

INTERNATIONAL
STANDARD

IEC
60335-2-41

Third edition
2002-10

**Household and similar electrical appliances –
Safety –**

**Part 2-41:
Particular requirements for pumps**

*Appareils électrodomestiques et analogues –
Sécurité –*

*Partie 2-41:
Règles particulières pour les pompes*



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES –
SAFETY –**
Part 2-41: Particular requirements for pumps

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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This part of International Standard IEC 60335 has been prepared by IEC technical committee 61: Safety of household and similar electrical appliances.

This third edition cancels and replaces the second edition published in 1996 and its amendment 1 (2000). It constitutes a technical revision.

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

FDIS	Report on voting
61/2217/FDIS	61/2292/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 pumps.

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 the associated noun are also in bold.

The committee has decided that the contents of this publication will remain unchanged until 2003. 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: Pumps intended to be used in or close to swimming pools, garden ponds and similar places may be class 0I if their supply circuit incorporates a residual current device. Other pumps may be class 0I (Japan).
- 6.1: Class 0 aquarium pumps are allowed (USA).
- 7.12.1: Stationary pumps not incorporating a protective device are to be marked with the characteristics of the device to be installed in the fixed wiring (USA).
- 15.1.1: The test is different (USA).
- 20.1: This test is only carried out on fountain pumps, the angle being 15° (USA).
- 22.105: The test is different (USA).

A bilingual version of this standard 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 2-41: Particular requirements for pumps

1 Scope

This clause of Part 1 is replaced by the following.

This International Standard deals with the safety of electric pumps for liquids having a temperature not exceeding 90 °C, intended for household and similar purposes, their **rated voltage** being not more than 250 V for single-phase appliances and 480 V for other appliances.

NOTE 101 Examples of appliances within the scope of this standard are

- aquarium pumps;
- pumps for garden ponds;
- **sludge pumps**;
- **submersible pumps**;
- table fountain pumps;
- **vertical wet pit pumps**.

Appliances not intended for normal household use, but that nevertheless may be a source of danger to the public, such as appliances intended to be used by laymen in shops, in light industry and on farms, are within the scope of this standard.

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 the national health authorities, the national authorities responsible for the protection of labour and similar authorities.

NOTE 103 This standard does not apply to

- **stationary circulation pumps** for heating and service water installations (IEC 60335-2-51);
- pumps for flammable liquids;
- pumps intended exclusively for industrial purposes;
- pumps intended to be used in locations where special conditions prevail, such as the presence of a corrosive or explosive atmosphere (dust, vapour or gas);
- pumps incorporating chlorinators of the electrolytic type.

NOTE 104 Pumps incorporated in appliances are not covered by this standard unless a specific reference is made.

2 Normative references

This clause of Part 1 is applicable.

3 Definitions

This clause of Part 1 is applicable except as follows.

3.1.9 *Replacement:*

normal operation

operation of the appliance under the following conditions

Pumps are operated with the inlet in liquid at zero pressure, and between the minimum and maximum total head, so that the highest power input is attained.

NOTE 101 The total head is measured between the inlet and the discharge outlet.

Sludge pumps are operated with water.

3.101

submersible pump

pump having the electrical part completely or partially immersed in liquid during normal use

NOTE The motor windings may be dry, immersed in oil or in the pumped liquid.

3.102

vertical wet pit pump

pump having the electrical part separated from the hydraulic part and not immersed in liquid during normal use

NOTE Controls such as water level switches may be immersed in the liquid.

3.103

sludge pump

pump intended for moving a mixture of water and small solids

NOTE **Sludge pumps** may be **submersible pumps** or **vertical wet pit pumps**.

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.

5.7 *Addition:*

The liquid temperature is maintained between 0 °C and –5 °C of the temperature marked on the pump.

5.101 *Pumps are tested as **portable appliances**, unless they are **fixed appliances**.*

5.102 ***Stationary pumps** having a three-phase motor that does not incorporate a **protective device** are installed with an appropriate device, in accordance with the instructions.*

6 Classification

This clause of Part 1 is applicable except as follows.

6.1 Modification:

Submersible pumps for use in swimming pools, when persons are in the pool, shall be **class III** with a **rated voltage** not exceeding 12 V.

Other **submersible pumps** for use in water and other conducting liquids shall be **class I** or **class III**. However, aquarium pumps may be **class II**.

Portable pumps for cleaning and other maintenance of swimming pools shall be **class I** or **class III**.

Other pumps shall be **class I**, **class II** or **class III**.

6.2 Addition:

Submersible pumps shall be IPX8.

Portable pumps for cleaning and other maintenance of swimming pools shall be at least IPX7.

Other pumps shall be at least IPX4.

7 Marking and instructions

This clause of Part 1 is applicable except as follows.

7.1 Addition:

Pumps having a **rated power input** exceeding 50 W shall be marked with

- the minimum total head, in metres, if greater than zero;
- the maximum operating depth, in metres with a minimum of 1 m (for **submersible pumps**);
- the direction of rotation (for pumps having three-phase motors).

Pumps shall be marked with the maximum liquid temperature, which shall not be less than 35 °C. If the temperature exceeds 35 °C, pumps shall be marked with the maximum period of operation, unless they are intended for continuous operation.

7.6 Addition:

H_{\min} minimum total head

$\frac{\nabla}{\dots m}$ maximum operating depth

7.12 Addition:

The instructions for **class I portable pumps** for cleaning and other maintenance of swimming pools shall include the substance of the following:

- the pump must not be used when people are in the water;
- the pump must be supplied through a residual current device (RCD) having a rated residual operating current not exceeding 30 mA.

The instructions for pumps marked with a temperature exceeding 35 °C shall state the maximum period of operation and the minimum rest period, unless the pump is intended for continuous operation at this temperature.

7.12.1 *Addition:*

The installation instructions shall provide information on requirements specified for the electrical installation and shall include reference to national wiring rules. If reference is made to zones, the corresponding drawings shall be included.

The installation instructions shall state the substance of the following:

- the maximum total head, in metres (for pumps having a **rated power input** exceeding 50 W);
- pollution of the liquid could occur due to leakage of lubricants (for **submersible pumps** and **vertical wet pit pumps** containing lubricants);
- a protective device is to be installed in the fixed wiring and its characteristics are to be specified (for **stationary pumps** having a three-phase motor not incorporating a **protective device**).

The installation instructions for pumps intended to be used in outdoor fountains, garden ponds and similar places shall state that the pump is to be supplied through a residual current device (RCD) having a rated residual operating current not exceeding 30 mA.

The installation instructions for **class I pumps** for swimming pools shall state that the pump is to be supplied by an isolating transformer or supplied through a residual current device (RCD) having a rated residual operating current not exceeding 30 mA.

The installation instructions for **class III pumps** intended to be installed in zone 0 of a swimming pool shall state that the transformer is to be located outside zone 1.

The installation instructions for **class II pumps** intended to be fixed in zone 1 of a swimming pool, or fixed close to a garden pond or similar place, shall state that the pump is to be located where flooding cannot occur.

NOTE 101 The zones are defined in IEC 60364-7-702.

NOTE 102 A sump without an adequate outlet for the liquid is considered to be a place where flooding is likely to occur.

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.

11 Heating

This clause of Part 1 is applicable except as follows.

11.7 Replacement:

Pumps are operated until steady conditions are established, the liquid temperature being 35 °C. However, if a liquid temperature is marked on the pump, the liquid is maintained at this temperature instead, unless the pump is also marked with the maximum period of operation.

If the pump is marked with a maximum period of operation, it is also operated for this period followed by the rest period specified in the instructions, the liquid being maintained at the marked temperature. This test is carried out for three cycles of operation.

11.8 Addition:

For pumps marked with a liquid temperature exceeding 35 °C, the temperature rise of the external enclosure is not measured.

12 Void

13 Leakage current and electric strength at operating temperature

This clause of Part 1 is applicable.

14 Transient overvoltages

This clause of Part 1 is applicable.

15 Moisture resistance

This clause of Part 1 is applicable except as follows.

15.1.2 Addition:

*Pumps classified IPX4 are tested with the inlet connected to the outlet by means of a tube filled with water. The pump is supplied at **rated voltage** and the tube is positioned so that the pump operates at any value between the minimum and maximum total head.*

***Submersible pumps** are immersed for 24 h in water containing approximately 1 % NaCl and having a temperature of 30 °C ± 5 °C. The water pressure on the enclosure is equal to*

- 1,5 times the pressure occurring at the maximum operating depth, when this depth does not exceed 10 m;*
- 1,3 times the pressure occurring at 15 m or at the maximum operating depth, whichever is greater, when this depth exceeds 10 m.*

Before the test, the temperature of the pump is raised to within 5 K of the water temperature.

15.3 Addition:

***Submersible pumps** are not subjected to the test.*

16 Leakage current and electric strength

This clause of Part 1 is applicable.

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.

19.1 Addition:

Pumps are also subjected to the tests of 19.101 and 19.102.

19.9 Not applicable.

19.101 *Pumps are supplied at **rated voltage** and operated at approximately half the maximum total head for 5 min, after which the inlet is removed from the liquid and the operation continued for 7 h. Pumps are then operated again for 5 min at approximately half the maximum total head.*

If the pump becomes inoperable during the test, it is disconnected from the supply and filled with water.

19.102 *Pumps marked with a maximum period of operation are supplied at **rated voltage** and operated under **normal operation** until steady conditions are established.*

20 Stability and mechanical hazards

This clause of Part 1 is applicable except as follows.

20.1 Addition:

Submersible pumps are not subjected to the test.

21 Mechanical strength

This clause of Part 1 is applicable except as follows.

Modification:

The impact energy is increased to 1,0 J.

22 Construction

This clause of Part 1 is applicable except as follows.

22.6 Addition:

*The seal is removed from the shaft of **class II pumps**. The pump is supplied at **rated voltage** and operated for 10 min with the maximum head that can be achieved.*

If a static pressure can occur, the test is repeated at a pressure corresponding to the maximum total head.

The pump shall then withstand the electric strength test of 16.3.

22.18 Addition:

NOTE 101 Direct contact between copper and aluminium or their alloys is likely to result in corrosion.

22.40 Addition:

The requirement is not applicable to **submersible pumps** and **vertical wet pit pumps**.

22.101 Pumps shall withstand the static pressure occurring in normal use.

Compliance is checked by the following test.

The pump is filled with water, ensuring that all air is removed. The pressure is raised hydraulically to 1,2 times the pressure occurring at maximum total head and is maintained for 1 min.

*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.*

Submersible pumps and vertical wet pit pumps are not subjected to this test.

NOTE **Submersible pumps** have already been checked by the test of 15.1.2 **Vertical wet pit pumps** are constructed so that the motor is not subjected to pressure.

22.102 The material of the pump shall not be affected by the liquid for which the pump is intended if a hazard could result.

Compliance is checked by inspection.

22.103 Submersible pumps and vertical wet pit pumps shall be constructed so that pollution of the liquid by lubricants is prevented as far as possible.

Compliance is checked by inspection.

22.104 Submersible pumps, and vertical wet pit pumps, having a mass exceeding 3 kg shall be constructed so that means for hoisting can be attached.

Compliance is checked by inspection.

22.105 Class I submersible pumps having a plastic enclosure shall be constructed so that leakage of liquid into the motor does not result in a hazard.

Compliance is checked by the following test.

A hole is made in the plastic enclosure.

*The pump is placed in the most unfavourable position intended in normal use. Water containing approximately 1 % NaCl is poured into the enclosure at a rate of approximately 100 ml/min, avoiding **live parts**. The accumulating water shall come into contact with earthed metal before it reaches **live parts**.*

23 Internal wiring

This clause of Part 1 is applicable.

24 Components

This clause of Part 1 is applicable except as follows.

24.1.3 Addition:

Level switches are subjected to 50 000 cycles of operation.

24.2 Modification:

Level switches may be incorporated in **interconnection cords**.

25 Supply connection and external flexible cords

This clause of Part 1 is applicable except as follows.

25.1 Modification:

Submersible pumps, other than **class III pumps**, shall be provided with a **supply cord** fitted with a plug.

25.3 Modification:

Submersible pumps, other than **class III pumps**, shall be provided with a flexible cord.

25.5 Addition:

Type X attachment is not allowed for **submersible pumps**.

Type Z attachment is allowed for

- pumps having a **rated power input** not exceeding 100 W;
- pumps for garden ponds.

25.7 Addition:

For pumps intended for outdoor use and pumps intended for use in swimming pools, other than **class III pumps**, the **supply cord** shall be polychloroprene sheathed or equivalent synthetic elastomer and not be lighter than heavy polychloroprene sheathed cord (code designation 60245 IEC 66). However, **fixed pumps** having a **rated power input** not exceeding 1 kW and **portable pumps** having a mass not exceeding 5 kg may be fitted with ordinary polychloroprene sheathed cord (code designation 60245 IEC 57).

NOTE 101 The mass of the pump is determined without water and without the **supply cord**.

For pumps intended for indoor use, except table fountain pumps, aquarium pumps and **class III pumps**, the **supply cord** shall be polychloroprene sheathed or equivalent synthetic elastomer and not be lighter than ordinary polychloroprene sheathed cord (code designation 60245 IEC 57).

25.8 Addition:

The **supply cord** of **submersible pumps** intended for outdoor use, other than **class III pumps**, shall have a length of at least 10 m.

25.14 Addition:

Portable pumps are subjected to the test.

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.

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.

32 Radiation, toxicity and similar hazards

This clause of Part 1 is applicable.

Annexes

The annexes of Part 1 are applicable.

Bibliography

The bibliography of Part 1 is applicable except as follows.

Addition:

IEC 60335-2-51, *Household and similar electrical appliances – Safety – Part 2-51: Particular requirements for stationary circulation pumps for heating and service water installations*

IEC 60364-7-702, *Electrical installations of buildings – Part 7: Requirements for special installations or locations – Section 702: Swimming pools and other basins*



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