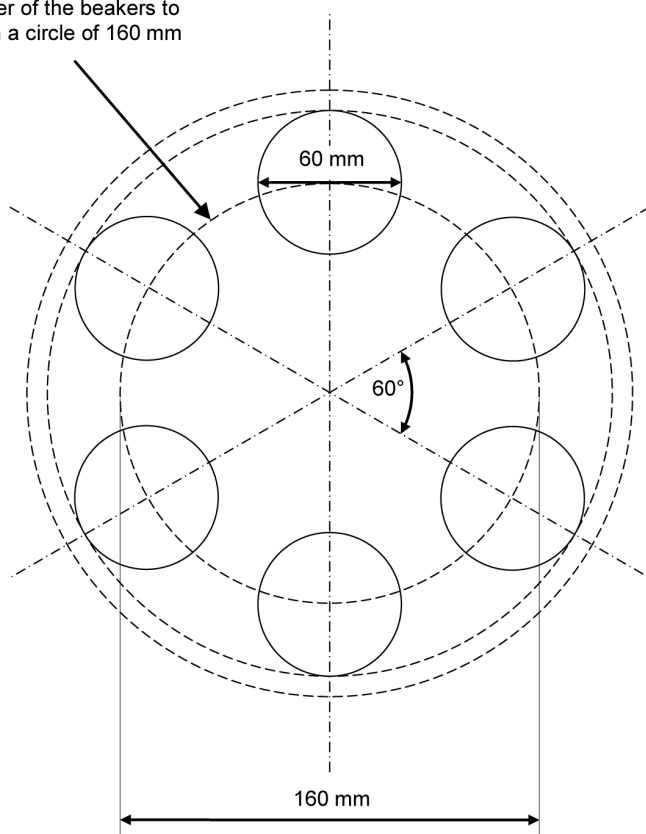
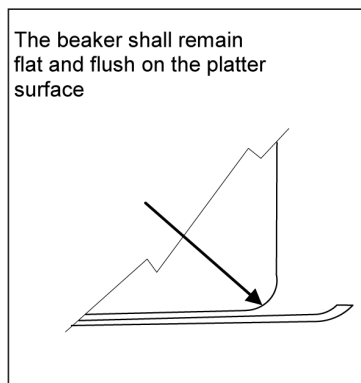
During each cooking [operation \(3.1.13\)](#) there shall always be 6 glasses, with milk, in the microwave oven. The glasses shall be placed on the turntable as shown in [Figure 1](#) and the base of each glass shall lie flat on the turntable.

For guidance, [Table J.1](#) contains an informative reference to a shade chart. After the cooking period in the microwave oven, the colour of the cooked milk can be compared with the colour chart referred to in [Annex J](#) as an indication of correct preparation. 90 % of the whole surface of the milk should have a colour shade between numbers 4 and 6 and 10 % should be between colour shade numbers 7 and 12. If differences are recognized, see [F.2](#). For colour comparing only original colour sheets should be used. They can be obtained from the supplier mentioned in L.1.7. The cooked glass with milk is shown on [Figure D.5](#).

NOTE If more than 6 glasses are required for testing, an additional 6 can be cooked immediately after the first set of 6 glasses, without repeating the pre-heating process.

Dimensions in millimetres

Center of the beakers to lie on a circle of 160 mm



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Figure 1 – Position of the glasses on the microwave turntable

6.4.3 Tea

6.4.3.1 General

Use tea with the following characteristics:

- tea type: black;
- tea quality: ceylon;
- leaf quality: orange pekoe;
- leaf size: broken.

NOTE Details of a supplier of suitable tea are given in [Annex L](#).

The remains of newly opened packets of tea can be used for subsequent tests for a period of up to 60 days after opening, provided the contents are stored in a sealed container.

A11 For energy labelling and ecodesign purposes, tea as described in Annex L shall be used. **A11**

6.4.3.2 Preparation

Pour the calculated amount of boiling water (see 5.6 for specification) over the tea (ratio: 1 l water to 6 g of tea) and allow to stand in a covered container, for a period of 5 min. Afterwards, pour the tea through a sieve (mesh aperture 1 mm) into a second container.

6.4.3.3 Application

Start the application immediately after completion of the preparation by filling approximately 120 ml of tea into each mug, 80 ml into each cup and 40 ml onto each saucer. An even distribution over mugs, cups and saucers can be ensured by using a proportioning pump with 40 ml dosage. Foam and particles are to be avoided.

NOTE Foam can be avoided if a proportioning pump is used with slow pumping.

Immediately after completion of application, proceed with pre-drying using either the oven drying method (6.4.3.4) or the air drying method (6.4.3.5).

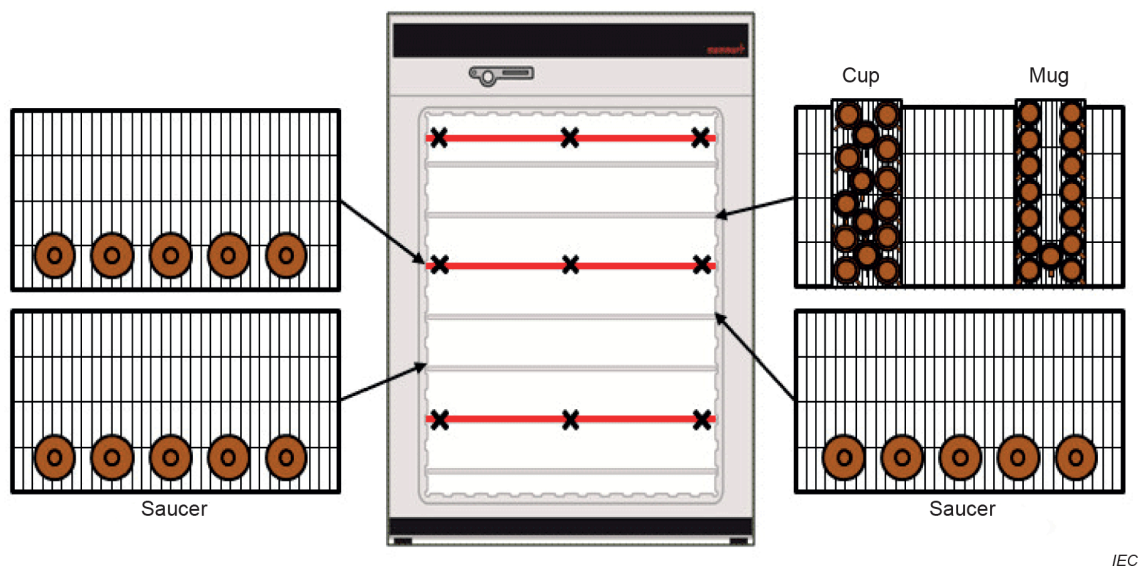
6.4.3.4 Pre-drying for oven drying method

All items soiled with tea shall be pre-dried in a thermal cabinet (specified in Annex G) prior to the oven drying method described in 6.5.2. The thermal cabinet shall be pre-heated to 80 °C by the time the tea application takes place. After completion of the tea application, the following procedure shall be carried out:

- Switch off the power and open the doors of the thermal cabinet.
- Load the [tableware \(3.1.9\)](#) items into the thermal cabinet. Refer to [Figure 2](#) for loading [tableware \(3.1.9\)](#) items.
- Close the doors and switch on the power of the thermal cabinet.
- This procedure shall be completed in 3 min.

The [tableware \(3.1.9\)](#) items shall remain in the thermal cabinet for a period of 1 h after the power of the thermal cabinet is switched back on. After this pre-drying period, proceed as described in 6.5.2.

In order to facilitate unloading of dishes soiled with tea after pre-drying phase and the loading of all dishes for the two hour drying phase, within 10 min, it is recommended to do so with two persons. The items soiled with tea after oven drying are shown on [Figure D.6](#).



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Figure 2 – Thermal cabinet for pre-drying of soiled cups, mugs and saucers