

INTERNATIONAL STANDARD

IEC
60335-2-72

Second edition
2002-07

Household and similar electrical appliances – Safety –

Part 2-72: Particular requirements for automatic machines for floor treatment for commercial and industrial use

*Appareils électrodomestiques et analogues –
Sécurité –*

*Partie 2-72:
Règles particulières pour les machines automatiques
de traitement des sols à usage industriel et commercial*



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES –
SAFETY –****Part 2-72: Particular requirements for automatic machines
for floor treatment for commercial and industrial use**

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 sub-committee 61J: Electrical motor-operated cleaning appliances for industrial use, of IEC technical committee 61: Safety of household and similar electrical appliances.

This second edition cancels and replaces the first edition published in 1995 and its amendment 1 (2000). It constitutes a technical revision.

The text of this standard is based on the following documents:

FDIS	Report on voting
61J/130/FDIS	61J/135/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 automatic machines for floor treatment for industrial and commercial use.

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 2004. At this date, the publication will be

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- withdrawn;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

Withdawn
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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 2-72: Particular requirements for automatic machines for floor treatment for commercial and industrial use

1 Scope

This clause of Part 1 is replaced by the following.

This International Standard deals with the safety of mains or battery supplied **portable** combined machines, with or without a built-in battery charger, having a chassis with or without traction drive, intended for commercial and industrial use indoors or outdoors for dry or wet treatment of hard floors or of floors with carpeting, their **rated voltage** being not more than 250 V for single-phase appliances and 480 V for other appliances.

NOTE 101 Examples of such appliances are catering equipment, cleaning appliances for industrial and commercial use, and appliances for hairdressers.

NOTE 102 Mobile equipment is defined as **portable** by part 1.

NOTE 103 Treatment within the meaning of this standard denotes for example

- scrubbing;
- wet or dry pick-up;
- polishing;
- application of wax and sealing products;
- shampooing.

It is also applicable to appliances making use of other forms of energy for the motor; but it is necessary that their influence is taken into consideration.

For machines denoted to handle hazardous dust in normal use, additional requirements are specified in Annex AA of IEC 60335-2-69.

NOTE 104 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, the national water supply authorities and similar authorities;
- for machines denoted for operation or transport in public areas additional requirements may be specified by the national authorities responsible for road traffic licensing regulations.

NOTE 105 This standard does not apply to

- appliances intended exclusively for industrial purposes;
- 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);
- audio, video and similar electronic apparatus (IEC 60065);
- appliances for medical purposes (IEC 60601);
- hand-held motor-operated electric tools (IEC 60745);
- personal computers and similar equipment (IEC 60950);
- transportable motor-operated electric tools (IEC 61029);
- floor treatment machines for commercial and industrial use (IEC 60335-2-67);
- spray extraction appliances for commercial and industrial use (IEC 60335-2-68);
- wet and dry vacuum cleaners for commercial and industrial use (IEC 60335-2-69).

2 Normative references

This clause of Part 1 is applicable except as follows.

Addition:

IEC 60312, *Vacuum cleaners for household use – Methods of measuring the performance*

IEC 60335-2-69, *Household and similar electrical appliances – Safety – Part 2-69: Particular requirements for wet and dry vacuum cleaners, including power brush, for industrial and commercial use*

NOTE Annex AA contains particular requirements for vacuum cleaners, suction sweeping machines and dust extractors for the collection of dusts hazardous to health.

ISO 3411, *Earth moving machinery – Human physical dimensions of operators and minimum operator space envelope*

3 Definitions

This clause of Part 1 is applicable except as follows.

3.1.9 Replacement:

normal operation

the load corresponding to the rated input or the highest obtainable load of all the particular loads of the various functions that can be operated at the same time in accordance with the manufacturer's instructions. For machines provided with a seat or an operator platform, a mass of 75 kg secured in position at the appropriate height is used to simulate the operator in the most unfavourable position.

Operational functions denote all treatment and driving functions.

The normal operation related to the operational functions is specified as follows:

3.1.9.101 Scrubbing and sweeping machines are operated on a surface of hydraulically pressed concrete paving slabs (see Annex AA) intermittently in accordance with the manufacturer's instructions, at least 30 min switched on, and for a period of 5 min switched off.

An alternative is a smooth concrete area of a surface consistency comparable with hydraulically pressed concrete paving slabs.

3.1.9.102 Dry and wet pick-up machines are operated according to IEC 60335-2-69.

3.1.9.103 Polishing and dry buffing machines are operated as follows.

PVC-surfaces are considered to be suitable for establishing normal operation. The peak of input occurring during the drying process of the chemical applied to treat the surface shall not be taken as normal operation but shall be averaged by extending measurements over a period of at least 10 min.

3.1.9.104 Carpet shampoos are operated on a test surface consisting of a carpet, in accordance with IEC 60312, the carpet being fastened to the floor. The brush of the shampooing machine has, prior to testing, to be conditioned by operating it for 15 min on a clean, dry concrete surface. After running on the concrete surface the brush has to be immersed in a shampoo solution for at least 30 min.

The operation has to be carried out over a period of 10 min where the solution tank has to be filled when starting the operation.

3.101

wet cleaning machines

machines for scrubbing and sucking up cleaning liquids on large surfaces indoors or outdoors, for example scrubbing machines. They may be designed also for combination of dry or wet cleaning and floor treatment with attachments for polishing, buffing, etc., and for sucking-up of dry dirt

3.102

walk-behind machines

machines with or without a traction drive that are guided or moved by the operator. They may be equipped with a sulky attachment with a seat for the operator, however they will be considered for the application as walk-behind machines also

3.103

ride-on machines with an operator platform

machines with a traction drive on which the operator is standing during operation

3.104

ride-on machines with an operator seat

machines with a traction drive on which the operator is sitting during the operation

3.105

sulky

device to enable the operation of machines in a sitting or standing position. They are also called trailers

3.106

instructed person

an individual adequately advised or supervised by a skilled person to enable that individual to avoid hazards that electricity can create

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.

5.101 *In appliances for wet scrubbing and shampooing the liquid containers are filled to the highest level indicated by the manufacturer.*

5.102 *If additional weights are delivered with the appliance, these are inserted before normal operation.*

6 Classification

This clause of Part 1 is applicable except as follows.

6.1 Replacement:

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

Compliance is checked by inspection and by the relevant tests.

6.2 Addition:

Mains supplied and battery powered machines for indoor use intended for dry cleaning only, shall be at least IPX0. Other machines shall be at least IPX3.

7 Marking and instructions

This clause of Part 1 is applicable except as follows.

7.1 Addition:

Machines shall be marked in addition with:

- serial number indicating (for example, in the form of a code), the year of manufacture, if this is not directly marked;
- gross weight of the machine as ready for use in kilograms, if higher than 100 kg;
- reference to the capability of picking up hazardous dust, in accordance with Annex AA to IEC 60335-2-69;
- substance of the statement "Suitable for picking up hazardous dust", if the machine is capable of doing this;
- substance of the statement "Suitable for use only on surfaces with a gradient not exceeding 2 %" if the machine is not designed to be operated on higher gradients.

7.12 Addition:

The instructions shall contain, if applicable, the substance of the following warnings:

- CAUTION: The machine is not suitable for picking up hazardous dust;
- CAUTION: The machine shall not be used on surfaces with a gradient exceeding 2 %.

The instructions shall include the following regarding preparation for use, operation, maintenance and service, as far as relevant:

- the machine shall be used only by instructed and authorised persons;
- when cleaning, servicing or maintaining the machine, replacing parts or converting to another function the power source shall be switched off. Mains operated machines shall be disconnected by removing the power plug, and battery operated machines shall be disconnected by removing the key of the power switch, or any other effective means;
- before use all covers and doors shall be put in the position specified in the instructions for use.

For mains supplied machines:

- to avoid hazards that may occur when rotating brushes touch or cross the supply cord;
- to take care not to damage or impair the supply cord by stroking, crushing, stretching, etc.;
- to inspect regularly the supply cord for signs of damage or aging;
- to stop using the machine, if the condition of the supply cord is not satisfactory;
- the machine shall be fitted with only those types of supply cords or detachable cords that are specified by the manufacturer of the machine;

- to ensure the required protection against moisture when replacing cable couplers of the supply cord.

For machines with a traction drive and a mass exceeding 100 kg:

- in order to prevent unauthorised use of the machine the power source shall be switched off or locked, for example, by removing the key of the power switch;
- machines left unattended shall be secured against unintentional movement;
- during operation attention shall be paid to other persons, especially children.

8 Protection against access to live parts

This clause of Part 1 is applicable except as follows.

8.1 Addition:

Parts working with a nominal battery voltage up to 48 V are not considered to be **live parts**.

NOTE 101 Water and water-borne cleaning agents are treated as conductive.

8.1.4 Addition:

Isolated battery systems of 18 to 24 cells of either acid or alkaline electrochemistry, including gel batteries, shall be regarded as **class III** provided that

- the maximum voltage per cell on charge does not exceed 2,7 V;
- there are no earthed parts;
- conductive parts cannot fall on to and thereby bridge **live parts** of opposite polarity.

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.

11.3 Addition:

If it is necessary to disassemble the machine for fitting thermo-couples or other wiring, the input shall be measured before and after fitting at the lowest possible load, for example, with closed suction openings, with brushes not in contact with the floor, with declutched drive, etc., to check if the assembling has been accomplished properly.

11.5 Addition:

*The **normal operation** may be simulated by applying an appropriate braking equipment.*

For battery supplied machines the test is carried out commencing with a fully charged battery.

11.7 Addition:

Appliances are operated until steady conditions are established.

12 Void**13 Leakage current and electric strength at operating temperature**

This clause of Part 1 is applicable except as follows.

13.2 Addition:

*For **class I appliances** where several motors operate at the same time, the leakage current shall not exceed 3,5 mA*

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 Modification:

Replace the first sentence by the following:

The enclosure of the appliance shall provide the degree of protection against moisture in accordance with the classification of the appliance, except for batteries.

Addition:

For mains supplied machines for outdoor use the tests of 15.1.1 shall be carried out with fans operating.

15.2 Addition:

For these tests detachable cords are removed. The machine is turned over until it falls into a stable position on a horizontal surface.

After these tests:

- wet cleaning machines, except machines for cleaning of textile floorings, are operated 10 min on a floor of paving slabs with a smooth surface that are fastened to the bottom of a pan. At the beginning of the test the pan is filled with a solution of a detergent in water in accordance with the instructions to a level of approximately 5 mm above the surface of the floor;*
- shampooing machines are operated 20 min with **normal operation**..*

Mains supplied machines with liquid containers with a mass of the appliance up to 100 kg are turned over with the full container into the most unfavourable horizontal position and left so for 5 min.

Machines with a liquid container that has to be filled by the operator are subjected to the overflow test using a solution of a detergent in water in accordance with the instructions.

After this test the machine shall withstand an electric strength test as specified in Clause 16.

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:

Appliances are also subjected to the test of 19.101.

19.7 Addition:

Brush and traction drive motors are tested for 30 s.

Fan blades are not regarded as parts liable to be jammed.

*Battery supplied machines and/or their electrical components shall be capable of being supplied at 0.7 times **rated voltage** without impairing the safety aspects of this standard.*

*Compliance is checked by operation and with respect to all relevant criteria by testing at 70 % of the **rated voltage** in cases when this may impair the safety aspects of this standard.*

NOTE 101 The requirements are deemed met if an overcurrent-protection, fuse or any other safety device interrupts the circuit before the allowed temperature of the windings is reached.

19.9 Not applicable

19.101 *Appliances having containers that are provided with shut-off device(s) or valve(s) are again subjected to the test of 15.2.*

Stop valves or other fluid shut-off devices are made inoperative. If two or more independent shut-off devices are provided, only one of them is made inoperative at a time, provided that they have passed the test of operating 3 000 times satisfactorily. Otherwise all that failed are made inoperative.

NOTE 101 Care should be taken to suck up an air-liquid mixture to prevent overloading of the motor of the suction unit. The input power should be observed to avoid overloading.

*After this test, the appliance shall be subjected to the electrical strength test of 16.4. Inspection shall show that water has not entered the appliance to any dangerous extent. In particular, there shall be no trace of water on the electrical insulation that would result in the reduction of **clearance and creepage distances** below the limits specified in Clause 29.*

20 Stability and mechanical hazards

This clause of Part 1 is applicable except as follows.

20.1 Modification:

Replace the test specification by the following.

Compliance is checked by the following test.

The machine is placed with the motor switched off, in any normal position of use on a gradient of 6° or the maximum climbing capacity declared by the manufacturer, whichever is greater, the cable or cord resting on the inclined plane in the most unfavourable position. During the test the parking brakes, if any, shall be applied and the wheels or rollers shall be blocked.

Machines provided with doors that can be opened without tools are tested with the doors open or closed, whichever is the more unfavourable. Doors that can be opened only with the aid of a tool remain closed.

Appliances intended to be filled with liquid by the user in normal use are tested empty or filled with the most unfavourable quantity of water up to the rated capacity.

Lift-off shall not occur at any wheel or roller, if this causes a danger for the operator.

20.2 Addition:

In particular

- cog and chain wheels and belt pulleys shall be enclosed and the inlet openings of chains or belts shall be guarded;
- slots, keys, screws, etc., on rotating or moving parts shall be enclosed or guarded by smooth and rounded guards;
- shaft ends and similar rotating parts shall be protected if they protrude by more than a quarter of their diameter, except rounded shaft ends shorter than 50 mm;
- places where crushing or cutting could occur shall be avoided or covered;
- protective covers or guards shall be sufficiently far from moving parts or shall be so designed that an access by hand is prevented.

This last requirement shall not apply to the bristles of rotating brushes or brooms. The solid parts of rotating brushes that are accessible during operation shall, however, be protected. It shall also not apply to rotating brushes or similar devices and to moving parts of vacuum cleaners if they become accessible during converting the machine to another application by changing of attachments.

The unintentional closing or slamming of ancillary structures, side walls, lids, covers etc., that could cause injury shall be prevented.

Wheels or rollers for the traction drive or the transport of machines shall be located or protected as to prevent injury to the feet of the operator.

Compliance is checked by inspection, taking into account the human physical dimensions of operators given in ISO 3411.

20.101 Fittings for the coupling of sulky attachments with seats shall be so designed that they are easily operable and cannot become disconnected unintentionally. Towing bars shall be clear of the floor.

Compliance is checked as follows: The link of the sulky and of the platform, with a total load of 150 kg, shall withstand 5 times the pull of the machine in a level area when accelerating up to the maximum speed.

20.102.1 Sulky attachments for seating the operator, shall have non-slip foot rests and shall be so designed that if the machine reverses, the operator cannot be jammed between the machine and the attachment.

Compliance is checked by inspection.

20.102.2 Walk-behind machines with traction drive shall be provided with a device that prevents the operator from becoming jammed in the event of reversing of the machine, for example, by a handle or a shaft of the machine. Such devices preventing jamming may be, for example, switches or controls that in the event of jamming automatically cut-out or reverse the drive, telescopic handles or shafts, rapid reversing switches, continuous action controls ("deadman" controls) requiring constant actuation by the operator, etc.

Compliance is checked by inspection.

20.102.3 Ride-on machines with an operator platform shall have adequate front and side protection for the operator, either by the location and arrangements of the platform or by guards, etc. The handles of the controls shall be located inside the protected area unless a special protection is provided for the hands. The platform shall be non-slip and shall have protection against slipping off.

Compliance is checked by inspection.

20.102.4 Ride-on machines with an operator seat shall be protected against slipping from the seat, shall have strong foot rests, and, if necessary, a mounting step.

Compliance is checked by inspection.

20.103 The emptying operation of soiled containers by powered assistance may not lead to dangerous conditions for the operator.

Compliance is checked by inspection.

20.104 On machines with a traction drive and on machines with accessible moving parts, switches shall be so located that inadvertent switching-on is unlikely to occur.

The machines shall be so constructed that the traction drive can only be started after the operator has taken place on the provided seat or platform and after he has carried out an intentional action.

Compliance is checked by inspection.

20.105 For **walk-behind machines** with traction drive and a mass of the appliance exceeding 100 kilograms the maximum speed on the level shall not exceed 6 kilometres per hour.

Traction drive does not include traction by the effect of rotating brushes.

They shall be provided with:

- a switch for continuous actuation ("deadman") that disconnects the driving motor when it is not actuated any more by the operator;
- a parking brake if the braking effect of the switched-off traction drive is insufficient. The parking brake shall be capable of holding the machine on a ramp with a gradient of 10 %, or, if the climbing capacity of the machine is higher, on the steepest possible gradient. The force required to operate the brake shall not exceed 200 N.

Machines denoted for operation on level surfaces with a gradient of maximum 2 % and marked accordingly need not be equipped with a parking brake.

Compliance is checked by inspection.

20.106 Ride-on machines with an operator platform:

- shall be so equipped that if the operator leaves the platform the traction drive is automatically switched off and the parking brake is set automatically, should the switched-off traction drive not have sufficient braking effect;
- shall be so equipped that, if the operator mounts the platform the traction drive is not automatically switched on;
- shall be held by the parking brake on a ramp with a gradient of 6° or, if the climbing capacity of the machine is higher, on the steepest possible gradient.

Compliance is checked as follows: The performance of the parking brake is checked on a ramp of dry pavement flagstones with a smooth surface and the appropriate slope. The result is taken as the mean of three measurements. During the tests the machine is loaded with a mass of its maximum capacity including the operator (75 kg).

20.107 Ride-on machines with an operator seat:

- shall be so equipped that, if the operator takes place on the seat, the traction drive is not automatically switched on;
- shall be equipped with a parking brake if the braking effect of the switched-off traction drive is insufficient. The parking brake shall hold the machine on a ramp with a gradient of 6°, or, if the designed climbing capacity of the machine is higher, on the steepest possible gradient. The force to operate the brake shall not exceed 400 N for manual operation.

Compliance is checked as follows: The performance of the parking brake is checked on a ramp of dry pavement flagstones with a smooth surface and the appropriate slope. The result is taken as the mean of three measurements. During the tests the machine is loaded with a mass of its maximum capacity including the operator (75 kg).

20.108 Ride-on machines with an operator platform and ride-on machines with an operator seat:

- shall not exceed a maximum speed of 25 kilometres per hour on a level surface;
- shall be equipped with a service brake.

The force required to operate the service brake shall not exceed

- 400 N, for hand operation, and
- 600 N, for foot operation

The brake shall stop the machine within a distance of maximum 0,19 m for each kilometre per hour of maximum speed of the machine.

Compliance is checked as follows: The performance of the service brake is checked on a level floor of pavement flagstones with a smooth surface. The result is taken as the mean of three measurements. During the measurements the machine is loaded with a mass of its maximum capacity including the operator (75 kg).

20.109 Machines with traction drive and a mass of the appliance exceeding 100 kilograms:

- shall be equipped with an emergency switch-off device which, if the controls or switches for **normal operation** are failing, can be operated rapidly without danger from the operator's position. This switching-off can be achieved, for example, by disconnecting the drive mechanically or electrically, by a switch for continuous actuation ("deadman"), etc.;
- shall be equipped with a device to prevent unauthorised switching-on of the operational functions or the driving function, for example, with a key-operated switch, mechanical locking means, removable handles of controls, etc.

NOTE Drive motors may be used as service brakes provided they cannot be disconnected by the operator.

Compliance is checked by inspection.

21 Mechanical strength

This clause of Part 1 is applicable, except as follows.

Modification:

The impact value is increased to $1,0 J \pm 0,04 J$.

21.101 Those parts of the machine that are subjected to impact in normal use are tested as follows.

If failure of the part subject to impact would cause a failure to comply with this specification, any spot of the machine that may be exposed during normal operation to impacts or blows is subjected to a single blow with an impact energy of 6,75 J. The impact stress on the free-standing machines is exerted by a steel sphere with a diameter of 50,8 mm and mass of 0,535 kg dropped from a height of 1,3 m or hanging on a string acting as a pendulum, falling from a height of 1,3 m.

22 Construction

This clause of Part 1 is applicable except as follows.

22.6 *Addition:*

Appliances shall be so constructed that neither water nor foam from detergents can penetrate into the motor or come in contact with **live parts**.

22.32 *Addition:*

Machines applying vacuum for picking up of dirt shall be so constructed that windings, internal wiring and electrical connections are not subjected to deposition of dust or dirt entering with the air that is drawn in.

Compliance is checked by inspection.

22.35 Modification:

Delete the note.

Addition:

These parts are subject to the hammer test of Clause 21. If this insulation does not meet the requirement of 29.3, these are subject to the following impact test.

A sample of the covered part is conditioned at a temperature of $70\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$, for seven days (168 h). After conditioning, the sample is allowed to attain approximately room temperature.

Inspection shall show that the covering has not shrunk to such an extent that the required insulation is no longer given or that the covering has not peeled off, so that it may move longitudinally.

After this, the sample is maintained for 4 h at a temperature of $-10\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$. While still at this temperature, the sample is then subjected to impact by means of the apparatus shown in Figure 101. The weight "A", having a mass of 0,3 kg, falls from a height of 350 mm on to the chisel "B" of hardened steel, the edge of which is placed on the sample.

One impact is applied to each place where the insulation is likely to be weak or damaged in normal operation, the distance between the points of impact being at least 10 mm.

After this test, it shall show that the insulation has not peeled off and an electric strength test as specified in 16.3 is made between metal parts and metal foil wrapped round the insulation in the required area.

22.101 Floor cleaning machines shall be constructed so as to prevent the penetration of objects from the floor, that may impair their safety.

Live parts shall be at least 30 mm distance from the surface of the floor, measured in vertical direction through existing holes.

Compliance is checked by inspection and measurements.

22.102 For battery supplied cleaning machines, secondary circuits shall not rely upon the chassis for electrical continuity. Non-SELV voltages shall be fully isolated from **accessible conductive parts**.

Bare conductors and terminations shall be installed so that short-circuiting is considered unlikely to occur.

Circuits for lighting or signalling may be installed with single-pole wiring and using the body if such circuits are firmly isolated from circuits of operational functions.

Compliance is checked by inspection.

22.103 The batteries of battery-supplied machines shall be located in a compartment separated from components liable to produce sparks. If this is not the case, adequate ventilation shall ensure that no explosive atmosphere can build up in the area of spark producing components.

Plug connection devices are considered to produce sparks only if they are employed for emergency switching.

During charging of batteries incorporated in battery-supplied machines

- all power-consuming circuits shall be positively interrupted, or
- the battery shall have **all-pole disconnection** from all power consuming circuits either by a changeover switch or by disconnecting the plug.

NOTE Machines exclusively using batteries that present no explosion risk, such as gel batteries, can use single pole switching.

Compliance is checked by inspection and by manual test.

22.104 Machines with batteries shall be designed in such a way that electrolyte leakage from the battery does not impair compliance with this standard; in particular there shall be no possibility of the electrolyte coming on insulation, which could result in a reduction of **clearances** and **creepage distances** below the values specified in Clause 29.

Compliance is checked by inspection.

22.105 **Class I** and **class II** appliances shall employ a mains isolating switch disconnecting all poles. Switches for machines that are supplied by **safety-extra-low voltage** or by batteries may be single pole.

Compliance is checked by inspection.

23 Internal wiring

This clause of Part 1 is applicable, except as follows.

23.5 Addition:

NOTE 101 This requirement can apply to the supplementary insulation of internal wiring.

24 Components

This clause of Part 1 is applicable, except as follows.

24.1.3 Addition:

*Switches for frequent operation, mains isolating switches and switches for machines that are supplied by **safety-extra-low voltage** or by batteries shall be tested for 50 000 cycles of operations.*

24.101 Components for machines with a traction drive shall be of adequate construction so that they are able to withstand any impact or vibrations occurring during operation, without impairing their performance. Switches or other controls shall not change their switching position under the effects of impacts or vibrations.

Compliance is checked by inspection.

24.102 The contacts of switches, contactors in circuits of the braking-system, etc., that are supplied at a **rated voltage** of up to 48 V, and contacts in circuits for self-excited electric braking shall have highly reliable conductivity (for example, self-cleaning contacts).

Compliance is checked by inspection.

25 Supply connection and external flexible cords

This clause of Part 1 is applicable except as follows.

25.1 Addition:

Appliances classified as IPX7 shall not be provided with an appliance inlet.

Appliances classified as IPX4, IPX5 or IPX6 shall not be provided with an appliance inlet, unless both inlet and connector have the same classification as the appliance when coupled or separated, or unless inlet and connector can only be separated by the use of a tool and have the same classification as the appliance when coupled.

Appliances provided with appliance inlets shall also be provided with an appropriate cord set.

25.7 Addition:

Supply cords shall be not lighter than:

- if rubber insulated, ordinary tough rubber sheathed flexible cord (code designation 60245 IEC 53);
- if polyvinyl chloride insulated, ordinary polyvinyl chloride sheathed flexible cord (code designation 60227 IEC 53).

25.14 Addition:

For appliances incorporating a **type X attachment** or **type Y attachment** the number of flexings is 20 000.

25.15 Modification:

Replace Table 12 by the following:

Table 12 – Pull force and torque

Mass of appliance kg	Pull force N	Torque Nm
≤ 1	30	0,1
>1 and ≤ 4	60	0,25
> 4	125	0,40

Addition:

The test is also applied to the cord in the cord set for appliances classified as IPX4 or higher that are provided with an appliance inlet. The cord set is fitted to the appliance inlet prior to the commencement of the test.

26 Terminals for external conductors

This clause of Part 1 is applicable.

27 Provisions 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:

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 Addition:

For these appliances, 30.2.2 is applicable except for built-in battery-chargers, for which 30.2.3 is applicable.

31 Resistance to rusting

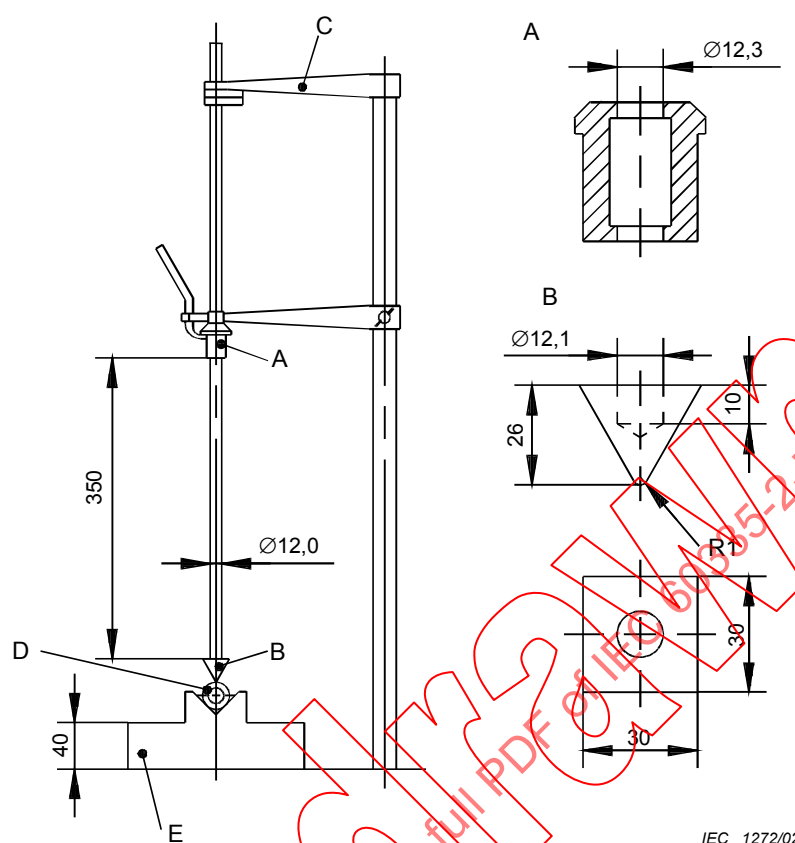
This clause of Part 1 is applicable.

32 Radiation, toxicity and similar hazards

This clause of Part 1 is applicable, except as follows.

Addition:

NOTE 101 For attachments intended to pick up hazardous dust, additional requirements are specified in Annex AA of IEC 60335-2-69.



IEC 1272/02

*Dimensions in millimeters***Key**

- A = Weight
- B = Chisel
- C = Fixing arm
- D = Sample
- E = Base having mass of 10 kg

Figure 101 – Impact test apparatus

Annexes

The annexes of Part 1 are applicable.

Annex AA (normative)

Precast concrete flags

The cement in the manufacturing of these paving flags shall be of, or similar to, one of the following:

- Portland cement (ordinary or rapid hardening);
- Portland blast furnace cement.

The fine and coarse aggregate shall consist of either naturally occurring materials, crushed or uncrushed, or alternatively of coarse aggregate to meet the following requirements:

- 10% fines test: not less than 10 t;
- flakiness index: not more than 35%.

The normal maximum size of the aggregate shall not exceed 14 mm.

The total sulphate content of the concrete mix shall not exceed 4,0 % as SO_3 by weight of the cement. The sulphate of the cement shall be calculated from the known sulphate contents of the cement, aggregates (where applicable) and pulverised fuel ash, as determined by tests.

The flags may be made by any process. The escape of the finer particles of mortar during the process of manufacture shall be prevented as far as practicable. A flag described as "pressed" shall only be made by employing a pressure of not less than 7 MN/m² over the entire surface.

After casting the flags shall be stored so as to prevent undue loss of moisture, particularly during the early stages of curing.

Flags shall be manufactured to the following size : 65 mm × 600 mm × 750 mm.

The maximum deviation from a 750 mm straight edge placed in any position on the wearing surface shall not exceed 2 mm. There shall be no special preparation for smoothing of the test surface. The flag should be made under normal production conditions for commercial use.