INTERNATIONAL STANDARD

IEC 60335-2-88

Second edition
2002-10

Household and similar electrical appliances – Safety –

Part 2-88: Particular requirements for humidifiers intended for use with heating, ventilation, or air-conditioning systems

Appareils électrodomestiques et analogues – Sécurité –

Partie 2-88: Règles particulières pour les humidificateurs destinés à être utilisés avec des appareils de chauffage, de ventilation ou de conditionnement d'air

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

Part 2-88: Particular requirements for humidifiers intended for use with heating, ventilation, or air-conditioning systems

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.
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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.
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This part of International Standard IEC 60335 has been prepared by subcommittee 61D: Appliances for air-conditioning for household and similar purposes, of IEC technical committee 61: Safety of household and similar electrical appliances.

This second edition cancels and replaces the first edition published in 1997. It constitutes a technical revision.

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

FDIS	Report on voting
61D/117/FDIS	61D/122/RVD

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 electric humidifiers intended for use with heating, ventilation, or air-conditioning systems.

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 concerns an adjective, the adjective and 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).

– 6.1: class 0 and 01 appliances are allowed (South Africa, Poland).

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 – SAFTEY –

Part 2-88: Particular requirements for humidifiers intended for use with heating, ventilation, or air-conditioning systems

1 Scope

This clause of Part 1 is replaced by the following.

This International Standard deals with the safety of electric **humidifiers** intended for use with heating, ventilation, or air-conditioning systems in household, commercial, and light industrial applications (and may include large stand-alone commercial equipment) which operate according to the evaporative or atomization system, water-injection, steam and the like, their maximum **rated voltage** being not more than 250 V for single-phase appliances and 600 V for all other appliances.

NOTE 101 Air-conditioning equipment to be used in conjunction with the **humidifiers** covered by this standard are covered in IEC 60335-2-40.

As far as is practicable, this standard deals with the common hazards presented by appliances that are encountered by all persons in and around the home. However, in general, it does not take into account

– the use of appliances by young children or infirm persons without supervision;

– playing with the appliance by young children.

NOTE 102 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;

– in many countries, additional requirements are specified by national health authorities, national authorities responsible for the protection of labour and similar authorities.

NOTE 103 This standard does not apply to

– **humidifiers** without room heating, ventilation or air-conditioning equipment intended exclusively for household use (IEC 60335-2-98);

– appliances designed exclusively for industrial processing;

– 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);

– **humidifiers** intended for medical purposes (see IEC 60601).

2 Normative references

This clause of Part 1 is applicable except as follows.

Addition:

IEC 60068-2-52:1996, *Environmental testing – Part 2: Tests – Test Kb: Salt mist, cyclic (sodium chloride solution)*

3 Definitions

This clause of Part 1 is applicable except as follows.

3.1.9 *Replacement:*
normal operation
conditions that apply when the appliance is mounted as in normal use and is operating under the most severe environmental operating conditions specified by the manufacturer

3.101
humidifiers
appliances which are intended to increase air humidity

3.102
appliances accessible to the general public
appliances intended to be located in residential buildings, or in commercial buildings

3.103
appliances not accessible to the general public
appliances which are intended to be maintained by qualified service personnel and located either in machine rooms and the like or at a level not less than 2,5 m or in secured rooftop areas

4 General requirement

This clause of Part 1 is applicable.

5 General conditions for the tests

This clause of Part 1 is applicable.

6 Classification

This clause of Part 1 is applicable except as follows.

6.1 *Replacement*:

Appliances shall be **class I, II** or **III** with respect to protection against electrical shock.

Compliance is checked by inspection and by the relevant additional tests.

6.101 Appliances shall be classified according to the accessibility as defined in 3.102 and 3.103

Compliance is checked by inspection and the relevant tests.

7 Marking and instructions

This clause of Part 1 is applicable except as follows.

7.1 *Addition*:

For **humidifiers** connected to the water supply:

permissible maximum pressure (in pascals) of the water supply system.

Humidifiers generating water or steam with a temperature exceeding 60 °C shall be marked with the following:

WARNING: Danger of hot water. Drain water before servicing.

7.12 *Addition*:

For **appliances accessible to the general public** the classification according to 6.101 shall be included.

7.12.1 *Addition*:

In particular, the following information shall be supplied:

– that the appliance shall be installed in accordance with national wiring regulations;
– the dimensions of the space necessary for correct installation of the appliance including the minimum permissible distances to adjacent structures;
– for appliances with electric resistance heaters and for those appliances tested in excess of zero clearance, the minimum clearance from the appliance to combustible surfaces;
– a diagram of the appliance with a clear indication of wiring to external control devices;
– the range of external static pressure at volumetric air flow at which the appliance was tested (add-on heat pumps, and appliances with electric resistance heaters, only);
– details of type and rating of fuses.

7.15 *Addition*:

A marking may be located on a panel that can be removed for installation or service, providing that the panel shall be in place for the intended operation of the appliance.

7.16 *Addition*:

This requirement is also applicable to overload protective devices.

7.101 If the product is suitable for permanent connection to fixed wiring with aluminium wires, the marking shall so state this.

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 not applicable.

10 Power input and current

This clause of Part 1 is applicable except as follows.

10.1 *Addition*:

*For **humidifiers** with electrode or bare resistance heating devices where an increase in the concentration of conductive components in residual water may occur, the test is carried out with a special test water which has a specific resistance of 2 000 Ω cm at a temperature of 15 °C.*

NOTE 101 The water may be brought to the above-mentioned resistance value by adding ammonium phosphate. Other additives, such as common salt, may also be used.

11 Heating

This clause of Part 1 is applicable except as follows.

11.7 *Replacement*:

The appliance is operated until steady-state conditions are reached.

12 Void

13 Leakage current and electric strength at operating temperature

This clause of Part 1 is applicable except as follows.

13.1 *Addition*:

*For **humidifiers** with electrode and bare resistance heating devices, the tests as specified in 13.2 and 13.3 are carried out with the special test water described in 10.1.*

13.2 *Modification*:

*For appliances connected to fixed wiring, the leakage current shall not exceed 2 mA per kilowatt of **rated power input**, with a maximum value of 5 mA **for appliances accessible to the general public** and a maximum value of 10 mA **for appliances not accessible to the general public**.*

The leakage current of filter electrodes shall not exceed

- *for **class I appliances*** *1,0 mA*
- *for **class II** and **class III appliances*** *0,50 mA*

14 Transient overvoltages

This clause of Part 1 is applicable.

15 Moisture resistance

This clause of Part 1 is applicable.

16 Leakage current and electric strength

This clause of Part 1 is applicable except as follows.

16.1 *Addition*:

For electrode and bare resistance heating devices, the tests as specified in Clause 16 are carried out with the special test water described in 10.1.

16.2 *Addition*:

For appliances connected to fixed wiring, the leakage current shall not exceed 2 mA per kilowatt ***rated power input*** *with a maximum value of 5 mA for* ***appliances accessible to the general public*** *and a maximum value of 10 mA for* ***appliances not accessible to the general public.***

17 Overload protection of transformers and associated circuits

This clause of Part 1 is applicable.

18 Endurance

This clause of Part 1 is not applicable.

19 Abnormal operation

This clause of Part 1 is applicable except as follows.

19.2 *Addition*:

The test is made without water in the appliance.

19.3 *Addition*:

The test is made without water in the appliance.

19.4 *Addition*:

Controls which operate during the test of Clause 11 are rendered inoperative. For ***humidifiers*** *with a fan, the fan is switched off or the air supply is interrupted, whichever is the most unfavourable condition.*

Appliances are filled with water so that the heating elements or electrodes are just covered; the water supply is then shut off. The water is evaporated until the appliance is dry.

20 Stability and mechanical hazards

This clause of Part 1 is applicable.

21 Mechanical strength

This clause of Part 1 is applicable.

22 Construction

This clause of Part 1 is applicable except as follows.

22.6 *Addition*:

Appliances shall be so constructed that water from condensation or leakage can flow out, if otherwise there would be a possibility of such water affecting the electrical insulation. If a drain hole is provided for this purpose, it shall be at least 6 mm in diameter, or 30 mm^2 in area with a width of at least 5 mm, and so arranged that the water can drain off without impairing the electrical insulation.

Compliance is also checked by measurement, if necessary.

22.7 *Addition:*

If a gasket is necessary to comply with the requirements of this subclause, then the gasket shall comply with the requirements of Annex AA.

Compliance is also checked by measurement, if necessary.

22.33 *Modification:*

Electrodes are allowed to be used for heating liquids.

22.101 The water systems of **humidifiers** shall be constructed so that the container is always open to the atmosphere through an aperture at least 6 mm in diameter, or 30 mm² in area with a width of at least 5 mm. The aperture shall be so located that it is unlikely to be obstructed in normal use.

Compliance is checked by inspection and manual test.

22.102 Humidifiers with electrode heating devices shall be provided with devices which disconnect all poles of the heating device before the power input exceeds 150 % of **rated current input.**

Compliance is checked by inspection.

22.103 Humidifiers which are intended to be fixed and designed for direct connection to the water supply mains shall not be retained in position by connection with the water supply alone, but shall be provided with fastening means (for example for wall mounting). An effective air gap fitting shall be provided to prevent back flow.

Compliance is checked by inspection.

NOTE Apertures in the form of a keyhole, hooks and the like are not regarded as safe devices for fixing a **humidifier**, unless additional measures are taken in order to prevent the **humidifier** from being removed out of the fixture.

22.104 Wiring connected to a **non-self-resetting thermal cut-out** designed to be replaced after its operation shall be so secured that replacement of the **thermal cut-out** itself or of a heating element assembly on which the **thermal cut-out** is mounted, will not damage other connections or internal wiring.

Compliance is checked by inspection and, if necessary, by manual test.

22.105 Non-self-resetting thermal cut-outs designed to be replaced after their operation shall open the circuit in the intended manner without rendering inoperative **live parts** of different polarity and without causing **live parts** to come into contact with the enclosure.

Compliance is checked by the following test.

*The appliance is operated five times, each time with a new **non-self-resetting thermal cut-out**, any other thermally operated control devices being short-circuited or otherwise rendered inoperative.*

*Each time, the **thermal cut-out** shall operate appropriately.*

During the test, the enclosure of the appliance is connected to earth, through a 3 A fuse. This fuse shall not blow.

After this test, the supplementary heating elements shall withstand an electric strength test as specified in 16.3.

22.106 If the deterioration or breakage of a liquid container, seal, or similar component may increase the risk of electric shock, the component shall be resistant to deterioration from the liquid intended to be used in contact with that component.

Compliance is checked by the tests in Annex BB.

23 Internal wiring

This clause of Part 1 is applicable.

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 *Replacement:*

The appliances referenced in this subclause may be cord-connected

– if they are for indoor use only;
– if they have a marked **rating** of 25 A or less;
– if they comply with the applicable code requirements for cord-connected appliances appropriate to the specific country in which they are to be used.

Appliances shall not be provided with an appliance inlet.

Compliance is checked by inspection.

26 Terminals for external conductors

This clause of Part 1 is applicable.

27 Provision for earthing

This clause of Part 1 is applicable.

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:*

For insulation located in any airflow, the microenvironment is pollution degree 3 unless the insulation is enclosed or located so that it is unlikely to be exposed to pollution due to normal use of the appliance.

30 Resistance to heat and fire

This clause of Part 1 is applicable except as follows.

30.2.2 Not applicable.

31 Resistance to rusting

This clause of Part 1 is applicable except as follows.

Addition:

Compliance is checked by the salt mist test of IEC 60068-2-52, severity 2 being applicable.

Before the test, coatings are scratched by means of a hardened steel pin, the end of which has the form of a cone with an angle of 40°. Its tip is rounded with a radius of 0,25 mm ± 0,02 mm. The pin is loaded so that the force exerted along its axis is 10 N ± 0,5 N. The scratches are made by drawing the pin along the surface of the coating at a speed of approximately 20 mm/s. Five scratches are made at least 5 mm apart and at least 5 mm from the edges.

After the test, the appliance shall not have deteriorated to such an extent that compliance with this standard, in particular with Clauses 8 and 27, is impaired. The coating shall not be broken and shall not have loosened from the metal surface.

32 Radiation, toxicity and similar hazards

This clause of Part 1 is applicable except as follows.

Addition:

NOTE 101 Additives recommended by the manufacturer shall not create any hazards.

Annexes

The annexes of Part 1 are applicable except as follows.

Annex AA
(normative)

Gaskets

A material indicated in Table AA.1 that is used for gaskets to seal an electrical enclosure shall have physical properties as specified in Table AA.1 before and after accelerated aging under the conditions specified in Table AA.2.

A gasket of material other than those given in Table AA.1 shall be non-absorptive and shall provide equivalent resistance to aging and temperature.

Table AA.1 – Physical properties of gasket materials

Materials	Physical properties	Acceptable limits	
		Before conditioning	After conditioning
Elastomers (neoprene, rubber, ethylene, propylene, and the like)	Minimum acceptable elongation [a]	250 %	65 % of original
	Minimum acceptable tensile strength	10,3 MPa [d]	75 % of original
	Maximum acceptable set [b]	6,4 mm	
	Maximum acceptable compression set [c]	15 %	
Non-elastomers (solid polyvinyl chloride, and the like, excluding cork, fibre, and similar materials)	Minimum acceptable elongation	200 %	65 % of original
	Minimum acceptable tensile strength	10,3 MPa	75 % of original
Foamed neoprene or rubber compound		The compound shall not deteriorate to a degree that will affect its sealing properties.	
Thermoplastic		The compound shall not deform or melt, or otherwise deteriorate to a degree that will affect its sealing properties.	

[a] Percent increase in distance between gauge marks at break compared to initial distance of 25,4 mm. For example, a distance at break of 88,9 mm is 250 % elongation.

[b] Difference between 63,5 mm and final distance when specimen is stretched so that gauge marks initially 25,4 mm apart are 63,5 mm apart, held for 2 min, and measured 2 min after release.

[c] Per cent set measured after Type 1 button specimens are compressed to one-third of original thickness and heat conditioned for 24 h at 70 °C or 10 °C higher than normal operating temperature, whichever is higher, following the procedure in test for compression set of vulcanized rubber under constant deflection (see ISO 815).

[d] 3,4 MPa for a silicone rubber gasket (having the characteristic constituent of polyorganosiloxane) that is not subjected to mechanical abuse after assembly in the product.

Table AA.2 – Accelerated aging conditions

Measured temperature rise[a] K	Test programme	
	Rubber or neoprene	**Thermoplastic**
35	4 days at 70 °C ± 1 °C in an oxygen bomb at 2,1 MPa ± 0,1 MPa	7 days in an air-circulating oven at 87 °C ± 1 °C
50	7 days at 80 °C ± 1 °C in an oxygen bomb at 2,1 MPa ± 0,1 MPa	10 days in an air-circulating oven at 100 °C ± 1,0 °C
55	7 days in an air-circulating oven at 113 °C ± 1 °C	
65	10 days in an air-conditioning oven at 121 °C ± 1 °C	7 days at 121 °C ± 1 °C or 60 days at 97 °C ± 1 °C in an air-circulating oven
80	7 days in an air-circulating oven at 136 °C ± 1 °C	

[a] These temperatures correspond to the maximum temperature rise measured on the gasket.

Annex BB
(normative)

Test for liquid-containers

BB.1 If the deterioration or breakage of a liquid container, seal, or similar component may increase the risk of electric shock, the component shall be resistant to deterioration from the liquid intended to be used in contact with that component.

BB.2 The test procedure for determining whether a component complies with these requirements depends upon the material of which it is composed, its size, shape, mode of application in the product, and the like. The test procedure shall include visual inspection for the determination of cracks, deformation, and the like, after accelerated aging, and a comparison of hardness, tensile strength, and elongation before and after accelerated aging.

BB.3 With reference to this requirement, a component of rubber, neoprene, or thermoplastic shall be tested to compare its tensile strength and elongation before and after conditioning as described in Clauses BB.4 and BB.5. The tensile strength and elongation after the conditioning described in Clause BB.4 shall not be less than 50 % of the tensile strength and elongation measured before the conditioning, and not less than 60 % of the tensile strength and elongation measured after the conditioning described in Clause BB.5.

BB.4 A component as mentioned in Clause BB.3 is to be immersed for 7 days in the liquid used with the material at a temperature not less than 10 °C higher than the maximum operating temperature of the material measured under intended operating conditions but not less than 70 °C.

BB.5 A component as mentioned in Clause BB.3 is to be conditioned in an air-circulating oven at the temperature and for the number of days specified in Table BB.1.

Table BB.1 – Oven conditioning temperatures

Temperature on material during normal temperature test °C	Number of days in oven	Oven temperature °C
60	7	87
75	7	100
80	7	113
90	7	121
105	7	136
145	10	150
150	10	160
160	30	170
170	30	180
180	30	190
190	30	200
200	30	210

Bibliography

The bibliography of Part 1 is applicable accept as follows.

Addition:

IEC 60335-2-40, *Household and similar electrical appliances – Safety – Part 2: Particular requirements for electric heat pumps, air-conditioners and dehumidifiers*

IEC 60335-2-98, *Household and similar electrical appliances – Safety – Part 2: Particular requirements for humidifiers*

ISO 815:1991, *Rubber, vulcanized or thermoplastic – Determination of compression set at ambient, elevated or low temperatures*

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