INTERNATIONAL STANDARD

IEC 60335-2-92

Second edition
2002-07

Household and similar electrical appliances – Safety –

Part 2-92: Particular requirements for pedestrian-controlled mains-operated lawn scarifiers and aerators

Appareils électrodomestiques et analogues – Sécurité –

Partie 2-92: Règles particulières pour les scarificateurs de gazon et les aérateurs fonctionnant sur le réseau et pour conducteur à pied

Reference number
IEC 60335-2-92:2002(E)

Publication numbering

As from 1 January 1997 all IEC publications are issued with a designation in the 60000 series. For example, IEC 34-1 is now referred to as IEC 60034-1.

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Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE S

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

Part 2-92: Particular requirements for pedestrian-controlled mains-operated lawn scarifiers and aerators

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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6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

This part of International Standard IEC 60335 has been prepared by IEC subcommittee 61F: Safety of hand-held motor-operated electric tools, of IEC technical committee 61: Safety of household and similar electrical appliances.

This second edition cancels and replaces the first edition published in 2000. It constitutes a technical revision.

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

FDIS	Report on voting
61F/453/FDIS	61F/474/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 pedestrian-controlled mains-operated electric lawn scarifiers and aerators.

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 proper: 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.

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

INTRODUCTION

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

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

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

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

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

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

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

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

Part 2-92: Particular requirements for pedestrian-controlled mains-operated lawn scarifiers and aerators

1 Scope

This clause of Part 1 is replaced by the following.

This International Standard deals with the safety of **pedestrian-controlled** mains-operated electrical lawn scarifiers and aerators with rotating cutters for regenerating lawns by, for instance, combing out grass thatch and moss, or by cutting vertically into the lawn face. These scarifiers are designed primarily for use at and around the home or for similar purposes, their **rated voltage** being not more than 250 V single phase.

This standard does not, in general, take into account:

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

– playing with the appliance by young children.

NOTE 101 Attention is drawn to the fact that

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

NOTE 102 This standard does not apply to

– **lawnmowers** (IEC 60335-2-77);

– **lawn trimmers and lawn edge trimmers** (IEC 60335-2-91);

– **lawn edgers, flail mowers, sickle-bar mowers** or **agricultural mowers**.

2 Normative references

This clause of Part 1 is applicable except as follows.

Addition:

ISO 2758:2001, *Paper – Determination of bursting strength*

ISO 3411:1995, *Earth-moving machinery – Human physical dimensions of operators and minimum operator space envelope*

ISO 3767-1:1998, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment – Symbols for operator controls and other displays – Part 1: Common symbols*

ISO 3767-3:1995, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment – Symbols for operator controls and other displays – Part 3: Symbols for powered lawn and garden equipment*

ISO 3864, *Safety colours and safety signs*

ISO 13852:1996, *Safety of machinery – Safety distances to prevent danger zones being reached by the upper limbs*

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: the appliance is operated at **rated voltage** with the load necessary to attain **rated power input**

3.101
braking system
a combination of one or more brakes and related means of operation and control

3.102
catcher
a part or combination of parts which provides a means for collecting grass, thatch, moss or other debris

3.103
control
means or device which will control the operation of the appliance or any specific operating function thereof

3.104
cutting means
for the purposes of this standard, the mechanism used to provide the cutting action of a scarifier or aerator

3.105
cutting means enclosure (housing)
the part of the assembly which provides the protective means around the **cutting means**

3.106
cutting means tip circle
the path described by the outermost point of the **cutting means** as it rotates about its shaft axis.

3.107
cutting position
any setting of the **cutting means** designated by the manufacturer

3.108
cutting width
the width of cut measured across the **cutting means** at right angles to the direction of travel and calculated from the dimensions of the **cutting means** or the diameter(s) of the **cutting means tip circle(s)**

3.109
discharge chute
an extension of the **cutting means enclosure** from the **discharge opening**, generally used to control the discharge of material from the cutting means

3.110
discharge opening
a gap or opening in the **cutting means enclosure** through which grass, thatch and moss may be discharged

3.111
guard
a part of the appliance or component incorporated to provide protection for the operator and/or bystander

3.112
handle
any part likely to be hand-held for guiding the appliance in normal use

3.113
hit
the test projectile passing completely through all layers of the target material

3.114
intended use
any use of the appliance which is reasonably foreseeable, as described in the user instructions, and which is consistent with such activities as operating, starting, stopping or connecting to (or disconnecting from) a **power source**

3.115
lawn aerator
a powered appliance designed for slitting the lawn surface. The appliance uses the ground to determine the height of cut

3.116
lawn scarifier
lawn rake
an appliance where the cutting means cuts vertically into the lawn or earthface, or scratches the surface, thereby also combing the lawn. The appliance uses the ground to determine the height of cut

3.117
maximum operating motor speed
the highest motor speed obtainable when the motor is adjusted in accordance with the manufacturer's specifications and/or instructions, with the cutting means engaged

3.118
operator control
any **control** requiring the operator’s actuation to perform specific functions

3.119
operator presence control
a **control** designed so that it will automatically interrupt power to a drive when the operator's actuating force is removed

3.120
operator zone
the operator zone for persons operating a **lawn scarifier** or **lawn aerator**

3.121
parking brake
a device incorporated into the appliance which, when operated, prevents the appliance from moving from a stationary position and remains applied without the operator present

3.122
pedestrian-controlled
ground-supported, controlled by an operator walking behind

3.123
power source
a motor which provides mechanical energy for linear or rotational movement

3.124
rotary appliance
a scarifier/ aerator in which the **cutting means** rotates about an axis or axes normal to the ground

3.125
service brake
the designated primary means for decelerating and stopping a machine from its ground travel speed

3.126
thrown object hazard
the potential for injury caused by object(s) propelled by the moving **cutting means**

3.127
tine(s)
for the purposes of this standard, a term used in warnings and instructions to denote "**cutting means**" (see 3.104)

3.128
traction drive
the means (system) used to transmit power from the **power source** to the ground drive means

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.

5.5 *Addition:*

*During the tests the **cutting means** are adjusted and lubricated in accordance with the manufacturer's instructions specific to the test.*

5.6 *Addition:*

*Electronic speed **control** devices are set for the highest speed.*

6 Classification

This clause of Part 1 is applicable except as follows.

6.1 *Replacement:*

Appliances shall be either **class II** or **class III** with respect to protection against electric shock.

Compliance is checked by inspection and by the relevant tests.

6.2 *Addition:*

Appliances shall be at least IPX4.

7 Marking and instructions

This clause of Part 1 is applicable except as follows.

7.1 *Addition*:

Appliances shall be marked with their **rated power input**.

The substance of the following warning shall be placed in a prominent position on the appliance. The letters, which may be in upper or lower case, shall be a minimum of 3 mm high, in black on a yellow background. Where appropriate IEC/ISO symbols or pictograms are available, they may be used. Markings or symbols giving cautionary information shall be located close to the hazard.

WARNING: Switch off and remove plug from mains before adjusting, cleaning or if the cord is entangled or damaged.

Read the instructions sheet.

Keep the supply flexible cord away from the cutting blades.

Blades continue to rotate after machine is switched off.

For rotary **lawn scarifiers/lawn aerators,** if applicable, an instruction that the appliance shall not be operated without either the entire **catcher** or **guard** in place shall be fixed near the **discharge opening** and the **catcher** adaptor, if one is used.

7.6 *Addition:*

NOTE 101 Information on operator symbols may be found in ISO 3767-1 and ISO 3767-3, and in ISO 3864 for colours.

7.9 *Modification*:

Replace the first paragraph by the following:

Operator controls as described in 20.101.1, other than those whose purpose is obvious, shall have the function, direction and/or method of operation clearly identified by a durable label or mark.

7.12 *Replacement:*

An instruction sheet shall be supplied with the appliance.

The instructions shall include

a) those warnings required to be marked on the appliance together with further explanation, where appropriate;

b) instructions for the proper assembly of the appliance for use, if the appliance is not supplied in a completely assembled form;

c) for rear delivery appliances with exposed rear rollers when used without a **catcher**, full eye protection shall be worn;

d) instructions for proper adjustment of the appliance, including a warning of the danger of rotating parts, for example,

CAUTION – Do not touch rotating parts;

e) instructions for the safe operation of the appliance, including a recommendation that the appliance should be supplied via a residual current device (RCD) with a rated tripping current of not more than 30 mA;

f) instructions on the operation of all **controls**;

g) advice on the use and type of extension cords to be used (not lighter than required in 25.7);

h) Instructions for fitting and use of attachments, if any;

i) the following information:

1) the continuous A-weighted equivalent sound pressure level at the operator's ear if over 70 dB(A), or a statement to the effect that it does not exceed 70 dB(A);

2) the peak C-weighted instantaneous sound pressure level if over 63 Pa (130 dB in relation to 20 μPa);

3) the sound power level emitted by the tool where the equivalent continuous sound pressure level exceeds 85 dB(A);

4) the weighted root mean square acceleration value if it exceeds 2,5 m/s^2;

5) a statement to the effect if the weighted r.m.s acceleration value does not exceed 2,5 m/s^2;

j) the substance of the following, where appropriate:

1) Training

– Read the instructions carefully. Be familiar with the **controls** and the proper use of the appliance.

– Never allow children to use the appliance.

– Never allow people unfamiliar with these instructions to use the appliance. Local regulations may restrict the age of the operator.

– Never operate the appliance while people, especially children, or pets are nearby.

– The operator or user is responsible for accidents or hazards occurring to other people or their property.

2) Preparation

– While operating the appliance, always wear substantial footwear and long trousers.

– Do not operate the appliance when barefoot or wearing open sandals.

– Thoroughly inspect the area where the appliance is to be used and remove all stones, sticks, wires, bones, and other foreign objects.

– Before using, always visually inspect to see that the rotating parts and cutter assembly are not worn or damaged. Replace worn or damaged parts in sets to preserve balance.

3) Operation

– Operate the appliance only in daylight or in good artificial light.

– Avoid operating the appliance in wet grass, where feasible.

– Always be sure of your footing on slopes.

– Walk, never run.

– Always work across the face of slopes, never up and down.

– Exercise extreme caution when changing direction on slopes.

– Do not operate the appliance on excessively steep slopes.

- Use extreme caution when reversing or pulling the appliance towards you.
- Stop the rotating parts if the appliance has to be tilted for transportation. Do not operate the **cutting means** when crossing surfaces other than grass, and when transporting the appliance to and from the working area.
- Never operate the appliance with defective **guards** or shields, or without safety devices, for example deflectors and/or **catchers** in place.
- Switch on the motor according to instructions and with feet well away from rotating parts.
- Do not tilt appliance when switching on the motor, except if the appliance has to be tilted for starting. In this case, do not tilt it more than absolutely necessary and lift only the part which is away from the operator. Always ensure that both hands are in the operating position before returning the appliance to the ground.
- Do not put hands or feet near or under rotating parts.
- For **rotary appliances** keep clear of the **discharge opening** at all times.
- Never pick up or carry an appliance while the motor is running.
- Pull the plug from the socket:
  - whenever you leave the machine;
  - before clearing a blockage;
  - before checking, cleaning or working on the appliance;
  - after striking a foreign object. Inspect the appliance for damage and make repairs as necessary;
  - if the appliance starts to vibrate abnormally, check immediately.

4) *Maintenance and storage*

- Keep all nuts, bolts and screws tight to be sure the appliance is in safe working condition.
- Check the **catcher** frequently for wear or deterioration.
- Replace worn or damaged parts for safety.

8 Protection against access to live parts

This clause of Part 1 is applicable except as follows.

8.2 *Addition:*

For **class II rotary appliances** access to the surface of **basic insulation** or metal parts separated from **live parts** by **basic insulation** shall be permitted when the **cutting means** is removed if a **tool** is required for its removal.

9 Starting a motor-operated appliance

This clause of Part 1 is replaced by the following.

Motors shall start under all normal voltage conditions which may occur in use.

Centrifugal and other automatic starting switches shall operate reliably and without contact chattering.

*Compliance is checked by starting the appliance three times, at no-load, at a voltage equal to 0,85 times **rated voltage** or the lower limit of the **rated voltage range**, with any **control** device set at maximum speed.*

*For the test the **cutting means** are adjusted according to the manufacturer's instructions related to this test.*

The appliance shall operate in such a way that safety is not affected.

10 Power input and current

This clause of Part 1 is applicable.

10.1 Not applicable.

11 Heating

This clause of Part 1 is applicable.

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:*

Appliances fitted with an appliance inlet or cable coupler shall be tested with the appropriate mating connector in place.

Air filters are not removed.

16 Leakage current and electric strength

This clause of Part 1 is applicable except as follows.

16.3 *Addition:*

*Insulation equivalent to **supplementary insulation** provided to comply with 22.35 shall be tested in accordance with the requirements for **supplementary insulation**.*

17 Overload protection of transformers and associated circuits

This clause of Part 1 is applicable.

18 Endurance

This clause of Part 1 is applicable except as follows.

18.101 Appliances shall be so constructed that, in normal use, there will be no electrical or mechanical failure that might impair compliance with this standard. The insulation shall not be damaged, and contacts and connections shall not have worked loose as a result of heating, vibration, etc.

Moreover, overload devices shall not operate under normal running conditions.

Compliance is checked by the tests of 18.2.

18.102 *The appliance is operated at no load, series motors being supplied at a voltage such that the rotating speed is the same as that obtained at **rated voltage** and under **normal operation**. The appliance is operated for 48 h, reduced by the running time necessary for the tests of Clauses 11 and 13.*

Appliances are operated continuously, or for a corresponding number of periods, each period being not less than 8 h.

During the test, replacement of carbon brushes is allowed and the appliance is lubricated as in normal use.

18.103 *During the tests of 18.2, overload **protective devices** shall not operate.*

*After the tests of 18.2, the appliance shall withstand the tests of Clause 16. Connections, **handles, guards,** brush-caps and other fittings or components shall not have worked loose, and there shall be no deterioration impairing safety in **intended use**.*

19 Abnormal operation

This clause of Part 1 is applicable except as follows.

19.7 *Addition:*

*This test is not made on appliances with flexible or freely pivoting **cutting means** mounted on a generally circular drive unit.*

19.9 Not applicable.

20 Stability and mechanical hazards

This clause of Part 1 is applicable except as follows.

20.2 *Replacement:*

To prevent unexpected operation which may result in a hazard, only manually reset cut-outs and those which require the operating **control** to be released are allowed.

All power-driven components except the **cutting means** and the ground-contacting parts of power-propelled appliances shall be guarded to prevent contact with these parts during **normal operation**.

All apertures and safety distances shall conform to the relevant clauses of ISO 13852.

Rotating covers or discs shall have a continuous unbroken or smooth surface.

Where a **guard** is designed to be opened or removed, thereby exposing a hazard, a safety sign warning of the hazard shall be located on the **guard** or adjacent to the **guard**.

All **guards** shall be permanently attached to the appliance and shall not be **detachable** without the use of **tools**. The opening of **guards** shall require the use of a **tool**. Exceptions to this are the opening or removing of interlocked **guards** which disable the protected moving parts, or the opening of automatically closing hinged **guards** for **discharge chutes**.

Compliance is checked by inspection and measurement.

20.101 Controls

20.101.1 General

The **operator controls** shall accommodate the 5th to 95th percentile adult operator as specified in ISO 3411.

The following are not **operator controls**:

– height/depth of cut setting;
– **catcher** discharge arrangements;
– cable restraint/guides.

The location and range of movement of **operator controls** shall be convenient to the operator and shall remain within the anthropometric dimensions given in Figure 106. The operating range of less frequently used **operator controls** may be extended by allowing the operator's trunk, when the operator is standing with both feet on the ground, to articulate within the confines of the **operator zone** (e.g. lean forward until contacting the **handle** in any of the operating positions).

20.101.2 Operator presence control

Appliances shall be fitted with a device on the **control handle** which will automatically stop the rotation of the **cutting means** when the operators hands are removed from the **handle**. This may be accomplished either by stopping the drive motor or by an intermediate **cutting means** clutch/brake mechanism. For starting the rotation of the **cutting means** the **control** must require two separate and dissimilar actions. If these actions are to be carried out by using the same hand, then the actions must be totally distinct in order to prevent accidental "switch on".

20.101.3 Traction drive

For appliances with **traction drive**

– the **control** for **traction drive** shall automatically stop or disengage the **traction drive** when the operator leaves the normal operating position;
– the reverse function of the **traction drive control** shall require continuous activation in the direction of travel to drive;
– it shall be possible to engage or disengage the **traction drive** when the **cutting means** is operating.

20.102 Braking requirements

20.102.1 General

Appliances shall not require an excessive force to hold the appliance stationary on a slope.

Appliances requiring additional means, i.e., **service brake** or **parking brake** system, shall meet the requirements of 20.102.2 and 20.102.3.

The appliance shall be equipped with the tyres supplied by the manufacturer having the least tread area in contact with the test surface.

If steering assisted brakes are also used for **service brakes** it shall be possible to connect them in such a way that they apply both brakes with equal force.

For appliances without braking means, compliance is checked as follows.

Tests are carried out with the appliance facing directly up and directly down a 30 % (16,7°) slope. A force of not more than 220 N, applied at or below the centre of gravity and directly up and down the slope, shall be required to hold the appliance stationary.

20.102.2 Service brake

*Test stops are conducted on a substantially level (not to exceed 1 % gradient) dry, smooth, hard surface roadway of concrete (or equivalent test surface). When testing an appliance with separate clutch and brake **control** means, the clutch shall be simultaneously disengaged with brake engagement. Tests are carried out with the appliance in both forward and reverse directions at the maximum ground speed attainable.*

*Using the **braking system** provided, the appliance shall stop within a distance of 0,19 m for each 1 km/h.*

20.102.3 Parking brake

A **parking brake** shall be provided on appliances requiring a **service brake**.

The **parking brake** may be in combination with the **service brake**.

An automatic **parking brake**, when provided, shall be activated when the **operator presence control** is released.

*Tests are conducted on a 30 % slope with a coefficient of friction such that the appliance does not slide down the slope. The appliance is positioned on the slope with its **parking brake** engaged and locked, transmission in neutral and the motor switched off. The appliance is tested both with its front downhill and its rear downhill.*

*The appliance shall not move down the slope, and the force required to engage and unlock the **parking brake** shall not exceed 220 N.*

20.102.4 Handle construction

The scarifier **handles** shall be fastened to the machine so as to prevent loss of control by unintentional uncoupling while in operation.

A positive means (latch or upper stop) shall be provided which cannot be unintentionally disengaged during **normal operation** of the scarifier, and shall not allow the end of the **handle** adjacent to the operator to come nearer than 450 mm horizontally behind the nearest path of the **cutting means** during **normal operation** (see Figure 101) on scarifiers with more than one axle. On single-axle scarifiers this distance shall be 600 mm when the grip of the **handle** is at a height of 900 mm above the ground (see Figure 102).

For easier storage, **handles** may be unlatched or folded up.

The width of the **handle** grip shall be at least three quarters of the **cutting width** of the scarifier or 500 mm, whichever is the greater. When this width of the **handle** grip is not achieved, the horizontal distance between the nearest path of the **cutting means** and the **handle** grip shall be 900 mm (see Figure 102).

The **handle** shall have a gripping length of at least 100 mm.

Compliance is checked by inspection and measurement.

20.103 Requirements for rotary appliances

20.103.1 Cutting means enclosure

20.103.1.1 General

Scarifiers with rear discharge openings shall have a movable deflector, the closing torque of which shall not be less than 0,30 Nm for machines with a cutting width of 300 mm or less, and not less than 0,40 Nm for machines with a cutting width of 300 mm to 400 mm.

20.103.1.2 Discharge openings (chutes)

When open **discharge chutes** are provided, no tangential line from the **cutting means tip circle** in or above the plane of the **cutting means tip circle** and in the direction of rotation of the **cutting means** shall intersect the operator target area without first contacting the **cutting means enclosure** or **guard.**

20.103.1.3 Access to cutting means

Inadvertent access to the **cutting means** by the feet during operation shall be prevented so far as is reasonably practicable.

On the operator side, the distance between the blade tip circle and the rear housing or a deflector shall be at least 120 mm (see Figure 101).

Scarifiers with **discharge openings** shall have deflectors (e.g. **catchers**, baffle plates) which catch thrown objects and prevent inadvertent access by the operator's feet.

Movable deflectors shall return to the closed position automatically.

Instructions shall be affixed to the scarifier near the **discharge opening** and to the **catcher** adapter, if one is used, stating that the scarifier shall not be operated without either the entire **catcher** or the **guard** in place.

Compliance is checked by inspection.

*For the **guards** at the sides of the machine, compliance is checked by the following test using the foot probe (Figure 103) as illustrated in Figure 104.*

*The scarifier is placed on a hard flat surface, the **guards** or deflectors or both being in the normal operating position on the **cutting means housing** and the support members (wheels) in contact with the supporting surface. The test is conducted under static conditions.*

*Single axle scarifiers are to be positioned as instructed by the manufacturer or so that the **handle** grip is 900 mm above the supporting surface.*

*The tests are made with the **cutting means** in the highest and lowest cutting position. The base of the test probe is held horizontally at any height and then inclined up to 15° forward or backward from the horizontal. The probe is applied at any point of the **housing** side.*

*The test probe shall not enter the path of the **cutting means** assembly. The test probe shall not lift the scarifier or any of its parts from the supporting surface.*

20.103.2 Thrown object hazard

Appliances shall be so constructed as to provide, in **intended use,** adequate protection against risk of injury to persons from foreign objects that may be thrown out by the rotating **cutting means.**

Compliance is checked by the following test.

The appliance is placed in the test enclosure described in Annex AA with the base of the enclosure being as described in Annex BB. The target panel construction used shall be checked by the tests contained in AA.2 immediately before and after this test. The target panels shall be divided into elevation zones by horizontal lines as indicated in Figure AA.1 and described in Annex CC.

The projectiles used in the test are 6,35 mm diameter balls of hardened steel 45 HRC minimum, (e.g. balls used as ball bearings).

*Injection points for the projectiles shall be provided at the 12 o'clock position, as shown in Figures AA.2 and AA.3 and located on the **cutting means tip circle** for injection of projectiles. An injection point shall be provided for each **cutting means** of a multispindle appliance.*

The injection tube outlets shall be fixed and flush with the upper surface of the coconut mat (see Annex BB, Figure BB.1) and the system shall be so arranged that the ball may be ejected with variable velocity.

*Where necessary, the appliance may be elastically restrained at the **handle** to prevent horizontal movement.*

*During the tests the appliance shall be operated at **maximum operating motor speed** (as defined by 3.117).*

*Tests are conducted for each **cutting means** assembly.*

The appliance shall be tested in all operational configurations.

NOTE 1 Test personnel should either be kept out of the test area or otherwise protected from the hazard of thrown objects.

*The **cutting means** shall be adjusted to be just clear of the ground when set on a hard level surface.*

*Before the test adjust the velocity with which the ball is ejected so that the ball rises not less than 30 mm above the surface of the coconut matting and within an angle of 10° of the vertical axis. Then with the appliance in place, allow balls one at a time into the appliance. Increase the velocity of the balls in small increments until each ball is hit by the appliance **cutting means**. Start the test when this minimum velocity is established. Chipped or damaged balls shall be replaced.*

Inject 500 projectiles into each injection point for each test. On multispindle appliances, the test shall be run for each spindle with the results evaluated for each test.

*During any of the tests, in the event of excessive **hits** in a localized area, it may be necessary to repair or replace the target before continuing with the tests. Replace the target panels if **hits***

from previous tests leave holes that cannot be covered by a 40 mm square gummed label. Not more than one thickness of gummed labels (patch) shall be placed over any one area.

*Balls remaining within the test fixture (on test surface) may be removed at the option of the tester to minimize ricochet **hits**.*

*If a retest is required, a new **cutting means** shall be used for each test (500 projectiles) unless the **cutting means** is not damaged by impact with projectiles.*

NOTE 2 The test does not require that the appliance be suitable for use after the test.

*Count and record the **hits** on a data sheet, shown in Annex CC. Projectiles that hit and damage the centreline of the target area height line shall be scored with the target area below that line.*

*For a **cutting width** equal to or less than 600 mm, for each test (500 projectiles), not more than 40 projectiles shall hit the target between the base and the 450 mm line (lower and middle elevation area) of which not more than six may hit the target above the 300 mm line (middle elevation area). There shall be no **hits** above the 450 mm line (top elevation area) and not more than two **hits** in the operator target area between the base and the 450 mm line.*

*For a **cutting width** greater than 600 mm, for each test (500 projectiles), not more than 50 projectiles shall hit the target between the base and the 450 mm line (lower and middle elevation area), of which not more than six may hit the target above the 300 mm line (middle elevation area). There shall be no **hits** above the 450 mm line (top elevation area) and not more than two **hits** in the operator target area between the base and the 450 mm line.*

In the event of a test failure, two additional appliances may be tested both of which must then pass the test.

20.103.3 Strength of cutting means enclosures, discharge chutes, guards, deflectors and catchers

Cutting means enclosures, **discharge chutes, guards**, deflectors and **catchers** shall have sufficient strength to withstand the impact from foreign objects which may be thrown out by the **cutting means**.

*Compliance is checked by inspection of the scarifier after the thrown object test. The **cutting means enclosures** shall show no breakages or visible cracks*.

20.104 Requirements for other lawn scarifiers and aerators

20.104.1 General construction – Guarding and shielding

20.104.1.1 **Cutting means** shall be guarded on both sides and from front and rear, so that it is not possible for a vertical rod 50 mm in diameter and 500 mm in length, with its lower end in contact with the ground (supporting surface), to approach any portion of the **cutting means** within 10 mm when any **catcher** has been removed (see Figure 107).

20.104.1.2 **Cutting means** shall be covered at the sides with **guards** extending at least as shown in Figure 108.

20.104.1.3 **Cutting means** of rear discharge appliances shall be covered from above with a **guard** that extends so that its projection on the horizontal plane covers at least the projection of the **cutting means** on the same horizontal plane, when any **catcher** has been removed (see Figure 109).

20.104.1.4 Cutting means of front discharge appliances shall be covered from the rear with a **guard** that extends so that its projection on the vertical plane covers at least the projection of the **cutting means** on the same vertical plane less up to 25 mm (see Figure 110).

Compliance with the requirements of 20.104.1 shall be checked by measurement and inspection.

NOTE 1 Rear discharge denotes throwing out grass, thatch and moss and other debris so that they will be collected in a **catcher** which is located behind the **cutting means**.

NOTE 2 Front discharge denotes throwing out grass, thatch and moss and other debris, so that they will be collected in a **catcher** which is located in front of the **cutting means**.

21 Mechanical strength

This clause of Part 1 is applicable except as follows.

Modification:

The impact energy shall be 1,0 J ± 0,05 J.

21.101 Strength of cutting means and cutting means mountings

These tests shall be done at the **maximum operating motor speed**.

21.101.1 Cutting means and their mountings shall have adequate strength to withstand impact with solid objects.

Compliance is checked by the following test.

The scarifier is placed on the carriage (see Figure 105) in the test enclosure described in Annex BB.

*The **handle** shall be retained elastically. Single-axle scarifiers are mounted so that the **handle** grip is 900 mm above the carriage level.*

The mounting of the scarifier shall allow for an upward movement of the machine.

A steel plate 8 mm thick, 100 mm wide and 400 mm long, mounted on a carriage at a height of 30 mm above the maximum cutting depth of the scarifier shall be pulled centrally under the scarifier. The speed of the pull shall be 1 m/s ± 5 % (Figure 105).

This test shall be carried out on all working spindles.

*During the test, no complete **cutting means** or parts thereof shall break off. Breakage of parts intended to break such as shearing pins, is not considered a failure. The **cutting means** need not be suitable for further use after the test.*

22 Construction

This clause of Part 1 is applicable except as follows.

22.6 *Addition:*

Any drain holes provided to prevent accumulation of water in an enclosure shall be at least 5 mm in diameter or 20 mm^2 in area with a width of at least 3 mm.

Compliance is checked by inspection.

22.35 *Replacement:*

For **class II appliances**:

Handles and **operator controls** which are held when operating the appliance shall either be of insulating material or covered by insulating material having a thickness of at least 1 mm, or separated by insulation equivalent to **supplementary insulation** from other accessible metal parts.

Handle shafts shall be

a) of insulating material, or,

b) if of metal, covered with insulating material having a thickness of at least 1 mm, which extends over a distance of 150 mm from **handles** and **handle-**mounted **operator controls**, or

c) so insulated that accessible metal parts within 150 mm of the **handle** and **handle**-mounted **operator controls** are insulated, by insulation equivalent to supplementary insulation, from other accessible metal parts which are within 75 mm of the ground measured as a clearance, or from accessible metal connected to such parts.

Cable restraints/guides are not considered to be **operator controls.**

For **rotary appliances,** the **cutting means** shall be insulated from other metal parts, which are accessible when the appliance is in its normal position of use, by insulating material equivalent to **supplementary insulation**.

*Compliance is checked by inspection, by measurement and, for the covering of insulating material on **handles, operator controls** and **handle** shafts, by the following tests.*

A sample of the covered part is conditioned at a temperature of 70 °C ± 2 °C for 7 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 length of 150 mm or the required insulation is no longer given, or that the covering has not peeled off and that it may move longitudinally.

After this, the sample is maintained for 4 h at a temperature of –10 °C ± 2 °C.

While still at this temperature, the sample is then subjected to impact by means of the apparatus shown in Figure 111. The weight A having a mass of 300 g falls from a height of 350 mm onto the chisel B of hardened steel, the edge of which is placed on the sample.

*One impact is applied to each place where the covering is likely to be weak or damaged in **intended use**, the distance between the points of impact being at least 10 mm.*

After this test, inspection shall show that the covering has not peeled off and an electric strength test is made between metal parts and metal foil wrapped round the covering in the area required to be insulated.

The test voltage of 1 750 V is applied for 1 min.

During this test, no flashover or breakdown shall occur.

22.36 This subclause does not apply.

22.101 Appliances shall be provided with a means such that damage to the supply cable due to movement of the appliance is prevented as far as possible. The means provided shall be re-usable.

This requirement is considered to be met by, for example,

– a cable-retaining device to keep the cable out of the vicinity of the **cutting means,** to which the cable may be adequately fastened, or

– the supply cable entry or attachment being at least 0,6 m from the nearest point of the **cutting means**.

Compliance is checked by inspection and by the following test procedure, except for automatic cord reel-in devices.

*The supply cable as delivered with the appliance is attached to the device in accordance with the instruction manual. The **supply cord** is then subjected 10 times to a pull of 100 N, the pull being applied in the most unfavourable direction, without jerks, for 1 s.*

*After the test the power **supply cord** shall show no damage within the meaning of this standard and it shall not have been displaced longitudinally, in the device, by more than 2 mm.*

22.102 Air filters which can be removed for cleaning purposes shall be so designed that they are unlikely to come off in **intended use**.

This requirement is met if, for example, the air filter

– can only be removed with the aid of a tool, or

– is provided with a spring that prevents it from falling away, in intended use, due to vibration, or

– needs a deliberate action of the user for its removal.

Compliance is checked by inspection.

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*:

Switches shall have a contact separation in all poles that provides full disconnection under overvoltage category III conditions.

The number of cycles of operation declared for 7.1.4 of IEC 61058-1 shall be at least 50 000.

25 Supply connection and external flexible cords

This clause of Part 1 is applicable except as follows.

25.1 *Replacement:*

Appliances shall be provided with a **supply cord** or an appliance inlet.

Appliance inlets shall not allow the introduction of a connector complying with the standard sheets of IEC 60320-1.

Compliance is checked by inspection.

25.5 *Replacement*:

Appliances shall be provided with one of the following:

– a **supply cord** not less that 10 m in length with **type X attachment**, or

– a **supply cord** of length not exceeding 0,5 m with **type X or Y attachment** and terminating in a cable coupler (this includes the appropriate mating connector) or,

– an appliance inlet supplied with the appropriate mating connector.

Compliance is checked by inspection.

25.7 *Modification:*

Replace the first paragraph by the following:

Supply cords shall not be 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).

In some countries these **supply cords** are not suitable and the **supply cord** shall be ordinary polychloroprene sheathed flexible cord (code designation 60245 IEC 57).

25.14 *Addition:*

This requirement also applies to external cables or cords where, because of the design of the appliance, there is relative movement of more than 45° of the cable or cord at its point of entry into an enclosure.

25.15 *Addition:*

This requirement applies to all accessible cables or cords.

Replace the fourth paragraph:

A mark shall be made on the cord on the appliance side of the cord anchorage while it is subject to the pull force shown in Table 12, at a distance of approximately 2 cm from the cord anchorage or other suitable point. If access to the appliance side of the cord anchorage is not practicable then the mark shall be made on the supply side of the anchorage and it shall be ensured that the pull force is applied to the cord in such a way that, at the point of application of the force, the sheath of the cord does not move with respect to the conductors or their insulation.

Modification:

*The pull force on the **supply cord** shall be 150 N.*

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 except as follows.

28.1 *Addition:*

Screws or nuts for fastening the **cutting means** of rotary appliances may be of insulating material or covered with insulating material, provided they cannot be replaced by readily available metal screws or nuts.

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.

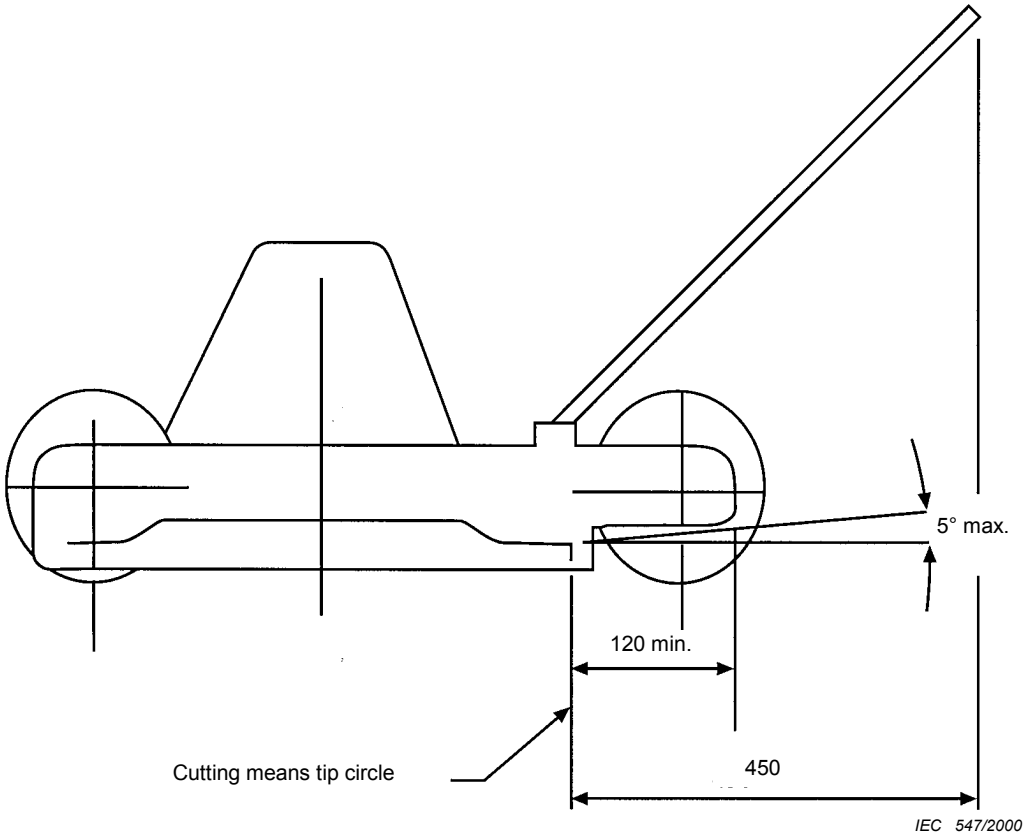
30.2.3 Not applicable.

31 Resistance to rusting

This clause of Part 1 is applicable.

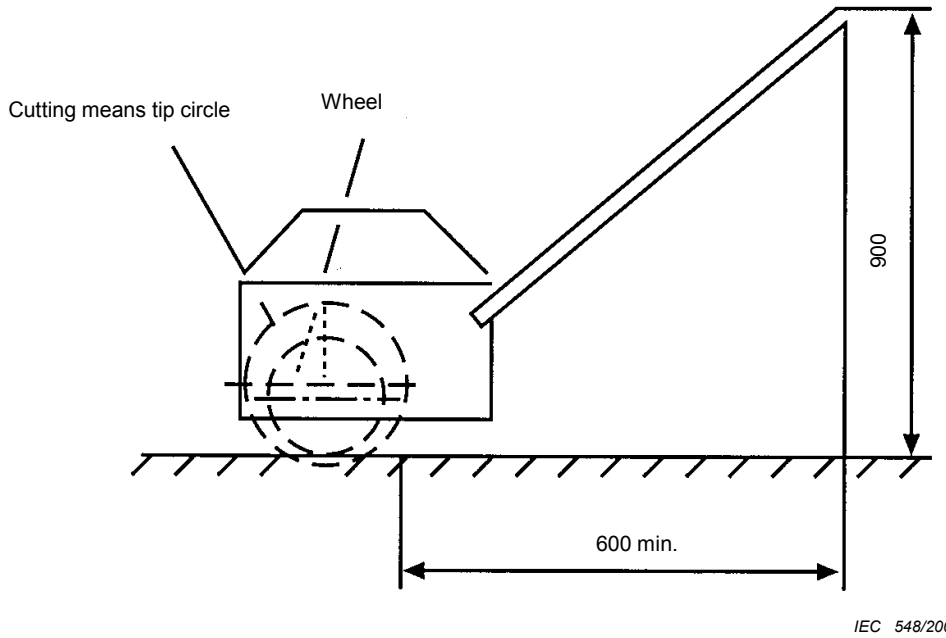
32 Radiation, toxicity and similar hazards

This clause of Part 1 is not applicable.



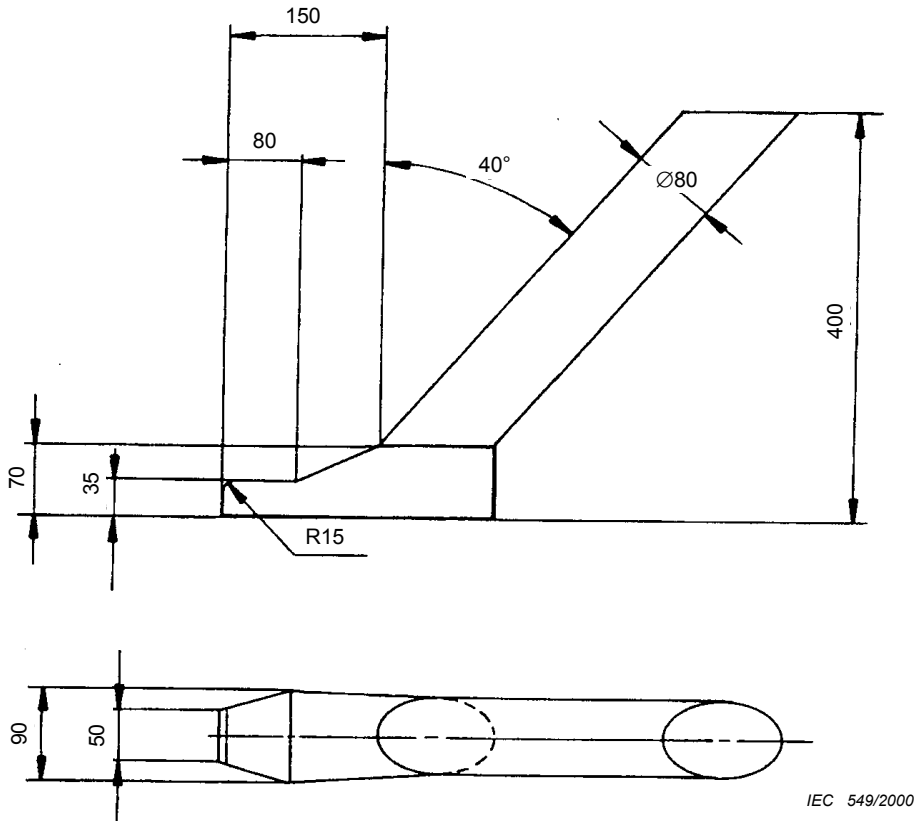
Dimensions in millimetres

Figure 101 – Safety distances – Rotary appliances



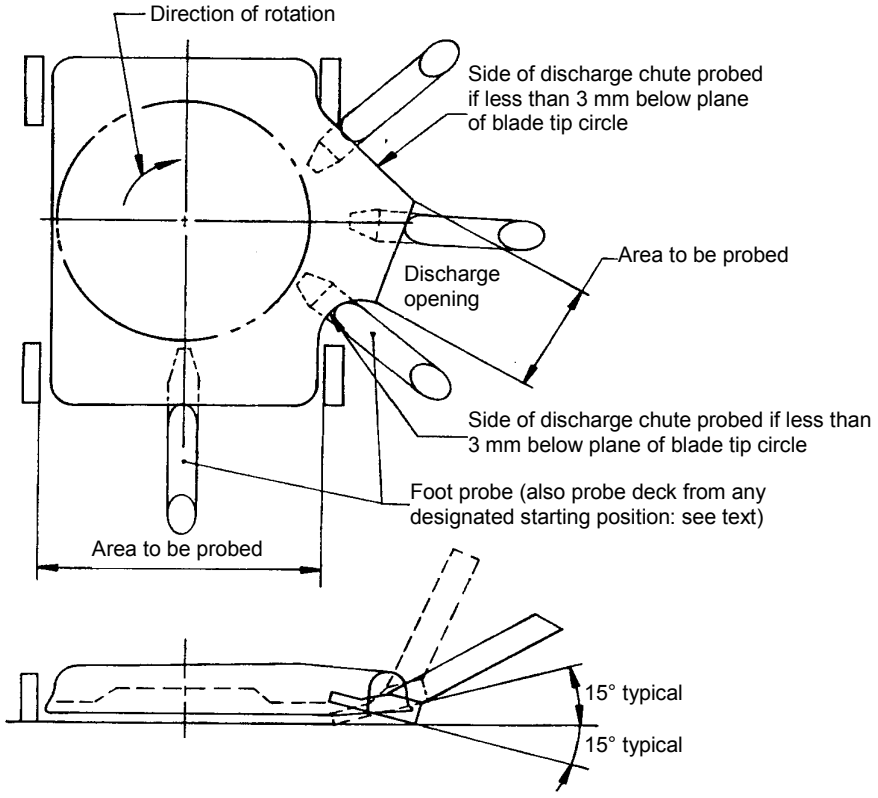
Dimensions in millimetres

Figure 102 – Safety distances – Other lawn scarifiers and aerators



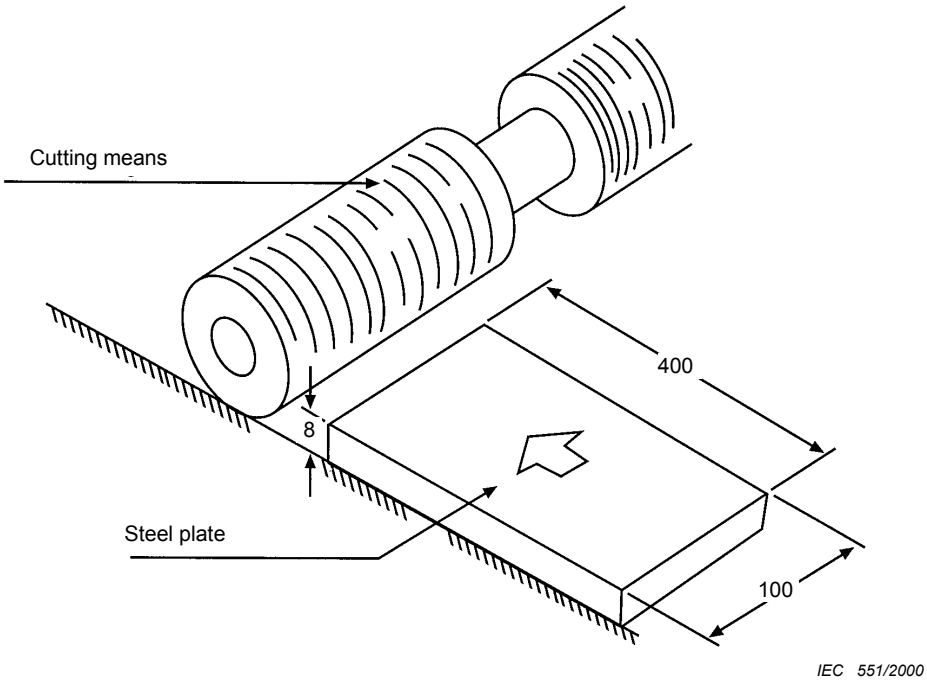
Dimensions in millimetres

Figure 103 – Foot probe



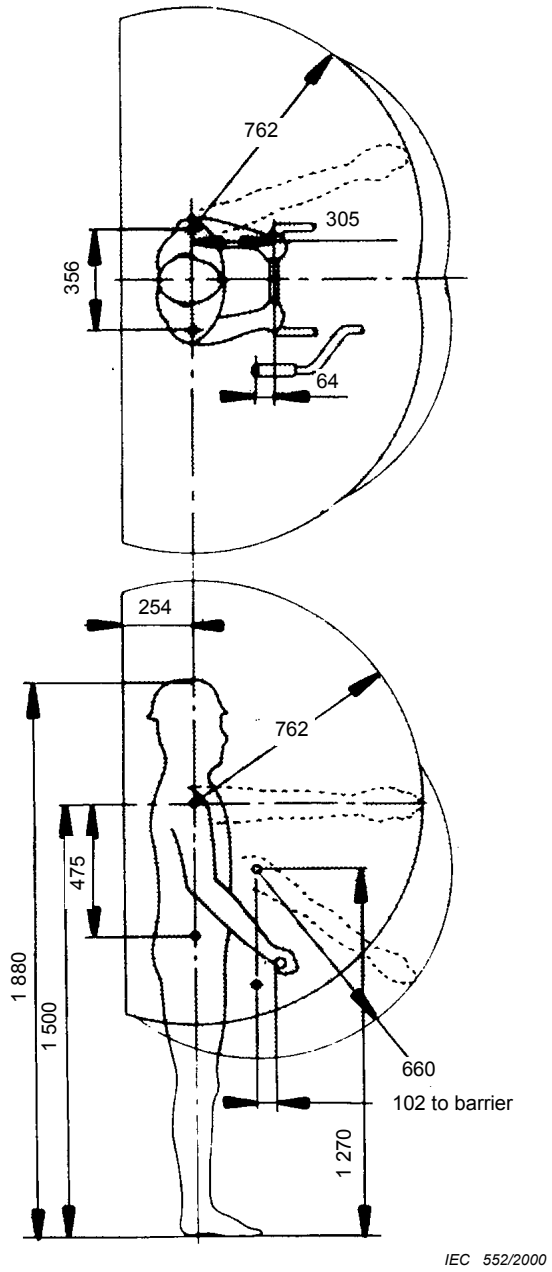
Dimensions in millimetres

Figure 104 – Foot probe test



Dimensions in millimetres

Figure 105 – Strength of cutting means



Dimensions in millimetres

NOTE 1 The **operator zone** is the area into which the extremities of a 95th percentile male can reach from the normal operator position.

NOTE 2 The lower forward zone is the area into which a 5th percentile male or a 50th percentile female can reach when against the **handle** barrier. This zone can also be reached by a 95th percentile male leaning forward against the **handle** barrier.

NOTE 3 All barriers within the **operator zone** will reduce the zone by the space occupied and protected by the barrier.

NOTE 4 The **operator zone** includes the maximum range of all frequently used **operator control** movements but is not intended to represent preferred **operator control** position.

Figure 106 – Operator zone

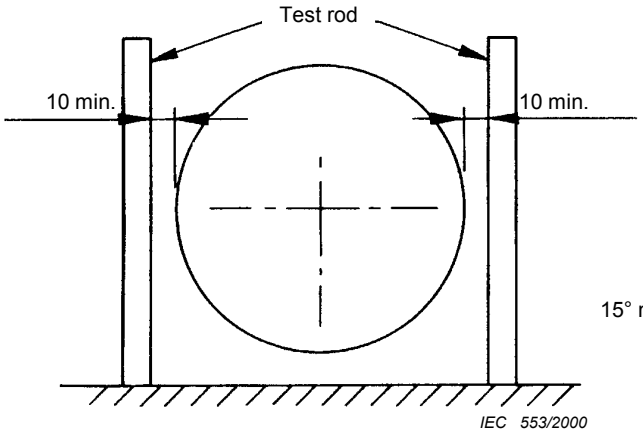
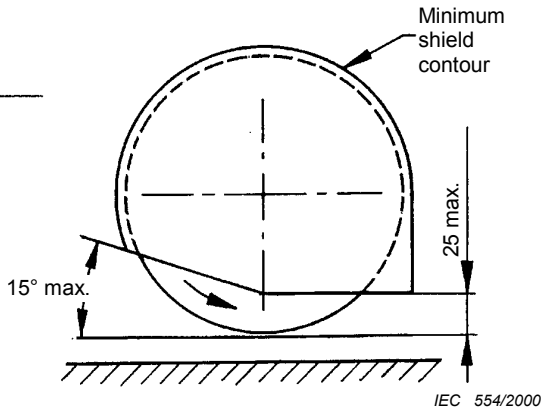


Figure 107 – Use of test rod to check guarding of cylinders



Dimensions in millimetres

Figure 108 – Side coverage of cylinders

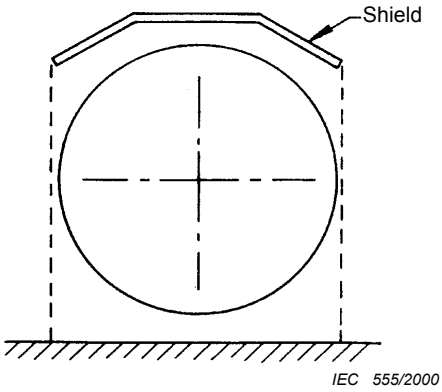
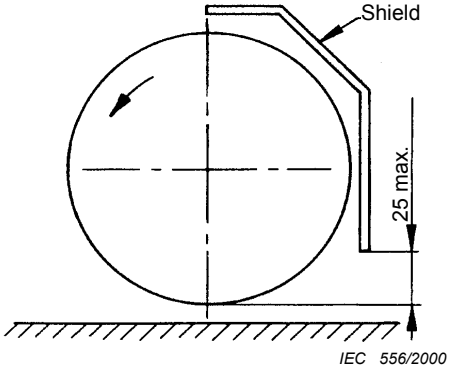
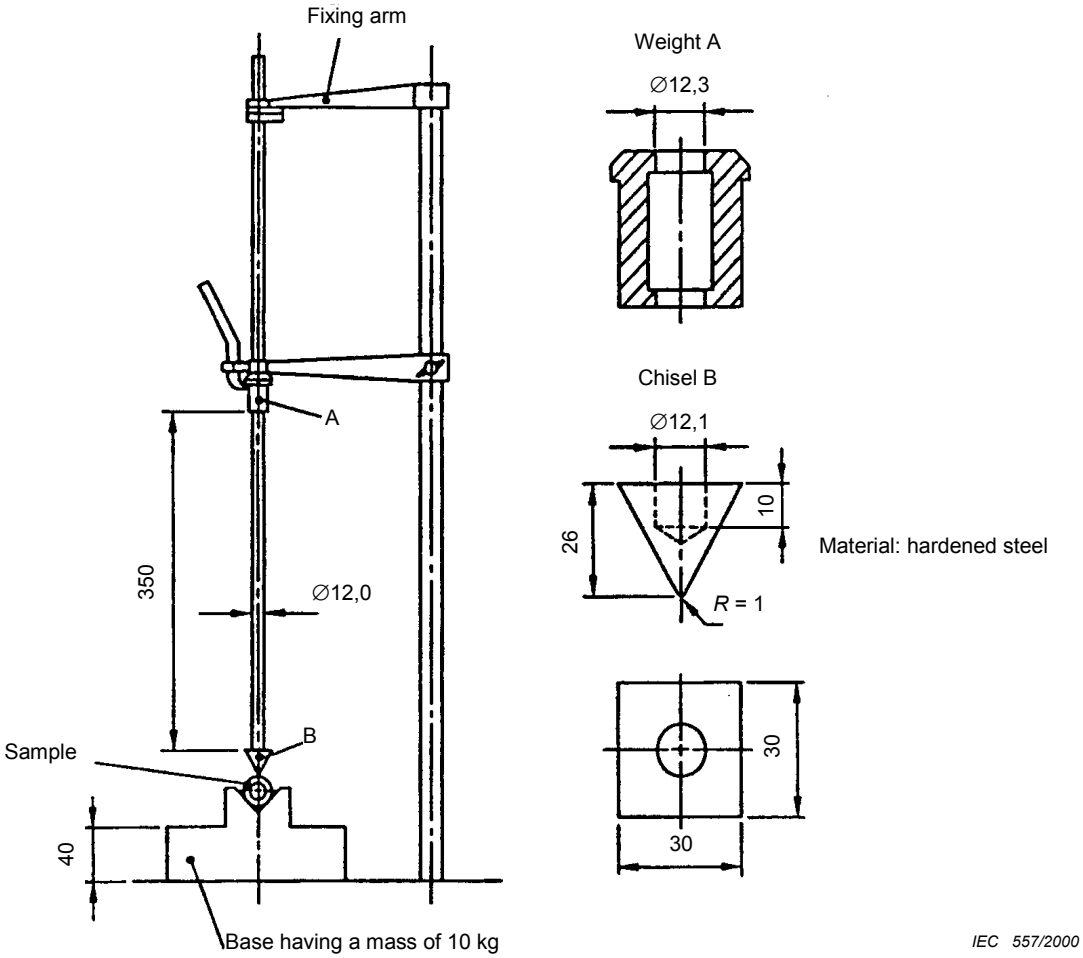


Figure 109 –Guarding of rear discharge cylinders



Dimensions in millimetres

Figure 110 – Guarding of front discharge cylinders



Dimensions in millimetres

Figure 111 – Impact test fixture for handle insulation

Annexes

The annexes of Part 1 are applicable except as follows.

Annex AA
(normative)

Test enclosure construction

AA.1 General construction

The test enclosure shall be constructed generally as shown in Figure AA.1. Variations to accommodate different appliance types are shown in Figure AA.2.

The walls shall consist of eight target panels, each 900 mm high, perpendicular to the base of the test fixture, (see Figure AA.3) so as to form an octagon. The target panel composition shall meet the material specification of AA.2. The target in the operator area above 900 mm shall consist of a single sheet of Kraft paper rising to a height of 2 000 mm. In order to facilitate the counting of **hits**, the panel supports should be designed to allow sliding in and out of at least one target panel.

The targets shall be generally located perpendicular to a radial line extending 750 mm ± 50 mm from the **cutting means tip circle** of a single spindle appliance, or to the nearest **cutting means tip circle** of multispindled appliances (see Figure AA.2). If a target interferes with a part of the appliance such as grass box, **handle**, or wheel, the target shall be moved back to avoid such interference.

The operator target area is determined by the intersection of the lines extending from centre (A) of the **cutting means tip circle** for single **cutting means appliances** or from the centre (B) of a line through the centres of the outer **cutting means tip circles** for multicutting means appliances and tangent to the 1 000 mm diameter operator target area. The centre of the operator target area is located 330 mm to the rear of the **handles** on a line passing from centres (A) or (B), through the centre of the handgrip part of the **handle** (see Figure AA.2). The target surface between the intersection of the two tangents and the target is the operator target area.

For appliances with movable offset **handles**, the **handle** shall be positioned to the left to locate the left limit of the operator target area and then to the right to locate the corresponding right limit.

AA.2 Target panel construction

The target panels shall consist of one or more sheets of corrugated fibreboard together with sheets of Kraft paper as required to meet the test criteria.

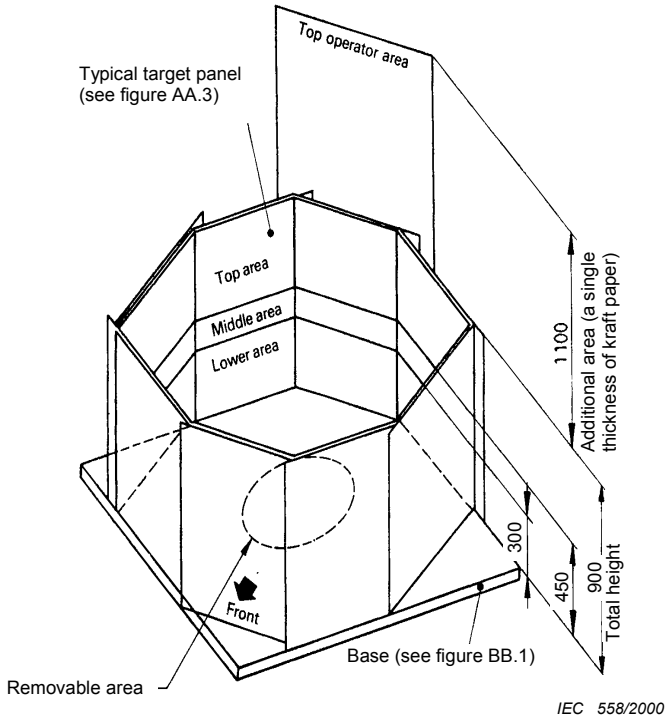
The fibreboard construction may have two or three liners and have one or two flutes.

The Kraft paper shall be of nominal 225 g/m^2 construction which satisfies the conditions of ISO 2758. Samples of the target panel construction used shall be cut into 150 mm × 150 mm squares and tested in the fixture shown in Figure AA.4 as follows.

The samples are placed centrally on the bottom plate, the edges of the square samples may be secured by adhesive or tape. Cover with the top plate, making sure that the central holes in the top and bottom plates are aligned and that the fibre board is flattened by the steel plate. The penetrator is raised to the required height and allowed to fall onto the target panel sample. The test is carried out on five samples at a height of 300 mm and then on a further five samples at a height of 400 mm.

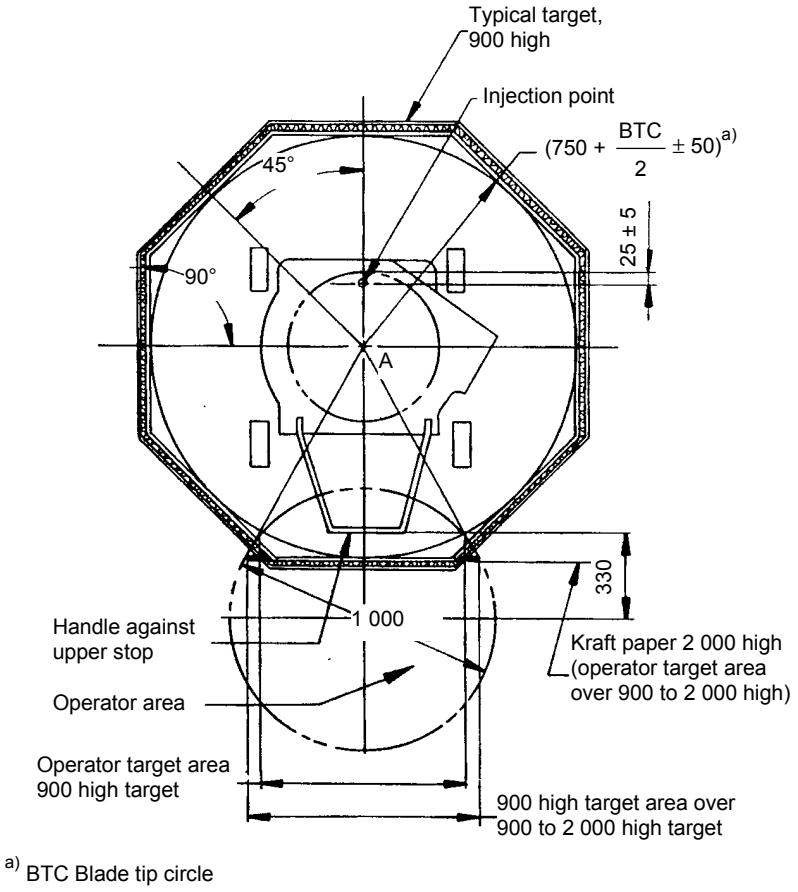
When dropped from 300 mm the penetrator shall not penetrate completely through the target panel in more than two out of five samples.

When dropped from 400 mm the penetrator shall pass completely through the target panel in at least four out of five samples.



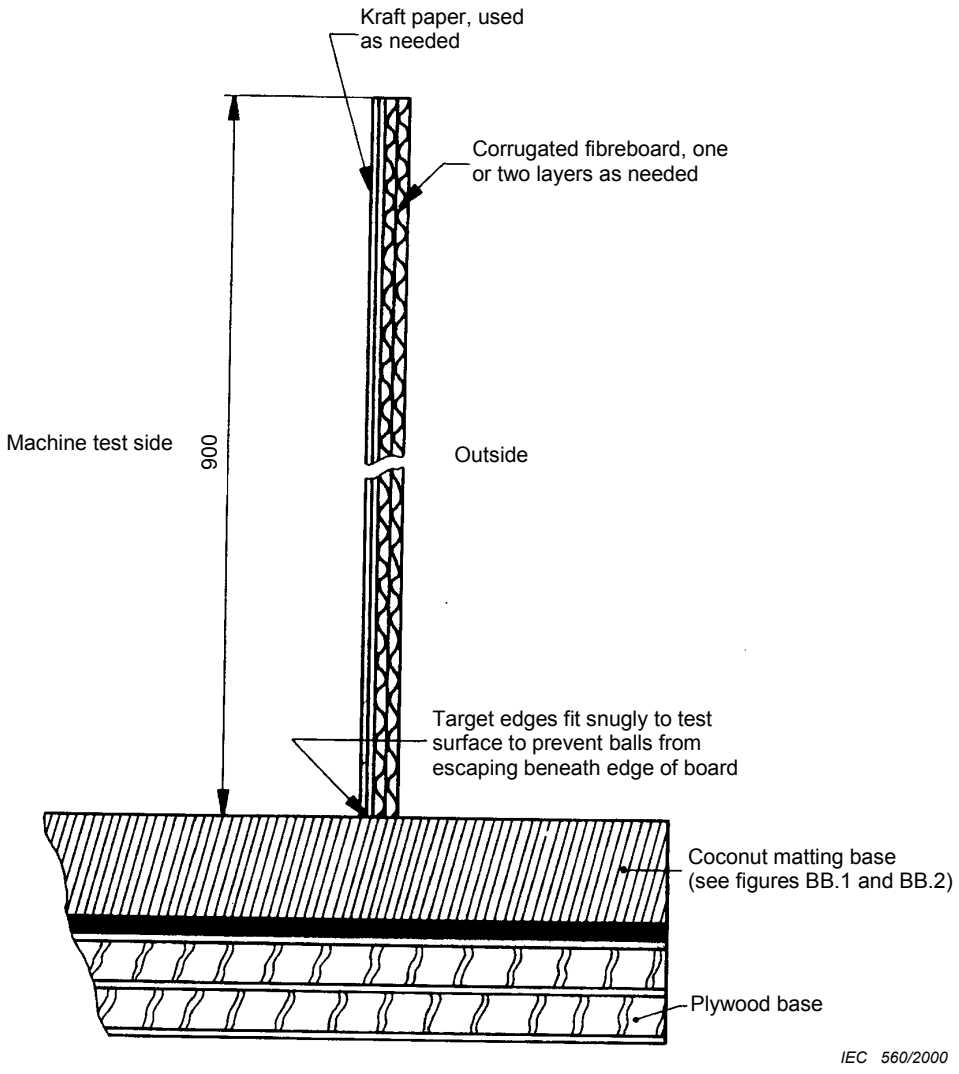
Dimensions in millimetres

Figure AA.1 – Thrown object test fixture



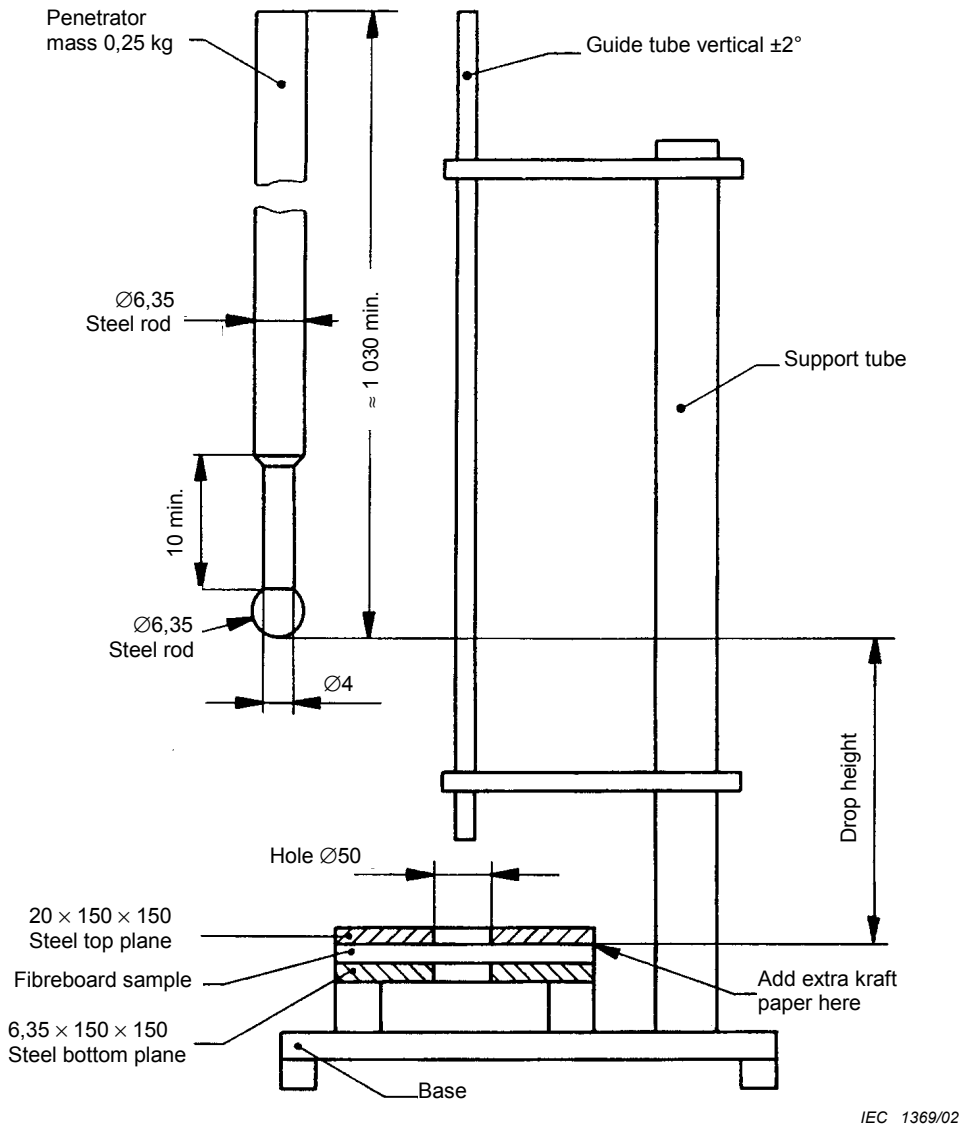
Dimensions in millimetres

Figure AA.2 – Single spindle rotary appliances – Test enclosure



Dimensions in millimetres

Figure AA.3 – Test enclosure walls and base



Dimensions in millimetres

Figure AA.4 – Test fixture for corrugated fibreboard penetration test

Annex BB
(normative)

Base for thrown object test enclosure

BB.1 Construction

The test fixture base shall consist of 19 mm plywood covered with squares of coconut matting of dimensions 500 mm × 500 mm in accordance with BB.3, nailed to the plywood, as shown in Figure BB.1 with nails spaced as shown in Figure BB.2.

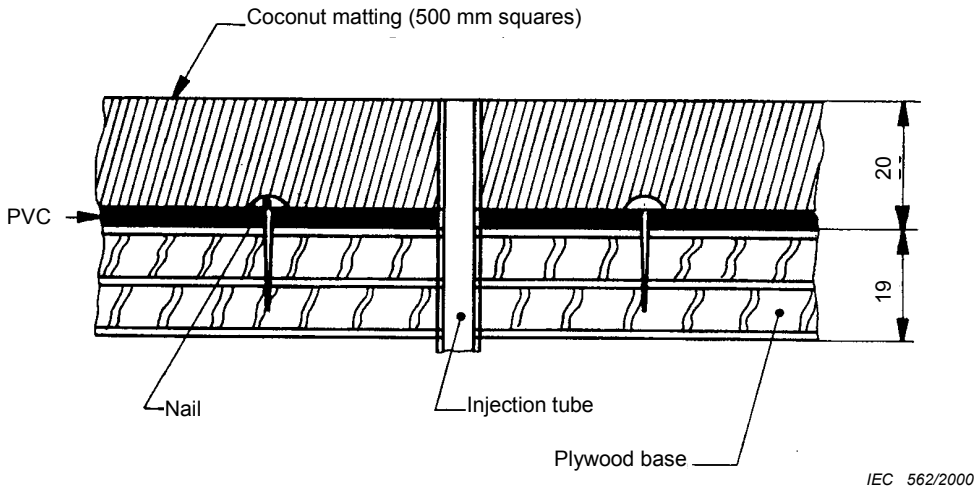
NOTE Squares are used so that, should wear develop, the **worn** part can be replaced without replacing the entire test surface.

BB.2 Minimum size

The minimum base size shall be such that with the test enclosure constructed in accordance with Annex AA, the target panels rest completely on the coconut matting base.

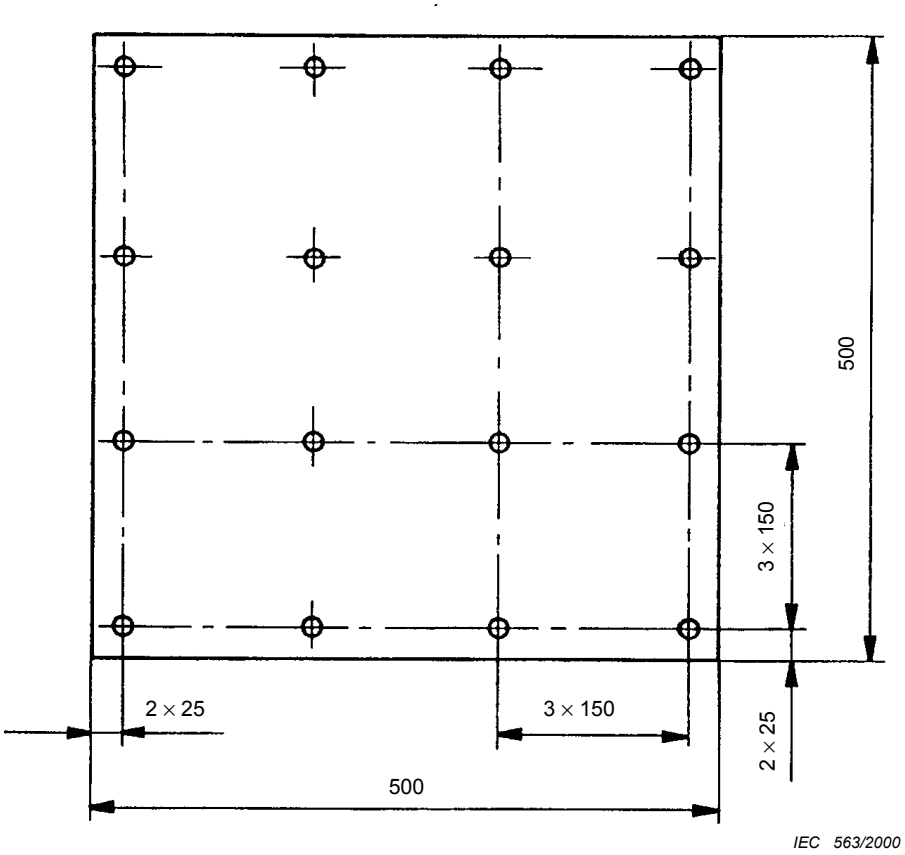
BB.3 Coconut matting

The coconut matting shall have approximately 20 mm high fibres embedded in a PVC base and shall weigh approximately 7 000 g/m^2.



Dimensions in millimetres

Figure BB.1 – Thrown object test fixture base detail



Dimensions in millimetres

Figure BB.2 – Nail plan of test fixture base

Annex CC
(normative)

Target panel elevation zones and recommended test report for thrown object test

CC.1 Target elevation zones

The target panels are divided horizontally into three elevation zones as shown in Figure AA.1.

CC.1.1 Lower elevation zone

The area between the base and the 300 mm line.

CC.1.2 Middle elevation zone

The area between the 300 mm line and the 450 mm line.

CC.1.3 Top elevation zone

The area between the 450 mm line and the top of the 900 mm target panel.

CC.2 Operator target area

The operator target area is determined in accordance with AA.1 and extends from the base to the top of the 2 000 mm high Kraft paper.

CC.3 Recommended test data sheet

The format suggested allows for counting **hits** and lots of 100 projectiles, and summarising the results at the bottom of the sheet.

See Table CC.1.

Table CC.1 – Recommended test data sheet

Manufacturer ..... Model: ..... Size: .....
Discharge location: .....
Blade-number: ..... r/min: .....

Lot	Elevation area	Sector		Total hits
		Operator (Rear)	Other (Front/sides)	
1	Top [a)]			
	Middle			
	Lower			
2	Top [a)]			
	Middle			
	Lower			
3	Top [a)]			
	Middle			
	Lower			
4	Top [a)]			
	Middle			
	Lower			
5	Top [a)]			
	Middle			
	Lower			
Test summary	Top [a)]			
	Middle			
	Lower			
	All areas			

[a)] Top includes the 900 mm to 2 000 mm high Kraft paper panel of the operator target area.

Bibliography

The bibliography of Part 1 is applicable except as follows.

Addition:

IEC 60335-2-77, *Household and similar electrical appliances – Safety – Part 2-77: Particular requirements for pedestrian controlled mains-operated lawnmowers*

IEC 60335-2-91, *Household and similar electrical appliances – Safety – Part 2-91: Particular requirements for walk-behind and hand-held lawn trimmers and lawn edge trimmers*

_____

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Q1 Please report on **ONE STANDARD** and **ONE STANDARD ONLY**. Enter the exact number of the standard: *(e.g. 60601-1-1)*

.....

Q2 Please tell us in what capacity(ies) you bought the standard *(tick all that apply).* I am the/a:

purchasing agent ❑
librarian ❑
researcher ❑
design engineer ❑
safety engineer ❑
testing engineer ❑
marketing specialist ❑
other.....

Q3 I work for/in/as a: *(tick all that apply)*

manufacturing ❑
consultant ❑
government ❑
test/certification facility ❑
public utility ❑
education ❑
military ❑
other.....

Q4 This standard will be used for: *(tick all that apply)*

general reference ❑
product research ❑
product design/development ❑
specifications ❑
tenders ❑
quality assessment ❑
certification ❑
technical documentation ❑
thesis ❑
manufacturing ❑
other.....

Q5 This standard meets my needs: *(tick one)*

not at all ❑
nearly ❑
fairly well ❑
exactly ❑

Q6 If you ticked NOT AT ALL in Question 5 the reason is: *(tick all that apply)*

standard is out of date ❑
standard is incomplete ❑
standard is too academic ❑
standard is too superficial ❑
title is misleading ❑
I made the wrong choice ❑
other .....

Q7 Please assess the standard in the following categories, using the numbers:
(1) unacceptable,
(2) below average,
(3) average,
(4) above average,
(5) exceptional,
(6) not applicable

timeliness.....
quality of writing.....
technical contents.....
logic of arrangement of contents .....
tables, charts, graphs, figures.....
other .....

Q8 I read/use the: *(tick one)*

French text only ❑
English text only ❑
both English and French texts ❑

Q9 Please share any comment on any aspect of the IEC that you would like us to know:

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ISBN 2-8318-6407-0

ICS 65.060.70

Typeset and printed by the IEC Central Office
GENEVA, SWITZERLAND