INTERNATIONAL STANDARD

IEC 60335-2-72

2002

AMENDMENT 1
2005-11

Amendment 1

Household and similar electrical appliances – Safety –

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

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FOREWORD

This amendment has been prepared by subcommittee 61J: Electrical motor-operated cleaning appliances for industrial use, of IEC technical committee 61: Safety of household and similar electrical appliances.

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

FDIS	Report on voting
61J/203/FDIS	61J/211/RVD

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

The committee has decided that the contents of this amendment and the base publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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- withdrawn,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

CONTENTS

Add the titles of the new Annexes BB and CC as follows:

Annex BB Measurement of acoustical noise.

Annex CC Falling-object protective structures (FOPS) – Dynamic test and performance requirements.

Add, in the list of figures, the titles of the new Figures 102 to 105 as follows:

Figure 102 – Apparatus for testing the abrasion resistance of current-carrying hoses

Figure 103 – Apparatus for testing the resistance to flexing of current-carrying hoses

Figure 104 – Configuration of the hose for the freezing treatment

Figure 105 – Flexing positions for the hose after removal from the freezing cabinet

FOREWORD

Add, at the end of the Foreword, the following new text:

The following differences exist in the countries indicated below:

– 7.12 No requirements for sound and vibration markings exist (USA).

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INTRODUCTION

Replace the second sentence of the second paragraph by the following:

It also covers abnormal situations that can be expected in practice and takes into account the way in which electromagnetic phenomena can affect the safe operation of appliances.

1 Scope

Delete Note 101and renumber the subsequent notes accordingly.

2 Normative references

Add the following new references:

ISO 2631-1, *Mechanical vibration and shock – Evaluation of human exposure to whole-body vibration – Part 1: General requirements*

ISO 3471, *Earth-moving machinery – Roll-over protective structures – Laboratory tests and performance requirements*

ISO 3743-1, *Acoustics – Determination of sound power levels of noise sources – Engineering methods for small, movable sources in reverberant fields – Part 1: Comparison method for hard-walled test rooms*

ISO 3744, *Acoustics – Determination of sound power levels of noise sources using sound pressure – Engineering method in an essentially free field over a reflecting plane*

ISO 4743-1, *Acoustics – Determination of sound power levels of noise sources – Engineering methods for small, movable sources in reverberant fields – Part 1: Comparison method for hard-walled test rooms*

ISO 4871, *Acoustics – Declaration and verification of noise emission values of machinery and equipment*

ISO 5349-1, *Mechanical vibration – Measurement and evaluation of human exposure to hand-transmitted vibration – Part 1: General requirements*

ISO 5353, *Earth-moving machinery, and tractors and machinery for agriculture and forestry – Seat index point*

ISO 6344-2, *Coated abrasives – Grain size analysis – Part 2: Determination of grain size distribution of macrogrits P12 to P220*

ISO 11201, *Acoustics – Noise emitted by machinery and equipment – Measurement of emission sound pressure levels at a work station and at other specified positions – Engineering method in an essentially free field over a reflecting plane*

ISO/TR 11688-1, *Acoustics – Recommended practice for the design of low-noise machinery and equipment – Part 1: Planning*

ISO 12100-2, *Safety of machinery – Basic concepts, general principles for design – Part 2: Technical principles*

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3 Definitions

3.1.9 *Add, after the first paragraph, the following new paragraph:*

Power outlets for accessories are loaded with a resistive load in accordance with the marking.

Add the following new definitions:

3.107
water-suction cleaning appliance
appliance for aspirating an aqueous solution that may contain foaming detergent

3.108
motorized cleaning head
accessory containing a motor that is supplied from the appliance and which is attached to the end of a hand-held hose or tube

NOTE The main cleaning head permanently attached is not regarded as a motorized cleaning head.

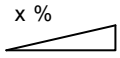
7 Marking and instructions

7.1 *Replace the last dashed item by the following:*

– the symbol indicating the maximum gradient of operation, with the value of *x* being a minimum of 2.

Add:

7.6 *Addition*:



maximum gradient of operation



[symbol IEC 60417-5935 (DB:2002-10)] **motorized cleaning head** for water-suction cleaning

7.12 *Replace the existing text by the following:*

Addition:

The front cover of the instruction manual shall include the substance of the following:

CAUTION Read the instruction manual before using the appliance.

This wording may be replaced by symbols 0434 and 1641 of ISO 7000. If these symbols are used, their meaning is to be explained in the instructions for use.

The instruction manual shall include the substance of the following warnings, as applicable.

– CAUTION This appliance is not suitable for picking up hazardous dust.
– CAUTION This appliance is for dry use only and is not to be used or stored outdoors in wet conditions.
– CAUTION Do not use on surfaces having a gradient exceeding that marked on the appliance.

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– WARNING Only use the brushes provided with the appliance or those specified in the instruction manual. The use of other brushes may impair safety.

The instruction manual shall give details regarding the following, as applicable:

– a statement that the appliance is only to be used by persons who have been adequately instructed;
– the precautions to be taken when using the appliance under specific conditions such as handling flammable liquids or dust, and dust hazardous to health;
– a statement that the appliance is to be disconnected from its power source during cleaning or maintenance and when replacing parts or converting the appliance to another function:
  - for mains operated appliances, the plug is to be removed from the socket-outlet;
  - for battery operated appliances, the key of the supply switch is to be removed or an equivalent disconnection is to be made;
– a statement that doors and covers are to be positioned as indicated in the instruction manual before using the appliance;
– the precautions to be taken when changing brushes or other attachments which require the appliance to be energized;
– the intended use of brushes which are specified for the appliance;
– a warning that large diameter brushes provided specifically for dry buffing are not intended for general polishing.

The instruction manual shall state

– the weighted r.m.s. acceleration value to which the operators' arms are subjected in m/s^2, separately for each arm (if applicable), measured in accordance with ISO 5349-1 for arm vibrations, the appliance being supplied at **rated voltage** or at the maximum **rated voltage** for machines with a range of voltages
– the weighted r.m.s. acceleration value to which the operator is subjected in m/s^2, measured in accordance with ISO 2631-1, the appliance being supplied at **rated voltage** and operated under **normal operation**.

The instruction manual for mains operated appliances shall include the substance of the following:

– do not allow the rotating brushes to come into contact with the supply cord;
– regularly examine the supply cord for damage, such as cracking or ageing. If damage is found, replace the cord before further use;
– only replace the supply cord with the type specified in the instruction manual;
– only use the socket outlet on the appliance for purposes specified in the instruction manual.

The instruction manual for appliances having a traction drive and a mass exceeding 100 kg shall include the substance of the following:

– in order to prevent unauthorised use of the appliance, the power source is to be switched off or locked, for example by removing the key of the power switch;
– appliances left unattended are to be secured against unintentional movement.

The instruction manual for appliances having anchorage points for installing roll-over protection systems (ROPS) or falling object protection systems (FOPS) shall include instructions for fitting the system. The intended purpose of any protection system shall be stated.

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The instructions for appliances having a current-carrying hose operating at other than **safety extra-low voltage** shall include the substance of the following:

CAUTION: This hose contains electrical connections:
– do not use to collect water;
– do not immerse in water for cleaning;
– the hose should be checked regularly and must not be used if damaged.

If the symbol IEC 60417-5935 is used, its meaning shall be explained.

Add the following new subclauses:

7.12.101 The instructions shall include a noise emission declaration according to BB 2.7.

7.14 *Addition:*

The height of symbol IEC 60417-5935 shall be at least 15 mm.

Compliance is checked by measurement.

7.101 Motorized cleaning heads shall be marked with

– **rated voltage** or **rated voltage range** in volts;
– **rated power input** in watts;
– name, trade mark or identification mark of the manufacturer or responsible vendor;
– model or type reference.

Motorized cleaning heads for **water-suction cleaning appliances**, except those of **class III construction** having a **working voltage** up to 24 V shall be marked with symbol IEC 60417-5935.

NOTE This symbol is an information sign and, except for the colours, the rules of ISO 3864-1 apply.

Compliance is checked by inspection.

7.102 Power outlets for accessories shall be marked with the maximum load in watts.

NOTE This marking may be on the appliance close to the appliance outlet.

Compliance is checked by inspection.

10 Power input and current

Replace the existing text by the following:

This clause of Part 1 is applicable except as follows.

10.1 *Addition:*

The power input of **motorized cleaning heads** is measured separately.

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15 Moisture resistance

15.2 *Replace the last sentence by the following:*

Motorized cleaning heads *of* ***water-suction cleaning appliances*** *are placed in a container, the base of which is level with the surface supporting the appliance. The container is filled with a detergent solution to a level of 5 mm above its base, this level being maintained throughout the test. The solution consists of 20 g of NaCl and 1 ml of a solution of 28 % by mass of dodecyl sodium sulphate in each 8 l of water.*

The appliance is operated until its liquid container is completely full and for a further 5 min.

NOTE 102 The solution is to be stored in a cool atmosphere and used within seven days of its preparation.

NOTE 103 The chemical designation of dodecyl sodium sulphate is $C_{12}H_{25}NaSO_4$.

After each of these tests, the appliance shall withstand the electric strength test of 16.3.

Inspection shall show that there is no trace of liquid on insulation that could result in a reduction of ***clearances*** *or* ***creepage distances*** *below the values specified in Clause 29.*

NOTE 104 The appliance is allowed to stand in normal test room atmosphere for 24h before being subjected to the test of 15.3

Add the following new subclause:

15.101 Motorized cleaning heads of **water suction cleaning appliances** shall be resistant to liquids that may come into contact with them.

Compliance is checked by the following tests.

The ***motorized cleaning head*** *is subjected to an impact test as described in IEC 60068-2-75, the value of the impact being 2 J. The* ***motorized cleaning head*** *is rigidly supported and three blows are applied to every point of the enclosure that is likely to be weak.*

It is then subjected to the free fall test procedure 1 of IEC 60068-2-32. It is dropped 4 000 times from a height of 100 mm onto a steel plate having a thickness of not less than 15 mm. It is dropped

– *1 000 times on its right side;*
– *1 000 times on its left side;*
– *1 000 times on its front face;*
– *1 000 times on its cleaning surface.*

The ***motorized cleaning head*** *is then subjected to the test described in 14.2.7 of IEC 60529, the water containing approximately 1 % NaCl.*

The ***motorized cleaning head*** *shall then withstand the electric strength test of 16.3, the voltage being applied between the* ***live parts*** *and the solution, and inspection shall show that there is no trace of saline solution on insulation which could result in a reduction of* ***clearances*** *and* ***creepage distances*** *below the values specified in Clause 29.*

NOTE The test is not carried out on **motorized cleaning heads** of **class III construction** having a **working voltage** up to 24 V.

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16 Leakage current and electric strength

Replace the existing text by the following:

This clause of Part 1 is applicable except as follows.

16.3 *Addition:*

Current-carrying hoses, except for their electrical connections, are immersed for 1 h in water containing approximately 1 % NaCl, at a temperature of 20 °C ± 5 °C. While the hose is still immersed, a voltage of 2 000 V is applied for 5 min between each conductor and all the other conductors connected together. A voltage of 3 000 V is then applied for 1 min between all the conductors and the saline solution.

19 Abnormal operation

19.7 *Add the following new paragraph:*

Motorized cleaning heads *are tested with the rotating brush or similar device locked for 30 s.*

20 Stability and mechanical hazards

20.1 *Add the following note:*

NOTE 101 **Motorized cleaning heads** are not subjected to this test.

20.102.4 *Add the following new paragraph:*

Pedals shall be arranged so that they can be operated without risk of confusion. Their surface shall be slip-resistant and easy to clean.

20.108 *Add to the existing text the following new paragraphs:*

Ride-on machines shall have an acoustic warning device controlled by the driver. If they are fitted with hazardous exposed moving brushes, they shall also have a yellow pulsating or rotating light. it shall not be possible to inadvertently disconnect these warning devices.

Compliance is checked by inspection and by manual test.

21 Mechanical strength

Add the following new subclauses:

21.102 Current-carrying hoses shall be resistant to crushing.

Compliance is checked by the following test.

The hose is placed between two parallel steel plates each having a length of 100 mm, a width of 50 mm and the edges of the longer sides rounded with a radius of 1 mm. The axis of the hose is positioned at right angles to the longer sides of the plates. The plates are placed at a distance of approximately 350 mm from one end of the hose.

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The steel plates are pressed together at a rate of 50 mm/min ± 5 mm/min until the applied force is 1,5 kN. The force is then released and the electric strength test of 16.3 is carried out between the conductors connected together and the saline solution.

21.103 Current-carrying hoses shall be resistant to abrasion.

Compliance is checked by the following test.

One end of the hose is attached to the connecting rod of the crank mechanism shown in Figure 102. The crank rotates at 30 revolutions per minute resulting in the end of the hose moving horizontally backwards and forwards over a distance of 300 mm.

The hose is supported by a rotating smooth roller over which a belt of abrasive cloth moves at a speed of 0,1 m/min. The abrasive is corundum grit size P 100, as specified in ISO 6344-2.

A mass of 1 kg is suspended from the other end of the hose, which is guided to avoid rotation.

In the lowest position, the mass has a maximum distance of 600 mm from the centre of the roller.

The test is carried out for 100 revolutions of the crank.

After the test, ***basic insulation*** *shall not be exposed and the electric strength test of 16.3 is carried out between the conductors connected together and the saline solution.*

21.104 Current-carrying hoses shall be resistant to flexing.

Compliance is checked by the following test.

The end of the hose intended to be connected to the ***motorized cleaning head*** *is attached to the pivoting arm of the test equipment shown in Figure 103. The distance between the pivot axis of the arm and the point where the hose enters the rigid part is 300 mm ± 5 mm. The arm can be raised from the horizontal position by an angle of 40° ± 1°. A mass of 5 kg is suspended from the other end of the hose or from a convenient point along the hose so that when the arm is in the horizontal position the mass is supported and there is no tension on the hose.*

NOTE 1 It may be necessary to reposition the mass during the test.

The mass slides against an inclined plate so that the maximum deflection of the hose is 3°.

The arm is raised and lowered by means of a crank that rotates at a speed of (10 ± 1) r/min..

The test is carried out for 2 500 revolutions of the crank after which the fixed end of the hose is turned through 90° and the test continued for a further 2 500 revolutions. The test is repeated in each of the other two 90° positions.

NOTE 2 If the hose ruptures before 10 000 revolutions of the crank, the flexing is terminated.

After the test, the hose shall withstand the electric strength test of 16.3.

21.105 Current-carrying hoses shall be resistant to torsion.

Compliance is checked by the following test.

One end of the hose is held in a horizontal position with the remainder of the hose freely suspended. The free end is rotated in cycles, each cycle consisting of five turns in one direction and five turns in the opposite direction, at a rate of 10 turns per minute.

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The test is carried out for 2 000 cycles.

After the test, the hose shall withstand the electric strength test of 16.3 and shall not be damaged to such an extent that compliance with this standard is impaired.

21.106 Current-carrying hoses shall be resistant to cold conditions.

Compliance is checked by the following test.

A 600 mm length of hose is bent as shown in Figure 104 and the ends are tied together over a length of 25 mm. The hose is then placed for 2 h in a cabinet having a temperature of –15 °C ± 2 °C. Immediately after the hose is removed from the cabinet it is flexed three times, as shown in Figure 104, at a rate of one flexing per second.

The test is carried out three times.

There shall be no cracks or breaks in the hose and it shall withstand the electric strength test of 16.3.

NOTE Any discoloration is neglected.

22 Construction

Add:

22.106 Machines shall be constructed so that parts related to the driving operation, such as the seat, steering wheel and controls, are in accordance with the relevant ergonomic principles.

NOTE Examples are given in ISO 3411.

Compliance is checked by inspection.

22.107 Machines shall be constructed so that drivers cabins are adequately ventilated in order to avoid the accumulation of exhaust gases or lack of oxygen. It shall be possible to evacuate the cabin rapidly. An emergency exit shall also be provided.

Compliance is checked by inspection.

22.108 If the machine is provided with a roll-over protection system (ROPS) or a falling objects protection system (FOPS), the system shall have an adequate deformation limit volume (DLV).

Compliance is checked in accordance with ISO 3471 or Annex CC, as appropriate.

25 Supply connection and external flexible cords

Add the following subclause:

25.23 *Addition*

NOTE 101 There is no limitation on the length of conductors in flexible hoses.

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30 Resistance to heat, fire and tracking

30.2 *Delete this subclause.*

Add the following subclause:

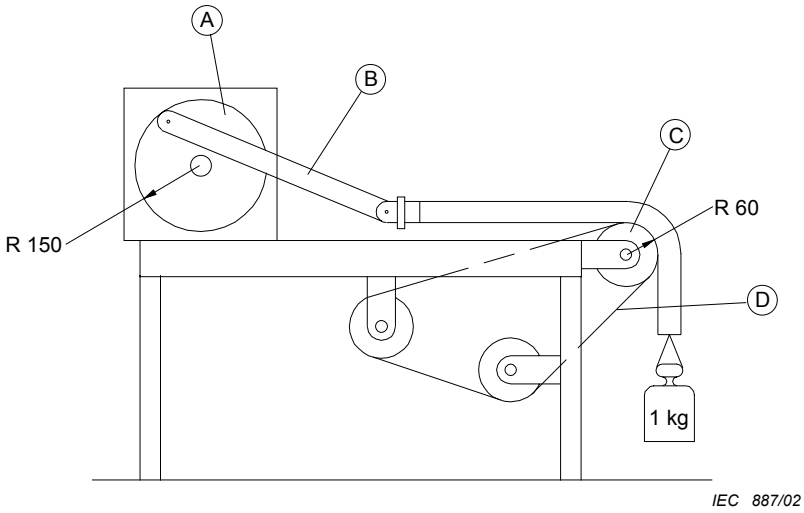
30.1 *Addition:*

NOTE 101 The cabin and its fittings are considered to be external parts.

Figures

Add the following figures:

Dimensions in millimetres



Key

A Crank mechanism

B Connecting rod

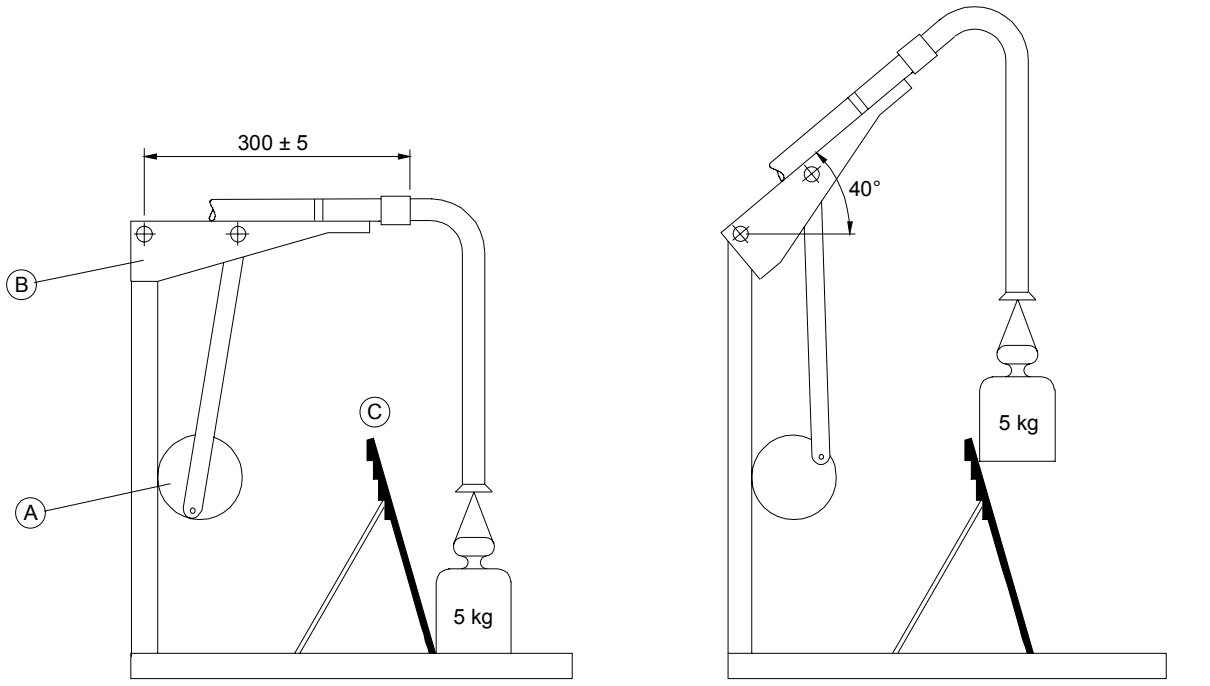
C Roller, diameter 120 mm

D Abrasive cloth belt

Figure 102 – Apparatus for testing the abrasion resistance of current-carrying hoses

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Dimensions in millimetres



IEC 2827/02

Key

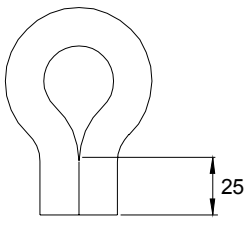
A Crank mechanism

B Arm

C Inclined plane

Figure 103 – Apparatus for testing the resistance to flexing of current-carrying hoses

Dimensions in millimetres



IEC 665/99

Figure 104 – Configuration of the hose for the freezing treatment

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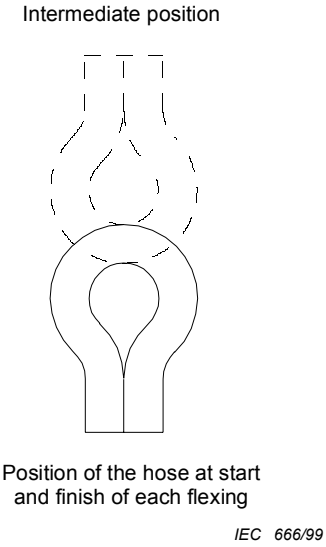


Figure 105 – Flexing positions for the hose after removal from the freezing cabinet

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Annexes

Add the following new annexes:

Annex BB
(normative)

Measurement of acoustical noise

BB.1 Noise reduction

Noise reduction at floor-treatment machines is an integral part of the design process and shall be achieved by particularly applying measures at source to control noise, see for example ISO/TR 11688-1. The success of the applied noise reduction measures is assessed on the basis of the actual noise emission values in relation to other machines of the same type with comparable non-acoustical technical data.

The major sound sources of floor-treatment machines are: motors, fan, brushes.

BB.2 Noise test code

BB.2.1 Emission sound pressure level determination

The emission sound pressure level is measured in accordance with ISO 11201.

The microphone is placed for

– **walk-behind machines** at a distance of 0,40 m ± 0,025 m behind the handle at a height of 1,55m ± 0,075m,

– **ride-on machines with an operator platform** at a distance of 0,40 m ± 0,025 m behind the handle at a height of 1,55 m ± 0,075 m above the operator platform;

– **ride-on machines with an operator seat** 0,80 m ± 0,05 m above the middle of the seat plane,

– machines with **sulkies** 0,80 m ± 0,05 m above the middle of the seat plane,

and directed towards to the geometrical center of the machine.

The operating condition shall be identical for the determination for both sound power and emission sound pressure level at the specified positions.

BB.2.2 Sound power level determination

The sound power level is measured in accordance with ISO 3744, or with ISO 3743-1 if a suitable hard-walled test room is available.

The operating condition shall be identical for the determination for both sound power and emission sound pressure level at the specified positions.

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BB.2.3 Operating conditions

The automatic floor-treatment machines shall be tested in a stationary position. The engine and auxiliary units operate at the speed provided by the manufacturer for the operation of the working equipment. The cleaning head operates at its highest speed; it is not in contact with the ground. The suction system (if applicable) operates at its maximum suction power with the distance between ground and mouth of the suction system not exceeding 25 mm. The machine shall be be placed on a surface in accordance with 3.1.9.101 – 3.1.9.104, as applicable. The measurement time shall be at least 15 s.

BB.2.4 Measurement uncertainties

A standard deviation of reproducibility of less than 1,5 dB is expected for the A-weighted sound power level determined according to ISO 3744 and the A-weighted emission sound pressure level determined according to ISO 11201.

BB.2.5 Information to be recorded

The information to be recorded covers all of the technical requirements of this noise test code. Any deviations from this noise test code or from the basic standards upon which it is based are to be recorded together with the technical justification for such deviations.

BB.2.6 Information to be reported

The information to be included in the test report is at least that which the manufacturer requires for a noise declaration or the user requires to verify the declared values.

BB.2.7 Declaration and verification of noise emission values

The declaration of the emission sound pressure level as required according to ISO 12100-2 shall be made as a dual-number noise emission declaration according to ISO 4871.

It shall declare the noise emission value L_{pA} and separately the respective uncertainty K_{pA}.

The sound power level shall be given as a single value declaration according to ISO 4871 declaring the sum of L_{WA} and the respective uncertainty K_{WA}.

K_{pA} and K_{WA} are expected to be 3 dB.

The noise declaration shall state that the noise emission values have been obtained according to this noise test code. If this statement is not true, the noise declaration shall indicate clearly what the deviations from this standard, and from the basic standards, are.

Additional noise emission quantities may also be given in the declaration.

If undertaken, the verification shall be undertaken according to ISO 4871. The verification shall be conducted by using the same mounting and operating conditions as those used for the initial determination of the noise emission values.

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Annex CC
(normative)

Falling-object protective structures (FOPS) – Dynamic test and performance requirements

The following requirements represent modifications to subclauses of this standard applying to dynamic test and performance requirements for falling-object protective structures (FOPS).

CC.21 Mechanical strength

CC.21.105 A dynamic type test shall be carried out on a guard fitted to a cleaning machine for which it has been designed. Alternatively, the guard may be mounted on a test chassis provided that the mounting is the same as that on the cleaning machine for which it is designed.

The test is made to determine the resistance to permanent deflection of the portion of the overhead guard under which the operator sits.

The overhead guard and its mountings shall be capable of withstanding the impact of the test object under the mentioned conditions.

Compliance is checked by the following tests.

The test object shall be a mass of 20 kg having a square striking face with a side dimension of 300 mm. The striking face shall be of oak wood or similar density, at last 50 mm thick, The corners and edges shall be radiused to 10 mm to 15 mm.

The test object shall be positioned to drop in free fall with the striking face approxiamtely parallel to the top of the overhead guard, so as not to strike with a corner or edge. Drop the test object 5 times from a height of 1,5 m.

One of the drops shall be from a point with the centre of the test object vertically above the seat index point of the operator's seat in accordance with ISO 5353 and, if applicable, with the seat at its midpoint of adjustment. The other 4 drops shall be made from points with the centre of the test object randomly spaced on a 600 mm diameter circle, the centre of which is vertically above the seat index point of the operator's seat.

NOTE It is recognized that in some positionss a portion of the test object may overlap the edge of the overhead guard when striking.

After the test the guard shall show no fracture, separation of parts or permanent vertical deformation exceeding 20 mm, measured on the underside of the guard within a 600 mm diameter circle whose centre is vertically above the centre point of the operator's seat in, if applicable, its midpoint of adjustment. Failure during the dynamic test of material fitted across the openings permitted in CC.22.107.3 (such as wire mesh cloth, toughened glass, transparent panel, etc.) shall be ignored. See also Figures CC.2 and CC.3.

CC.22 Construction

CC.22.107.1 The overhead guard shall extend the operator when he/she is in the operating place, operating the controls as provided by the cleaning machine manufacturer.

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The control levers (in their neutral position), any unprotected pedals, feet and the steering wheel may project in the front direction up to a maximum distance of 150 mm beyond the vertical projection of the outline of the overhead guard onto a horizontal plane (see Figure CC.1). No account is taken of the parking brake in its "off" position.

Protection of the operator's legs and feet is regarded as satisfactory if the distance, vertically projected onto a horizontal plane, between the front of the overhead guard and the rear of the forward structure of the chassis providing the protection, does not exceed 150 mm (see Figure CC.1).

Compliance is checked by inspection and measurements.

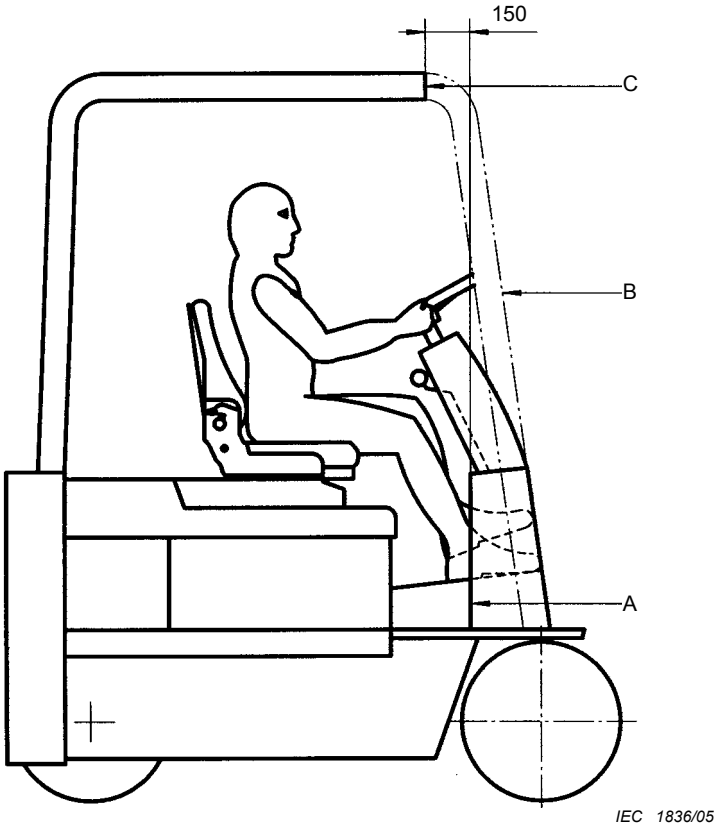
CC.22.107.2 The guard shall be constructed in a manner that does not interfere with good visibility.

Compliance is checked by inspection.

CC.22.107.3 Openings in the top of the overhead guard shall not exceed 150 mm in one of the two dimensions; i.e. width or length.

Compliance is checked by inspection and measurements.

Dimensions in milimeters



Key

A = Rear of forward structure

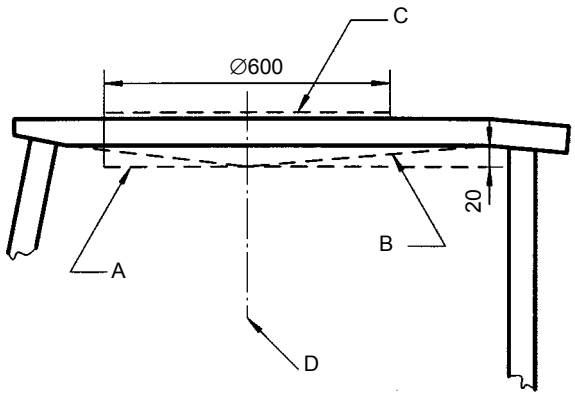
B = Phantom view of rear support

C = Edge of overhead guard

Figure CC.1 – Satisfactory protection by the overhead guard

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Dimensions in milimeters



IEC 1837/05

key

A = Deformation limiting line

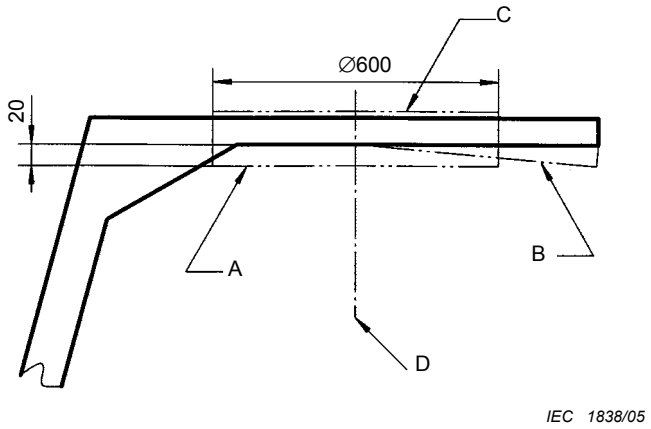
B = Deformed underside

C = Measuring area of deformation

D = Centre of the operator's standing position or seat index point with the seat, if applicable, at its midpoint of adjustment.

Figure CC.2 – Admissible deformation when the overhead guard is supported at all sides

Dimensions in milimeters



IEC 1838/05

Key

A = Deformation limiting line

B = Deformed underside

C = Measuring area of deformation

D = Centre of the operator's standing position or seat index point with the seat, if applicable, at its midpoint of adjustment.

Figure CC.3 – Admissible deformation when the overhead guard is supported at one side

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Bibliography

Add the following references:

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

ISO 3864-1, *Graphical symbols – Safety colours and safety signs – Part 1: Design principles for safety signs in workplaces and public areas*

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