INTERNATIONAL STANDARD

IEC 60335-2-58

Third edition
2002-11

Household and similar electrical appliances – Safety –

Part 2-58: Particular requirements for commercial electric dishwashing machines

Appareils électrodomestiques et analogues – Sécurité –

Partie 2-58: Règles particulières pour les lave-vaisselle électriques à usage collectif

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

Part 2- 58: Particular requirements for commercial electric dishwashing machines

FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.
3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

This part of International Standard IEC 60335 has been prepared by IEC subcommittee 61E: Safety of electrical commercial catering equipment, of IEC technical committee 61: Safety of household and similar electrical appliances.

This third edition cancels and replaces the second edition published in 1995 and its amendment 1 (1998). It constitutes a technical revision.

The text of this part of IEC 60335 is based on the second edition and the following documents:

FDIS	Report on voting
61E/406/FDIS	61E/418RVD

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

This part 2 is to be used in conjunction with the latest edition of IEC 60335-1 and its amendments. It was established on the basis of the fourth edition (2001) of that standard.

NOTE 1 When “Part 1” is mentioned in this standard, it refers to IEC 60335-1.

This part 2 supplements or modifies the corresponding clauses in IEC 60335-1, so as to convert that publication into the IEC standard: Safety requirements for commercial electric dishwashing machines.

When a particular subclause of Part 1 is not mentioned in this part 2, that subclause applies as far as is reasonable. When this standard states "addition", "modification" or "replacement", the relevant text in Part 1 is to be adapted accordingly.

NOTE 2 The following numbering system is used:

– subclauses, tables and figures that are numbered starting from 101 are additional to those in Part 1;

– unless notes are in a new subclause or involve notes in Part 1, they are numbered starting from 101, including those in a replaced clause or subclause;

– additional annexes are lettered AA, BB, etc.

NOTE 3 The following print types are used:

– requirements: in roman type;

– *test specifications: in italic type;*

– notes: in small roman type.

Words in **bold** in the text are defined in Clause 3. When a definition of Part 1 concerns an adjective, the adjective and the associated noun are also in bold .

The committee has decided that the contents of this publication will remain unchanged until 2004. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

The following differences exist in the countries indicated below.

– 6.1: Class 01 appliances are allowed (Japan).

– 6.2: For appliances intended to be installed in a kitchen, an appropriate degree of protection against harmful ingress of water is required according to their height of installation (France).

– 13.2: Leakage current limits are different (Japan).

– 16.2: Leakage current limits are different (Japan).

– Clause 21: For appliances intended to be installed in a kitchen, different values of impact energy are applicable according to the height of the impact point (France).

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

INTRODUCTION

It has been assumed in the drafting of this International Standard that the execution of its provisions is entrusted to appropriately qualified and experienced persons.

This standard recognizes the internationally accepted level of protection against hazards such as electrical, mechanical, thermal, fire and radiation of appliances when operated as in normal use taking into account the manufacturer's instructions. It also covers abnormal situations that can be expected in practice.

This standard takes into account the requirements of IEC 60364 as far as possible so that there is compatibility with the wiring rules when the appliance is connected to the supply mains. However, national wiring rules may differ.

If an appliance within the scope of this standard also incorporates functions that are covered by another part 2 of IEC 60335, the relevant part 2 is applied to each function separately, as far as is reasonable. If applicable, the influence of one function on the other is taken into account.

This standard is a product family standard dealing with the safety of appliances and takes precedence over horizontal and generic standards covering the same subject.

An appliance that complies with the text of this standard will not necessarily be considered to comply with the safety principles of the standard if, when examined and tested, it is found to have other features that impair the level of safety covered by these requirements.

An appliance employing materials or having forms of construction differing from those detailed in the requirements of this standard may be examined and tested according to the intent of the requirements and, if found to be substantially equivalent, may be considered to comply with the standard.

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

Part 2-58: Particular requirements for commercial electric dishwashing machines

1 Scope

This clause of Part 1 is replaced by the following.

This International Standard deals with the safety of electrically operated dishwashing machines for washing plates, dishes, glassware, cutlery and similar articles, with or without means for water heating or drying, not intended for household use, their **rated voltage** being not more than 250 V for single-phase appliances connected between one phase and neutral and 480 V for other appliances.

NOTE 101 These appliances are used for example in restaurants, canteens, hospitals, and commercial enterprises such as bakeries, butcheries, etc.

NOTE 102 Examples of such appliances are

- **conveyor dishwashers**;
- **batch dishwashers**;
- **brush machines**.

Requirements to avoid backsiphonage of non-potable water into the water mains are specified in Annex CC.

The electrical part of appliances making use of other forms of energy is also within the scope of this standard.

As far as is practicable, this standard deals with the common hazards presented by these types of appliances.

NOTE 103 Attention is drawn to the fact that:

- for appliances intended to be used in vehicles or on board ships or aircraft, additional requirements may be necessary;
- for appliances intended for disinfection, additional requirements may be necessary;
- in many countries additional requirements are specified by the national health authorities, the national authorities responsible for the protection of labour, the national water supply authorities and similar authorities;
- in many countries additional requirements are specified for pressure appliances.

NOTE 104 This standard does not apply to:

- appliances designed exclusively for industrial purposes, for example machines used in the food industry for cleaning receptacles that serve as packaging for final products (e.g. bottle-cleaning machines), and machines used in manufacturing processes;
- dishwashers that do not form one functional unit, for example where a transportation device transfers the load from one separate unit to another;
- separately driven transport devices not confined in the appliance;
- appliances intended to be used in locations where special conditions prevail, such as the presence of a corrosive or explosive atmosphere (dust, vapour or gas).

2 Normative references

This clause of Part 1 is applicable except as follows.

Addition:

IEC 60436:1981, *Methods for measuring the performance of electric dishwashers*

IEC 61770:1998, *Electric appliances connected to the water mains – Avoidance of backsiphonage and failure of hose-sets*

ISO 1817:1999, *Rubber, vulcanised – Determination of the effect of liquids*

3 Definitions

This clause of Part 1 is applicable except as follows.

3.1.4 *Addition:*

NOTE 101 The **rated power input** is the sum of the power inputs of all the individual elements in the appliance that can be on at one time; where there are several such combinations possible, that giving the highest power input is used in determining the **rated power input**.

3.1.9 *Replacement:*

normal operation
operation of the appliance under the following conditions

Appliances intended to be connected to a water supply are connected to a water supply having the pressure and temperature specified in the instructions.

If a range of temperatures and pressures is specified in the instructions then the water supply is at the conditions within the range that will give the most unfavourable temperature results. Water inlets intended for cold water only are connected to a source supplying water at a temperature of 15 °C ± 5 °C.

The appliance is filled with the maximum quantity of water for which it is designed, without detergents or rinsing agents. **Brush machines** are tested with dishes and the dishwasher is loaded with the maximum number of dishes specified in the instructions for use. The dimensions of the dishes are as specified in IEC 60436. Other appliances are tested without dishes.

Batch dishwashers are operated on continuous cycles, each cycle being followed by a rest period of 1 min. Lids or covers, if any, are left open during the rest period.

Conveyor dishwashers and **brush machines** are operated continuously.

The appliance is operated as follows:

– appliances with automatic timers or programmers are operated with the programme that will give the most unfavourable temperature results;

– appliances that have neither an automatic timer nor a programmer are operated in accordance with the instructions for use, but with the controls intended to be set by the user set at maximum or that setting giving the most unfavourable temperature results.

3.101
conveyor (rack or flight) dishwasher
an appliance in which the various processes e.g. washing, rinsing etc., are carried out, the load being moved through the various operations automatically

3.102
batch dishwasher
an appliance in which the various processes are carried out sequentially on a single load

3.103
brush machine
an appliance in which plates are cleaned by being placed between or held in contact with brushes or similar devices

3.104
indicated level
a mark on the appliance to indicate the maximum liquid level for correct operation

4 General requirement

This clause of Part 1 is applicable.

5 General conditions for the tests

This clause of Part 1 is applicable except as follows.

5.3 *Addition:*

The tests of 22.6 are carried out before the tests of Clause 19.

5.101 *Appliances are tested as* ***motor-operated appliances****, even if they incorporate a heating element.*

Appliances incorporating means for heating water, but that may also be operated without the heating elements being energized, are tested without the heating elements energized should this be more unfavourable.

5.102 *Appliances, when assembled in combination with or incorporating other appliances, are tested in accordance with the requirements of this standard. The other appliances are operated simultaneously in accordance with the requirements of the relevant standards.*

6 Classification

This clause of Part 1 is applicable except as follows.

6.1 *Replacement:*

Appliances shall be **class I** with respect to protection against electric shock.

Compliance is checked by inspection and by the relevant tests.

6.2 *Modification:*

Replace the requirement paragraph with the following.

Appliances shall be at least IPX1 with respect to protection against harmful ingress of water.

7 Marking and instructions

This clause of Part 1 is applicable except as follows.

7.1 *Addition:*

In addition, appliances shall be marked with

– the water pressure or range of pressures, in kilopascals (kPa), for appliances intended to be connected to a water supply, unless this is indicated in the instruction sheet;
– the maximum permissible steam pressure, in kilopascals (kPa), unless this is indicated in the instruction sheet;
– the maximum permissible hot water pressure, in kilopascals (kPa), unless this is indicated in the instruction sheet;
– the maximum permissible water, steam and hot water temperatures in degrees Celsius, unless this is indicated in the instruction sheet.

If the reversal of a motor could result in a hazard, the direction of rotation shall be clearly and visibly indicated on the motor.

7.6 *Addition:*

 [symbol 5021 of IEC 60417-1] equipotentiality

7.12 *Addition:*

If symbol 5021 of IEC 60417-1 is marked on the appliance its meaning shall be explained.

7.12.1 *Replacement:*

The appliance shall be accompanied by instructions detailing any special precautions necessary for installation. The maximum level of the water discharge outlet shall be indicated in the instructions. Instructions for **user maintenance**, for example cleaning, shall also be given. They shall include a statement that the appliance is not to be cleaned with a water jet.

For appliances that are permanently connected to fixed wiring and for which leakage currents may exceed 10 mA, particularly if disconnected or not used for long periods, or during initial installation, the instructions shall give recommendations regarding the rating of **protective devices,** such as earth leakage relays, to be installed.

Compliance is checked by inspection.

7.12.4 *Addition:*

The instructions for **built-in appliances** having a separate control panel for several appliances shall state that the control panel is only to be connected to the specified appliances in order to avoid a possible hazard.

7.15 *Addition:*

When it is not practical to place the marking of **fixed appliances** so that it is visible after the appliance has been installed, the relevant information shall also be included in the instructions for use or on an additional label that can be fixed near the appliance after installation.

NOTE 101 An example of such a **fixed appliance** is a **built-in appliance**.

7.101 Appliances intended to be filled by hand or a manually operated tap shall be marked with an **indicated level**.

Compliance is checked by inspection.

7.102 Equipotential bonding terminals shall be marked with symbol 5021 of IEC 60417-1.

These markings shall not be placed on screws, removable washers or other parts that can be removed when conductors are being connected.

Compliance is checked by inspection.

8 Protection against access to live parts

This clause of Part 1 is applicable.

9 Starting of motor-operated appliances

This clause of Part 1 is applicable except as follows.

9.101 Fan motors providing a cooling effect in order to comply with the requirements of Clause 11 shall start under all voltage conditions that may occur in use.

*Compliance is checked by starting the motor three times at a voltage equal to 0,85 times **rated voltage**, the motor being at room temperature at the beginning of the test.*

*The motor is started each time under the conditions occurring at the beginning of **normal operation** or, for automatic appliances, at the beginning of the normal cycle of operation, the motor being allowed to come to rest between successive starts. For appliances provided with motors having other than centrifugal starting switches, this test is repeated at a voltage equal to 1,06 times **rated voltage**.*

*In all cases, the motor shall start and it shall function in such a way that safety is not affected and overload **protection devices** of the motor shall not operate.*

NOTE The supply source must be such that during the test the drop in voltage does not exceed 1 %.

10 Power input and current

This clause of Part 1 is applicable except as follows.

10.1 *Addition:*

NOTE 101 A representative period is the period with the highest total power input.

11 Heating

This clause of Part 1 is applicable except as follows.

11.2 *Addition:*

Appliances intended to be fixed to the floor and appliances with a mass greater than 40 kg and not provided with rollers, castors or similar means are installed in accordance with the instructions. If no instructions are given, these appliances are considered as appliances normally placed on the floor. However, appliances provided with heating elements for drying, except ***conveyor dishwashers****, are placed in the test corner as near to the walls as possible.*

11.5 *Addition:*

Conveyor dishwashers *may be supplied at* ***rated voltage****. In this case the addition to 11.8 applies.*

11.7 *Replacement:*

Appliances are operated until steady conditions are established.

NOTE 101 The duration of the test may consist of more than one cycle of operation.

At the conclusion of the test and with the appliance at maximum temperature, motor-driven emptying pumps that employ separate motors and that are manually switched on and off are subjected to an operating period equal to 1,5 times the period for emptying the container(s) when filled to the ***indicated level****, the level of the water discharge outlet being the maximum indicated in the instructions.*

11.8 *Addition:*

For ***conveyor dishwashers*** *tested at* ***rated voltage****, the relevant values shown in Table 3 are reduced by 10 %.*

12 Void

13 Leakage current and electric strength at operating temperature

This clause of Part 1 is applicable except as follows.

13.1 *Addition:*

Conveyor dishwashers *may be supplied at* ***rated voltage****. In this case the permissible leakage current allowed is reduced by 10 %.*

13.2 *Modification:*

Instead of the permissible leakage current for **stationary class I appliances**, the following applies:

– *for cord and plug connected appliances*	*1 mA per kW* ***rated power input*** *of the appliance with a maximum of 10 mA*
– *for other appliances*	*1 mA per kW* ***rated power input*** *of the appliance with no maximum*

14 Transient overvoltages

This clause of Part 1 is applicable.

15 Moisture resistance

This clause of Part 1 is applicable except as follows.

15.1.1 *Addition:*

In addition, IPX1, IPX2, IPX3 and IPX4 appliances are subjected for 5 min to the following splash test.

The apparatus shown in Figure 101 is used. During the test, the water pressure is so regulated that the water splashes up 150 mm above the bottom of the bowl. The bowl is placed on the floor for appliances normally used on the floor. For all other appliances on a horizontal support 50 mm below the lowest edge of the appliance, the bowl is so moved around as to splash the appliance from all directions. Care is taken that the appliance is not hit by the direct jet.

15.1.2 *Modification:*

Appliances normally used on a table are placed on a support having dimensions that are 15 cm ± 5 cm in excess of those of the orthogonal projection of the appliance on the support.

15.2 *Replacement:*

Appliances shall be so constructed that spillage of liquid in normal use does not affect their electrical insulation, even in the event that an inlet valve fails to close.

Compliance is checked by the following test:

*Appliances with **type X attachment**, except those having a specially prepared cord, are fitted with the lightest permissible type of flexible cable or cord of the smallest cross-sectional area specified in 26.6, and other appliances are tested as delivered.*

***Detachable parts** are removed.*

Appliances intended to be filled with water by the user are completely filled with water containing approximately 1 % NaCl, and a further quantity of water, equal to 5 % of the capacity of the dishwasher or 10 l, whichever is the greater, is poured in steadily over a period of 1 min.

*Other appliances are operated through one complete cycle of **normal operation**, after which the timer switch, float or pressure-operated switch is made inoperative, and 5 g of the standard detergent given in Annex AA is added per litre of water in the appliance at the highest level of fill during normal operation and the appliance is operated in the intended manner.*

Only one switch is rendered inoperative at a time.

If a means is not provided to prevent overfilling of the appliance, the fill is continued for an additional 15 min following the first evidence of overflow. If a float or pressure-operated switch is provided to prevent overfilling, actuation of the fill switch to terminate the fill shall also terminate the test. If both timer and fill switch are provided, a second test shall be conducted as described above with the timer operating normally and with the fill switch rendered inoperative.

Appliances, the tops of which are intended to form working surfaces, are also subjected to the following test.

A quantity of 0,2 l of water is poured steadily from a height of about 50 mm on to the middle of the top of the appliance for a period of 15 s.

*Immediately after this treatment, the appliance shall withstand the electric strength test as specified in 16.3 and inspection shall show that there is no trace of water on insulation that could result in a reduction of **clearances** and **creepage distances** below the values specified in Clause 29.*

15.3 *Addition:*

NOTE 101 If it is not possible to place the whole appliance in the humidity cabinet, parts containing electrical components are tested separately, taking into account the conditions that occur in the appliance.

15.101 Appliances that are provided with a tap intended for filling or cleaning, shall be constructed so that the water from the tap cannot come into contact with **live parts**.

Compliance is checked by the following test.

The tap is fully opened for 1 min with the appliance connected to a water supply having the maximum water pressure indicated. Tiltable and movable parts, including lids, are tilted or placed in the most unfavourable positions. Swivelling outlets of water taps are so positioned as to direct water on to those parts that will give the most unfavourable result. Immediately following this treatment the appliance shall withstand the electric strength test of 16.3.

16 Leakage current and electric strength

This clause of Part 1 is applicable except as follows.

16.2 *Modification:*

Instead of the permissible leakage current for **stationary class I appliances**, the following applies:

– *for cord and plug connected appliances*	*1 mA per kW **rated power input** of the appliance with a maximum of 10 mA*
– *for other appliances*	*1 mA per kW **rated power input** of the appliance with no maximum*

17 Overload protection of transformers and associated circuits

This clause of Part 1 is applicable.

18 Endurance

This clause of Part 1 is applicable.

19 Abnormal operation

This clause of Part 1 is applicable except as follows.

19.1 *Addition:*

Appliances with a programme controller or timer are also subjected to the test of 19.101.

*For **conveyor dishwashers** incorporating heating elements, the tests of 19.2, 19.3, and where applicable 19.4, 19.5 and 19.6 may be made at **rated voltage**. In this case the addition to 19.13 applies.*

19.2 *Addition:*

Appliances are filled with just sufficient water to cover the heating elements.

19.4 *Addition:*

NOTE 101 The main contacts of the contactor intended for switching on and off the heating element(s) in normal use are locked in the "ON" position. However, if two contactors operate independently of each other or if one contactor operates two independent sets of main contacts, these contacts are locked in the "ON" position in turn.

19.7 *Modification:*

Instead of the text preceding the table, the following applies.

*Moving parts are locked and the appliance is operated, starting from cold, at **rated voltage** or at the upper limit of the **rated voltage** range, for a period*

– *of 5 min for appliances without a programme controller or timer;*
– *equal to the maximum period allowed by the programme controller or timer, for appliances provided with a programme controller or timer.*

Appliances incorporating motors having capacitors in the circuit of an auxiliary winding are operated with the rotor locked, the capacitors being open-circuited one at a time. The test is repeated with the capacitors short-circuited one at a time unless they comply with IEC 60252-1.

NOTE 101 If an appliance has more than one motor, the test is made for each motor separately.

NOTE 102 Alternative tests for protected motor units are given in Annex D.

NOTE 103 This test is made with the rotor locked because certain motors with capacitors may or may not start so that variable results could be obtained.

During the test, the temperature of the windings shall not exceed the values shown in Table 8.

19.13 *Addition:*

For **conveyor dishwashers** supplied at **rated voltage**, the appliance shall not emit any poisonous or ignitable gas during the tests.

*In addition, for **basic insulation**, the test voltage for the electric strength test in 16.3 is 1 000 V plus **rated voltage**.*

19.101 Appliances provided with a programme controller or a timer shall be so constructed that the risk of fire, mechanical hazard or electric shock is obviated as far as is practicable in the event of incorrect operation, or the development of defects in control devices, such as programme controllers and timers, or in their associated devices.

*Compliance is checked by applying any form of operation or any defect that may be expected in normal use, while the appliance is operated under **normal operation** and at **rated voltage** or at the upper limit of the **rated voltage range**. Only one fault condition is reproduced at a time, the tests being made consecutively.*

During the tests, the appliance shall not emit flames or molten metal and the temperature of windings shall not exceed the values shown in Table 8.

NOTE 1 Examples of fault conditions are

– the programme controller stopping in any position;

– the disconnection and reconnection of one or more phases of the supply during any part of the programme:

– the open-circuiting or short-circuiting of components;

– the failure of a magnetic valve;

– the opening and reclosing of the door or lid during any part of the programme, if this is possible.

NOTE 2 In general, tests are limited to those cases that may be expected to give the most unfavourable results.

NOTE 3 If operation without water in the appliance is considered to be a more severe condition for starting any programme, the tests with that programme are made with the water inlet valve closed; however, this valve is not closed after the programme has been started. If the appliance stops at any particular point in the programme, the test with that fault condition is considered to be ended.

NOTE 4 For the purpose of these tests, thermal controls are not short-circuited.

NOTE 5 Components complying with the relevant IEC standards are not open-circuited or short-circuited, provided the appropriate standard covers the conditions that occur in the appliance.

NOTE 6 The test, during which the automatic filling device is held open, has already been made during the test of 15.2.

NOTE 7 The test with motor capacitors short-circuited or open-circuited has already been made during the test of 19.7.

20 Stability and mechanical hazards

This clause of Part 1 is applicable except as follows.

20.1 *Modification:*

Replace the requirement by the following.

Appliances other than those intended to be fixed to their supporting surface shall have adequate stability.

Replace the last four paragraphs of the test specification by the following.

Appliances are tested empty or filled with water, whichever imposes the most severe condition, and the maximum load of dishes specified in the instructions for use and with doors, lids, rollers or castors, if any, in the most unfavourable position.

The appliance shall not overturn.

Appliances having a mass greater than 40 kg are also subjected to the test of 20.101. In addition, front loading appliances are also subjected to the test of 20.102.

20.101 *A force of 340 N is applied to the top edge of the appliance with doors or lids closed and in the most unfavourable direction under the conditions described in 20.1 but with the appliance supported on a horizontal plane.*

The appliance shall not overturn.

NOTE This test is only made in case of doubt.

20.102 *A weight of 23 kg is applied to or suspended from the centre of the open door or the loading drawer when it is in its outermost position, whichever is the more unfavourable, with no dishes or water in the appliance and with the rollers or castors, if any, turned to the most unfavourable position.*

Water containers integral with the appliance are filled unless they are drained during any part of the operating cycle or when the appliance is switched off.

During this test the machine shall not tilt.

NOTE This test is not carried out on those appliances that are intended to be fixed to the supporting surface or are intended to be built-in in such a manner that tilting cannot occur.

20.103 Vertical-lift doors shall be so constructed as to provide adequate protection against personal injury.

Vertical-lift doors with a mass of more than 5 kg and all vertical-lift doors with a lift height of more than 400 mm shall be provided with an operational and emergency locking device. The emergency locking device shall become operational at least 120 mm above the impact surface.

Other vertical-lift doors shall have impact surfaces at least 20 mm wide and be provided with an operational locking device. If an emergency locking device is also provided, the requirement related to the impact surface does not apply. In this case the emergency locking device shall become effective at least 120 mm above the impact surface.

A counterbalance system which, in the case of a single defect in the counterbalance system, ensures that the force causing the door to descend does not exceed 50 N may be used as a substitute in all cases.

Compliance is checked by inspection, by manual test and by measurement.

20.104 In the case of cleaning and maintenance work as in normal use in accordance with the instructions provided, mechanical risks shall be prevented, for example by the use of key-switches or tools.

Compliance is checked by inspection and by manual test.

20.105 Doors and lids shall be interlocked in such a way that the dishwasher can only be operated when the door or lid is closed, unless there is adequate protection against ejection of hot water when the door or lid is open.

Compliance is checked by inspection and by manual test.

NOTE Slight splashing or spraying of hot water, occurring immediately after the door or lid has been opened, is neglected.

20.106 Conveyor dishwashers shall not start automatically after doors or lids have been closed.

Compliance is checked by inspection and by manual test.

21 Mechanical strength

This clause of Part 1 is applicable.

21.101 Shelves and racks supporting articles to be washed shall have adequate mechanical strength and shall not deform in normal use.

Compliance is checked by the following test.

Each shelf in turn is loaded uniformly at a rate of 1 000 N/m², left for 1 min and then unloaded. The shelf and shelf supports shall show no appreciable distortion.

22 Construction

This clause of Part 1 is applicable except as follows.

22.6 *Modification:*

Instead of the test specification the following applies.

Compliance is checked by inspection and by the following tests, that are made in the order given.

The appliance is operated under the conditions specified in Clause 11 except that it is subjected to three successive cycles. A ***conveyor dishwasher*** *is only subjected to one cycle of duration equal to the time needed to move a dish through all the operations of the appliance.*

The water to be used for the test has a hardness between 25 ppm and 75 ppm related to calcium carbonate ($CaCO_3$). At the beginning of each rinsing period and after the machine has been filled with water, a foaming agent is added through the opened door, which is then closed until the machine stops according to the programme. Automatically controlled dispensers for the rinsing agent are rendered ineffective during the test.

The foaming agent is a solution of 25 % by mass of alcohol ethoxylate (Triton DF-12) in water, 2,5 ml of the solution and 20 g of sodium chloride being added for every 8 l of water.

If the machine stops due to excessive foam production, the test is finished 1 h after the rinsing period started.

Drops of a solution composed of 0,6 ml of the rinsing agent specified in Annex AA, per litre of distilled water are then applied by means of a syringe to those parts inside the appliance where leakage of a liquid could occur and affect the electrical insulation. Moving parts are in operation or at rest, whichever is the more unfavourable.

After these tests, inspection shall show that there is no deposit of rinsing agent or any traces of liquid on windings or insulation that could result in a reduction of ***creepage distances*** *below the values specified in 29.2.*

Addition:

NOTE 101 Parts that withstand the ageing test specified in Annex BB are not considered to be parts where leakage could occur.

22.101 Thermal cut-outs protecting circuits with heating elements and those for motors of which the unexpected starting may cause a hazard shall be of the **non-self-resetting** trip-free type and shall provide **all-pole disconnection** from the supply. If the **non-self-resetting thermal cut-out** is only accessible after removing parts with the aid of a tool, the trip-free type is not required.

NOTE 1 **Thermal cut-outs** of the trip-free type have an automatic action, with a reset actuating member, so constructed that the automatic action is independent of manipulation or position of the reset mechanism.

Thermal cut-outs of the bulb and capillary type that operate during the tests of Clause 19 shall be such that rupture of the capillary tube shall not impair compliance with the requirements of 19.13.

Compliance is checked by inspection and by manual test and by rupturing the capillary tube.

NOTE 2 Care must be taken to ensure that the rupture does not seal the capillary tube.

22.102 Lights, switches or push-buttons shall only be coloured red for the indication of danger, alarm or similar situations.

Compliance is checked by inspection.

22.103 The level to which manually filled appliances are to be filled shall be so located as to be readily visible when filling.

Compliance is checked by inspection.

22.104 Portable appliances shall not have openings on the underside that would allow small items to penetrate and touch **live parts**.

*Compliance is checked by inspection and by measuring the distance between the supporting surface and **live parts** through openings. This distance shall be at least 6 mm. However, if the appliance is fitted with legs, this distance is increased to 10 mm if the appliance is intended to stand on the table and to 20 mm if it is intended to stand on the floor.*

22.105 Appliances shall withstand the water pressure to which they may be subjected in normal use.

Compliance is checked by subjecting those parts of the appliance that are under pressure from the water supply to a static pressure equal to twice the maximum permissible inlet water pressure or 1 200 kPa (12 bar), whichever is the higher, for a period of 5 min.

During the test, there shall be no leakage from any part, including the inlet water hose.

The pressure shall be applied to the inlet with the valves set in the most unfavourable position encountered in normal use.

22.106 Appliances shall be constructed so that no fire hazard is caused by objects intended to be cleaned contacting heating elements not covered by water during the drying period.

Compliance is checked by the following test.

The appliance is placed on a piece of white pine-wood board covered with tissue paper. Polyethylene disks, 80 mm in diameter and 2 mm thick, are placed at the most unfavourable place and, where possible, directly on the heating element. The appliance is then operated for a drying period under the following conditions, with the heating element energized:

The appliance is connected to a water supply having a maximum hardness of 50 ppm ± 25 ppm related to $CaCO_3$, as in normal use, but without detergents or rinsing agents and without dishes.

Appliances provided with a programme controller are tested using the most unfavourable programme.

Appliances without a programme controller are operated on continuous cycles in accordance with the instructions for use.

*The appliance is operated at a voltage equal to 1,1 times the **rated voltage**.*

After one-third of the drying period has elapsed or when smoke or smell occurs, whichever occurs first, the door or lid is opened.

During the test, flames, burning drops or glowing particles shall not spread fire to other parts of the appliance or to its surroundings. Any flames, except from the disks, shall extinguish within 30 s. The tissue paper shall not burn or the board become scorched.

NOTE 1 Tissue paper is specified in 6.86 of ISO 4046 as thin, soft and strong lightweight wrapping paper generally intended for packing delicate articles, its substance being between 12 g/m² and 30 g/m².

NOTE 2 The material of the disks used for the test is unfilled natural colour polyethylene without flame-retardants and has a relative density of 0,96 ± 0,005.

22.107 Appliances shall be constructed so that heating elements cannot come into contact with combustible material inside the appliance or in any container used in the appliance as a result of deformation of the heating elements or of parts supporting them or of the container itself.

Compliance is checked by inspection.

NOTE A metallic container, whether or not coated with thermoplastic material, is considered not to deform by heat.

22.108 The appliance shall not automatically restart when the supply is re-established after a temporary disconnection, if restarting could result in a hazard, for example mechanical (moving parts) or thermal (hot parts or liquids).

Compliance is checked by the following test:

*The appliance is operated at **rated voltage** and in accordance with the instructions for use.*

At any time during the operating cycle the supply to the appliance is switched off and any moving parts are allowed to come to rest.

The supply is then restored.

23 Internal wiring

This clause of Part 1 is applicable except as follows.

23.3 *Addition:*

*When the capillary tube of the **thermostat** is liable to flexing in normal use the following applies:*

– *where the capillary tube is fitted as part of the internal wiring, Part 1 applies;*
– *where the capillary tube is separate, it is subjected to 1 000 flexings at a rate not exceeding 30 per minute.*

NOTE 101 If, in any of the above cases, it is not possible to move the movable part of the appliance at the given rate, due for example to the mass of the part, the rate of flexing may be reduced.

After the test, the capillary tube shall show no sign of damage within the meaning of this standard and no damage impairing its further use.

However, if a rupture of the capillary tube renders the appliance inoperative (fail-safe), separate capillary tubes are not tested, and those fitted as part of the internal wiring are not inspected for compliance with the requirements.

Compliance in this instance is checked by rupturing the capillary tube.

NOTE 102 Care must be taken to ensure that the rupture does not seal the capillary tube.

24 Components

This clause of Part 1 is applicable.

25 Supply connection and external flexible cords

This clause of Part 1 is applicable except as follows.

25.1 *Modification:*

Appliances shall not be provided with an appliance inlet.

25.3 *Addition:*

Fixed appliances and appliances with a mass greater than 40 kg and not provided with rollers, castors or similar means shall be constructed so that the **supply cord** can be connected after the appliance has been installed in accordance with the instructions.

Terminals for permanent connection of cables to fixed wiring may also be suitable for the **type X attachment** of a **supply cord**. In this case a cord anchorage complying with 25.16 shall be fitted to the appliance.

If the appliance is provided with a set of terminals allowing the connection of a flexible cord, they shall be suitable for the **type X attachment** of the cord.

In both cases the instructions shall give full particulars of the power **supply cord**.

The connection to the supply wires of **built-in appliances** may be made before the appliance is installed.

Compliance is checked by inspection.

25.7 *Modification:*

*Instead of the types of **supply cords** specified, the following applies.*

Supply cords shall be oil-resistant, sheathed flexible cable not lighter than ordinary polychloroprene or other equivalent synthetic elastomer-sheathed cord (code designation 60245 IEC 57).

26 Terminals for external conductors

This clause of Part 1 is applicable.

27 Provision for earthing

This clause of Part 1 is applicable except as follows.

27.2 *Addition:*

Stationary appliances shall be provided with a terminal for the connection of an external equipotential conductor. This terminal shall be in effective electrical contact with all fixed exposed metal parts of the appliance, and shall allow the connection of a conductor having a nominal cross-sectional area of up to 10 mm². It shall be located in a position convenient for the connection of the bonding conductor after installation of the appliance.

NOTE 101 Small fixed exposed metal parts, for example name-plates and the like, are not required to be in electrical contact with the terminal.

28 Screws and connections

This clause of Part 1 is applicable.

29 Clearances, creepage distances and solid insulation

This clause of Part 1 is applicable except as follows.

29.2 *Addition:*

The microenvironment is pollution degree 3 and the insulation shall have a comparative tracking index (CTI) not less than 250, unless the insulation is enclosed or located so that it is unlikely to be exposed to pollution due to

– condensation produced by the appliance;
– chemicals, such as detergent or rinse aid.

30 Resistance to heat and fire

This clause of Part 1 is applicable except as follows.

30.2.1 *Modification:*

The glow-wire test is carried out at 650 °C.

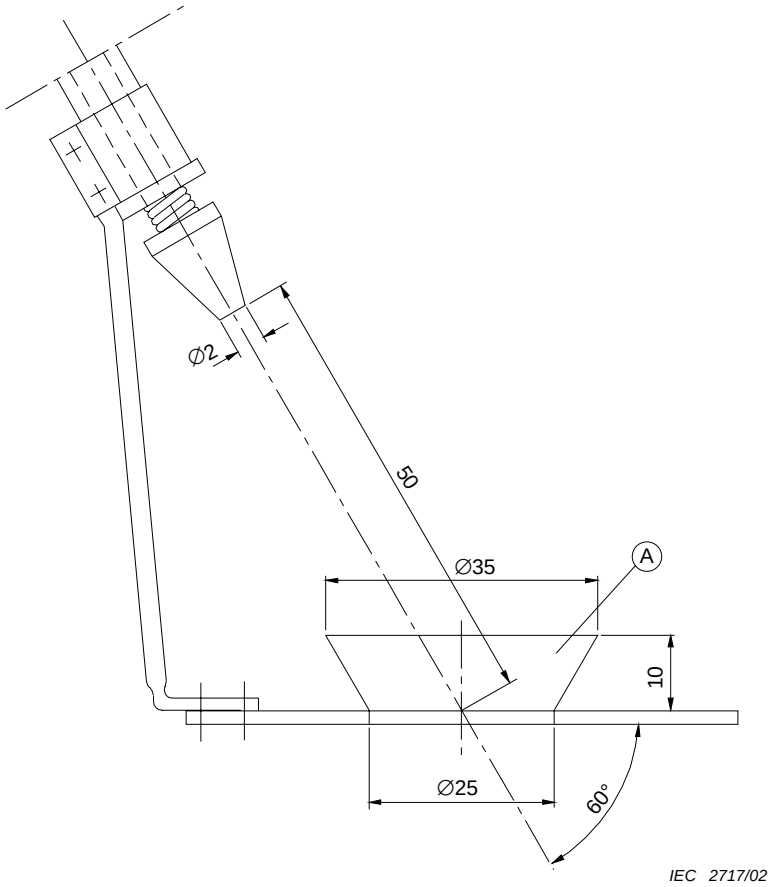
30.2.2 Not applicable

31 Resistance to rusting

This clause of Part 1 is applicable.

32 Radiation, toxicity and similar hazards

This clause of Part 1 is applicable.



Dimensions in millimetres

Key

A Bowl

Figure 101 – Splash apparatus

Annexes

The annexes of Part 1 are applicable except as follows.

Annex AA
(normative)

Detergent and rinsing agent
(Extract from IEC 60436)

AA.1 Detergents

The detergent containing phosphate shall consist of the following:

– Thermphos NW	24,0 %
– Plurafac LF403	1,0 %
– Sodium dichlorisocyanurate	2,3 %
– Sodium carbonate	10,7 %
– Sodium metasilicate	25,0 %
– Sodium metasilicate pentahydrate	37,0 %

Detergent shall be stored in a waterproof bag in quantities of no more than 1 kg in a cool and dry atmosphere. It should be used within six months and within one month of opening.

The detergent containing no phosphate shall consist of the following:

– Trisodium citrate dihydrate	30,0 %
Sokalan CP5 compound (50 % active substance)	12,0 %
– Plurafac LF403	2,0 %
– Sodium disilicate	25,0 %
– Sodium carbonate	23,0 %
– Sodium perborate monohydrate	5,0 %
– TAED	2,0 %
– Amylase	0,5 %
– Protease	0,5 %

AA.2 Rinsing agent

The rinsing agent consists of one of the following mixtures according to the practice of the country in which the tests are carried out:

Neutral rinsing agent	*Acid rinsing agent*
10 % plurafac RA 40	17,5 % plurafac RA 40
50 % plurafac RA 30	17,5 % plurafac RA 30
24 % isopropanol	25,0 % citric acid (anhydrous)
16 % deionized water	12,0 % isopropanol
	28,0 % deionized water

Annex BB
(normative)

Ageing test for elastomeric parts

The ageing test on elastomeric parts is carried out by measuring their hardness and mass before and after immersion in solutions of detergent and rinsing agent at elevated temperature.

The test is carried out on at least three samples of each part. The samples and test procedure are as specified in ISO 1817, with the following modifications.

4 Test liquids

Two test liquids are used:

– *one liquid is obtained by dissolving 6 g of the detergent specified in Annex AA per litre of distilled water;*

– *the other liquid is composed of 0,6 ml of rinsing agent as specified in Annex AA per litre of distilled water.*

NOTE Care is to be taken to ensure that the total mass of the test pieces immersed does not exceed 100 g for each litre of solution, that the test pieces are completely immersed and that their entire surface is freely exposed to the solution. During the tests, the test pieces are not to be exposed to direct light. Test pieces of different compounds are not to be immersed at the same time in the same solution.

5 Test pieces

5.4 Conditioning of test pieces

The temperature is 23 °C ± 2 °C and the relative humidity is (50 ± 5) %.

6 Immersion in the test liquid

6.1 Temperature

The solution is heated within 1 h with the test pieces immersed, to a temperature of 75^{+5}_{0} °C and maintained at this value. The solution is renewed every 24 h and heated in the same way.

NOTE To avoid undue evaporation of the solution, it is recommended to use a closed-circuit system or similar method for renewing the solution.

6.2 Duration

The test pieces are immersed for a total period of 48^{+1}_{0} h.

The test pieces are then immediately immersed in a fresh solution, whicht is maintained at ambient temperature. The pieces are immersed for 45 min ± 15 min.

After having been removed from the solution, the test pieces are rinsed in cold water at 15 °C ± 5 °C and then dried with blotting paper.

7 Procedure

7.2 Change in mass

The increase in mass of the test pieces shall not exceed 10 % of the value determined before immersion.

7.6 Change in hardness

The micro-test for hardness applies.

The hardness of the test pieces shall not have changed by more than 8 IRHD. Their surface shall not have become sticky and shall show no crack visible to the naked eye or any other deterioration.

Annex CC
(normative)

Requirements to avoid backsiphonage

The requirements of IEC 61770 are applicable except as follows:

1 Scope

Replace the text of this clause by the following new text:

This standard specifies requirements for the connection of commercial electric dishwashing machines to water mains having a water pressure not exceeding 1 MPa. These requirements are intended to prevent the backsiphonage of **non-potable water** into the water mains.

NOTE The connection of the appliance to the water mains may be temporary or permanent.

3 Definitions

Replace, the text of definition 3.9 by the following new text:

3.9
critical water level
level of the **non-potable water** 5 s after water inlets have been closed in the case of batch dishwashers and rinsing compartments of dishwashers with separate washing and rinsing compartments, and 2 s after water inlets have been closed for washing compartments

4 General requirements

4.1 *Addition:*

Add the following note after the first paragraph:

Note 101 Other means to prevent backsiphonage of **non-potable water** into the water mains may be used, provided compliance with the requirements of this annex is achieved or such a risk is otherwise manifestly excluded.

4.3 *Replacement:*

Replace the text of 4.3 by the following:

Hose-sets for the connection of appliances to the water mains shall be delivered with the appliance, except where the connections are made outside the appliance and the **hose-set** contains no electrical parts.

Hose-sets required to be delivered with the appliance shall be constructed so that the risk of flooding is obviated as far as possible.

Compliance is checked by inspection and by the tests of Clause 9.

4.4 Not applicable

5 General conditions for the tests

5.1 *Modification:*

In the fifth dashed item, delete the words "textiles or".

5.2 *Modification:*

*In the third dashed item, replace the words "of an **airgap** or **pipe interrupter**" by the words "of a **backflow preventer**".*

Delete note 2.

8 Dynamic backflow preventers

8.1 *Addition:*

Add the following note after the third dashed item:

NOTE 101 For **batch dishwashers** and separate rinsing compartments, the conditions for the determination of the **maximum** and **critical water levels** for the test of Annex A are shown in Figures CC.101 and CC.102.

Annex A
(normative)

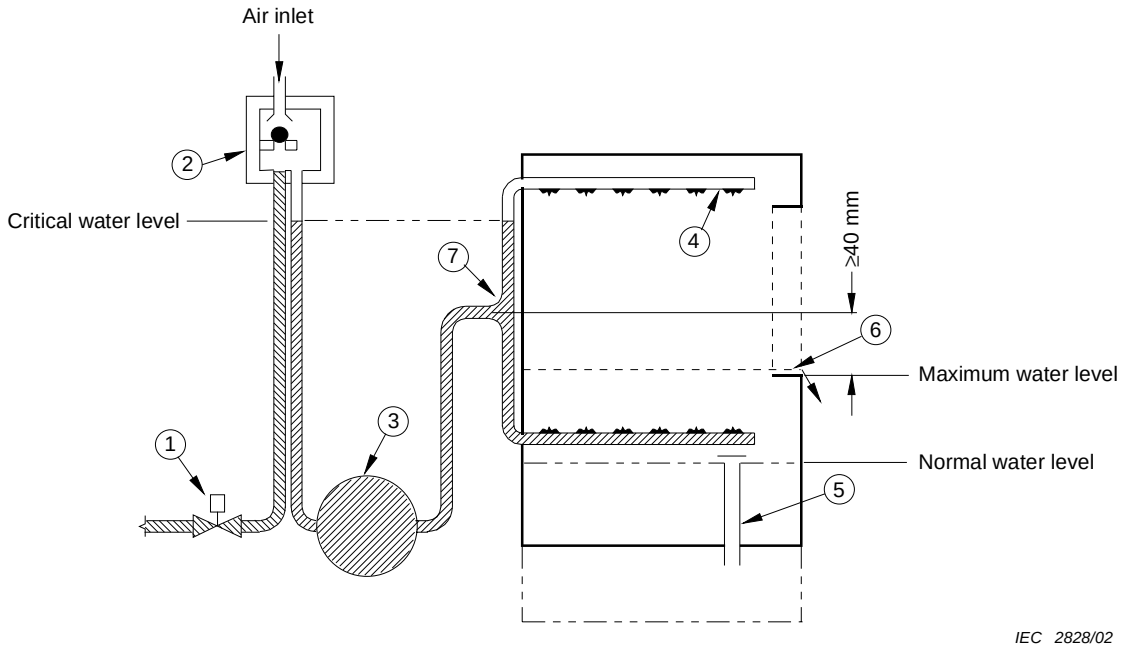
Backsiphonage test

Addition:

For **batch dishwashers** and separate rinsing compartments the branching point between the upper and lower water inlets (spray arms or nozzles) shall be located at least 40 mm above the **maximum water level** (see Figure CC.101).

Compliance is checked by measurement.

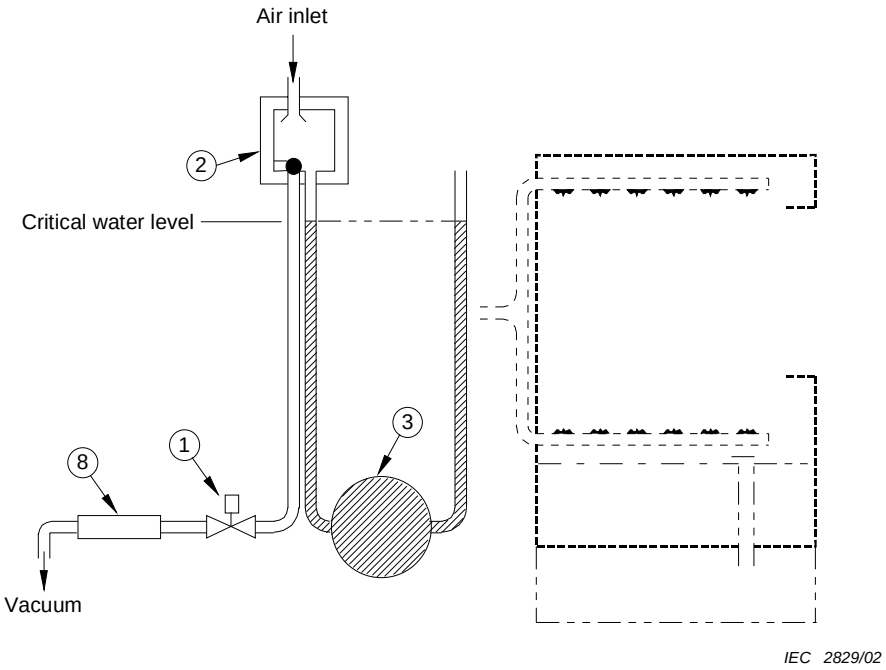
Note The **critical water level** may be established by using a substitute hose having a ventilated cross section equal to the port area of the upper water inlet (upper spray arm).



Key

1 Solenoid valve
2 Dynamic backflow preventer
3 Boiler
4 Rinse arm
5 Normal drain outlet
6 Overflow in a defective situation
7 Branch point
8 Transparent hose

Figure CC.101 – Arrangement for the determination of maximum and critical water level for dynamic backflow preventer (see 3.9 of Annex CC)



Key

1 Solenoid valve
2 Dynamic backflow preventer
3 Boiler
4 Rinse arm
5 Normal drain outlet
6 Overflow in a defective situation
7 Branch point
8 Transparent hose

Figure CC.102 – Backsiphonage test

Bibliography

The bibliography of Part 1 is applicable except as follows.

Addition:

ISO 4046:1978, *Paper, board, pulp and related terms – Vocabulary*

_____

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