

INTERNATIONAL STANDARD

IEC
60335-2-91

Second edition
2002-08

Household and similar electrical appliances – Safety –

Part 2-91: **Particular requirements for walk-behind and hand-held lawn trimmers and lawn edge trimmers**

Appareils électrodomestiques et analogues – Sécurité –

Partie 2-91: *Règles particulières pour les coupe-gazon et les coupe-bordures portatifs et à conducteur à pied*



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES –
SAFETY –****Part 2-91: Particular requirements for walk-behind
and hand-held lawn trimmers and lawn edge trimmers**

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.
- 3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
- 4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
- 5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
- 6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

This part of International Standard IEC 60335 has been prepared by 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 1997. It constitutes a technical revision.

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

FDIS	Report on voting
61F/449/FDIS	61F/469/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 (2000) 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 walk-behind and hand-held electric lawn trimmers and lawn edge trimmers.

Where a particular subclause of Part 1 is not mentioned in this part 2, that subclause applies as far as is reasonable. Where 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;

NOTE 3 The following print types are used:

- requirements: in roman type;
- *test specifications: in italic type;*
- notes: in small roman type.

Words in **bold** in the text are defined in Clause 3. When a definition concerns an adjective, the adjective and the associated noun are also in bold.

The committee has decided that the contents of this publication will remain unchanged until 2004. At this date, the publication will be

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

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 2-91: Particular requirements for walk-behind and hand-held lawn trimmers and lawn edge trimmers

1 Scope

This clause of Part 1 is replaced by the following.

This International Standard deals with the safety of mains-operated **walk-behind** and **hand-held lawn trimmers** and **lawn edge trimmers**, with **cutting element(s)** of non-metallic filament line or freely pivoting non-metallic cutter(s), with a kinetic energy of not more than 10 J each, used by a standing operator for cutting grass, their **rated voltage** being not more than 250 V for single-phase appliances and 480 V for other appliances.

NOTE 101 In this standard **hand-held** and **walk-behind lawn trimmers** and **lawn edge trimmers** are referred to collectively as appliances.

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

- the use of appliances by young children or infirm persons without supervision;
- playing with the appliance by young children.

NOTE 102 Attention is drawn to the fact that

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

NOTE 103 This standard does not apply to

- to scissor type or rigid bladed **lawn trimmers** or **lawn edge trimmers**.

2 Normative references

This clause of Part 1 is applicable except as follows.

Addition:

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 5395:1990, *Power lawn-mowers, lawn tractors, lawn and garden tractors, professional mowers and lawn and garden tractors with mowing attachments – Definitions, safety requirements and test procedures*

ISO 11448:1997, *Powered shredders and chippers – Definitions, safety requirements and test procedures*

EN 50144-2-15:2001, *Safety of hand-held electric motor operated tools – Part 2-15: Particular requirements for hedge trimmers*

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

hand-held

portable appliance intended to be held in the hand during normal use, including appliances which will not maintain their operating position unless supported, possibly assisted by wheels, skids or similar

3.102

walk-behind

ground-supported, controlled by an operator walking behind

3.103

lawn trimmer

grass trimming machine where the **cutting means** operates in a plane approximately parallel to the ground

3.104

lawn edge trimmer

grass trimming machine where the **cutting means** operates in a plane approximately perpendicular to the ground

3.105

cutting means

mechanism used to provide the cutting action in which one or more **cutting elements**, cutting by impact, rotate about an axis normal to the cutting plane

3.106

cutting element

single non-metallic filament line or freely pivoting non-metallic cutter

3.107

cutting head

support system for the **cutting element**

4 General requirement

This clause of Part 1 is applicable.

5 General conditions for the tests

This clause of Part 1 is applicable.

6 Classification

This clause of Part 1 is applicable except as follows.

6.1 Replacement:

Appliances shall be of **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:

Walk-behind lawn trimmers and **walk-behind lawn edge trimmers** shall be classified as 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**.

Appliances shall be marked with the substance of the following:

WARNING: Read operator's manual. Wear eye protection. Keep bystanders away.

Additionally, **hand-held lawn trimmers** and **hand-held lawn edge trimmers** shall be marked with the following:

Do not expose to moisture

Symbols according to ISO 3767-1 and ISO 3767-3 may be used as appropriate. Colours shall be in accordance with ISO 3864 unless the symbols are cast, embossed or stamped. Instead of written markings, symbols according to Annex BB are allowed.

7.12 Addition:

An instruction sheet shall be supplied with the appliance.

The instructions shall include

- those warnings required to be marked on the appliance together with further explanation, where appropriate. Where symbols or pictograms are used in the marking on the appliance, their function shall be explained;
- instructions for the proper assembly of the appliance for use, if the appliance is not supplied in a completely assembled form.
- instructions for proper adjustment and maintenance of the appliance, including a warning of the danger of rotating **cutting elements**, for example: "Attention! Danger! - The **cutting elements** continue to rotate after the motor is switched off". Where parts are consumable (e.g. cutter line), the part number of the replacement shall be specified;
- 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 tripping current of not more than 30 mA;
- Instructions on the operation of all controls;

- f) advice on the use and type of extension cords to be used (not lighter than required by 25.7);
- g) the substance of the following, where appropriate:
 - Before use check the supply and extension cord for signs of damage or aging. If the cord becomes damaged during use, disconnect the cord from the supply immediately. DO NOT TOUCH THE CORD BEFORE DISCONNECTING THE SUPPLY. Do not use the appliance if the cord is damaged or worn.
 - Read the instructions carefully. Be familiar with the controls and proper use of the equipment.
 - Keep extension cord away from cutting elements.
 - Wear eye protection.
 - Never allow children or people unfamiliar with these instructions to use the trimmer.
 - Avoid using the trimmer, while people, especially children or pets, are nearby.
 - Use the trimmer only in daylight or good artificial light.
 - Never operate the trimmer with damaged guards or shields, or without guards or shields in place.
 - Switch on the motor only when the hands and feet are away from the cutting means.
 - Never fit metal cutting elements.
 - Use only the manufacturer's recommended replacement parts and accessories.
 - Always disconnect the trimmer from the mains when leaving the trimmer unattended.
 - Disconnect the trimmer from the mains before carrying out maintenance or cleaning work.
 - Inspect and maintain the trimmer regularly. Have the trimmer repaired only by an authorized repairer.
 - Take care against injury from the blade(s) fitted for trimming the filament line length. After extending new cutter line, always return the trimmer to its normal operating position before switching on.
 - Always ensure that the ventilation openings are kept clear of debris.
 - When not in use, store the trimmer out of the reach of children.

8 Protection against access to live parts

This clause of Part 1 is applicable.

9 Starting of motor-operated appliances

This clause of Part 1 is not applicable.

10 Power input and current

This clause of Part 1 is applicable except as follows.

10.1 Not applicable.

11 Heating

This clause of Part 1 is applicable except as follows.

11.7 Replacement:

Appliances are operated until steady conditions are established.

12 Void

13 Leakage current and electric strength at operating temperature

This clause of Part 1 is applicable.

14 Transient overvoltages

This clause of Part 1 is applicable.

15 Moisture resistance

This clause of Part 1 is applicable.

16 Leakage current and electric strength

This clause of Part 1 is applicable.

17 Overload protection of transformers and associated circuits

This clause of Part 1 is applicable.

18 Endurance

This clause of Part 1 is not applicable.

19 Abnormal operation

This clause of Part 1 is applicable except as follows.

19.7 Not applicable.

20 Stability and mechanical hazards

This clause of Part 1 is applicable except as follows.

20.2 Replacement:

All power driven transmission parts (other than the **cutting means**) shall be guarded to prevent the operator's contact with these parts.

The principles set out in Annex AA shall be followed when developing a guarding system.

All guards or shields shall be either permanently attached, or secured to prevent removal without the use of tools, or the construction of the appliance shall be such that it cannot be used without the guard in its guarding position.

Compliance is checked by inspection.

20.101 Guarding of cutting means

20.101.1 Lawn trimmers

Lawn trimmers shall be guarded on the operator's side, as a minimum, to the extent shown in Figure 101.

The radius X of the guard shall not be smaller than the major swept radius of the **cutting head** and the guard shall extend beyond the plane of the **cutting element** by at least 3 mm for **walk-behind lawn trimmers** and 10 mm for **hand-held lawn trimmers**. The guard shall extend at least 45° from the axis of the handle on the side where the **cutting element** is moving away from the operator and at least 90° from the axis of the handle on the side where the **cutting element** is moving towards the operator. The vertices of these angles lie on the axis of the **cutting head** spindle.

If the guarding is less than a total of 360°, the direction of rotation of the **cutting element(s)** shall be marked on the **lawn trimmer**.

Compliance is checked by inspection and measurement.

20.101.2 Lawn edge trimmers

Lawn edge trimmers shall be guarded, as a minimum, to the extent shown in Figure 102. The radius X of the guard shall not be smaller than the major swept radius of the **cutting head**. The guard shall extend beyond the plane of the cutting element by at least 10 mm. With the **lawn edge trimmer** in its normal position of use, the guard shall extend a minimum of 90° from the vertical towards the ground on the side where the **cutting element** is moving upwards and a minimum of 45° from the vertical towards the ground on the side where the **cutting element** is moving downwards. The vertices of these angles lie on the axis of the **cutting head** spindle.

If the guarding is less than a total of 360°, the direction of rotation of the **cutting elements** shall be marked on the **lawn edge trimmer**.

Compliance is checked by inspection and measurement.

20.101.3 Guards shall not be detachable without the use of a tool.

Compliance is checked by inspection.

21 Mechanical strength

This clause of Part 1 is applicable except as follows.

Replace the second paragraph by the following:

*The compliance of **cutting means** guards is checked by the tests of 21.101 and the compliance of **cutting heads** are checked by the tests of 21.102. Other parts of the appliance are checked by applying blows to the appliance by means of the spring-operated impact test apparatus described in IEC 60068-2-75.*

21.101 Strength and rigidity of cutting means guard

21.101.1 The rigidity of the **cutting means** guard is checked by applying a force, at any point, equivalent to the weight of the **lawn trimmer** in the most unfavourable direction for 30 s. Before the test the temperature of the parts to be tested are stabilized to an ambient temperature of $20\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$.

During and after the test, the guard shall not distort or have become detached, nor shall it show any visible cracks. The screws and retaining clips shall still be secure and the requirements of 20.101.1 and 20.101.2 shall still be met.

21.101.2 The strength of **cutting means** guards of **walk-behind lawn trimmers** and **walk-behind lawn edge trimmers** is tested by means of a ball impact test on the part of the guard likely to be the weakest, with the **lawn trimmer** resting on a smooth, rigid surface. Before the test the temperature of the parts to be tested are stabilized to an ambient temperature of $20\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$.

Each of three samples of the complete appliance is subjected to an impact of $6,5\text{ J} \pm 2\text{ J}$ on a part of the guard likely to be the weakest, with the trimmer resting on a smooth, rigid, level surface.

The tests are conducted so that, in each test, the sample receives an impact in a location different from the other two tests.

The impact is produced with a smooth steel sphere (as used for ball bearings) having a diameter of $50\text{ mm} \pm 0,8\text{ mm}$. If the part to be tested is at an angle of up to 45° to the horizontal, the sphere is allowed to fall vertically from rest to strike the part. Otherwise, the sphere is suspended by a cord and is allowed to fall from rest as a pendulum to strike the part. In either case, the vertical travel of the sphere is to be $1\text{ }300\text{ mm} \pm 3\text{ mm}$.

After the tests, the guard shall not have become detached nor shall it show any visible cracks. The screws and retaining clips shall still be secure and the requirements of 20.101.1 and 20.101.2 shall still be met.

21.101.3 The strength of the **cutting means** guards of **hand-held lawn trimmers** and **hand-held lawn edge trimmers** is tested by means of the following drop test.

One sample of the complete appliance is dropped three times so that the guard falls through a vertical distance of $900\text{ mm} \pm 2\text{ mm}$ onto a smooth horizontal concrete surface in such a manner as to test the guard most severely (see Figure 103).

After the tests, the guard shall not have become detached nor shall it show any visible cracks. The screws and retaining clips shall still be secure and the requirements of 20.101.1 and 20.101.2 shall still be met.

21.102 Strength of the cutting head

One sample of the complete appliance is dropped so that the **cutting head**, in a horizontal plane, falls through a vertical distance to make contact with a rigidly supported horizontal steel block. The drop height is $900\text{ mm} \pm 2\text{ mm}$ for **hand-held lawn trimmers** and **hand-held lawn edge trimmers** and $250\text{ mm} \pm 1,2\text{ mm}$ for **walk-behind lawn trimmers** and **walk-behind lawn edge trimmers** (see Figure 104). During this test other parts of the appliance shall be protected, as necessary, against impact.

It is not necessary for the appliance to be operable after the test.

If the appliance is operable, then, immediately following the test, the appliance shall be run at its maximum speed for 30 seconds both with and without **cutting elements**.

*If the appliance is not operable and the **cutting head** is not visibly damaged, all parts of the **cutting head** that are replaceable by the user and which can be transferred are fitted to a new appliance. This new appliance is then run at its maximum speed for 30 s both with and without **cutting elements**.*

No parts shall become detached and no visible cracks shall have developed.

22 Construction

This clause of Part 1 is applicable except as follows.

22.36 Addition:

Hand-held lawn trimmers and **hand-held lawn edge trimmers** shall have at least one handle.

All **hand-held lawn trimmers** and **hand-held lawn edge trimmers** with a mass of more than 3,5 kg shall have two handles and the distance between the centres of the two handles shall be at least 250 mm.

NOTE This measurement of 250 mm does not apply to two handled **lawn trimmers** or **lawn edge trimmers** with a mass of 3,5 kg or less.

Additionally, all **hand-held lawn trimmers** and **hand-held lawn edge trimmers** with a mass of more than 6 kg shall also have at least a single shoulder harness.

The mass of the appliance shall be determined in its heaviest condition of normal use and without cable.

The gripping surface of any handle required by this standard shall be at least 100 mm long.

NOTE If the part containing the motor complies with the 100 mm dimension it may be considered as a handle.

The gripping length of a bail or closed loop handle shall comprise any length that is straight or curved at a radius greater than 100 mm together with any bend radius but not more than 10 mm at either or both ends of the gripping surface.

If a straight handle is supported centrally (i.e. "T" type), the gripping length shall be calculated as follows:

- for handles with a periphery (not including the support) of less than 80 mm, the gripping length shall be the sum of the two parts either side of the support;
- for handles with a periphery (not including the support) of 80 mm or more, the gripping length shall be the complete length from end to end.

Where appropriate the part of the handle containing the **cutting means** control actuator shall be counted as part of the handle gripping length. Finger grip or similar superimposed profiles shall not affect the method of calculating the handle gripping length.

Compliance is checked by inspection and measurement.

22.40 Addition:

A control shall be provided and this shall require two separate and dissimilar actions before the **cutting elements** can be driven, or the control shall be guarded to prevent inadvertent operation. There shall be no means of locking this control in the "on" position and the movement of the **cutting element** shall come to rest when the control is released.

Compliance is checked by inspection and it shall not be possible to operate the control by means of a 100 mm ± 1 mm diameter sphere.

22.101 A cutting means shall consist of one or more non-metallic **cutting elements** mounted on or emerging from a generally circular **cutting head**.

Compliance is checked by inspection.

22.102 A cutting element shall consist of one of the following:

- a) a non-metallic filament line or,
- b) a non-metallic freely pivoting cutter.

Appliances having **cutting means** using one or more **cutting elements** of continuous filament line (e.g. wound on a spool contained either in the **cutting head** or other attachment) shall have incorporated a means to automatically limit the line to its correct operating length after the line has been extended and/or the appliance is operated.

The manufacturer shall not supply metallic **cutting elements** which can replace the non-metallic ones.

Compliance is checked by inspection.

22.103 A cutting element shall have a kinetic energy of not more than 10 J.

*Compliance is checked by inspection, measurement and test. Polyamide **cutting elements** are stored at 20 °C ± 3 °C and at atmospheric humidity for at least seven days before carrying out the test and measurement.*

For the purposes of this standard, the kinetic energy shall be determined by means of the following formula:

$$\text{kinetic energy} = \frac{1}{2} mv^2 \text{ (J)}$$

where

*m is the mass of the measurable length L of the **cutting element**, in kilograms (see Figure 105);*

*v is the maximum attainable velocity of point Z which is half-way along the measurable length L of the **cutting element**, in metres per second.*

Therefore:
$$v = 0,1047 n (r - (L/2))$$

where

n is the maximum rotational speed with a full length of line or a new cutter fitted, in revolutions per minute;

*r is the distance from the axis of rotation of the **cutting head** to the outer tip of the **cutting means**, in metres;*

*L is the measurable length of the **cutting element**, in metres.*

NOTE Tolerances are in accordance with ISO 2768-1.

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 provide full disconnection under overvoltage category III conditions.

25 Supply connection and external flexible cords

This clause of Part 1 is applicable except as follows.

25.1 Addition:

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

25.7 Replace the first paragraph by the following:

Supply cords shall be not lighter than:

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

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).

26 Terminals for external conductors

This clause of Part 1 is applicable.

27 Provision for earthing

This clause of Part 1 is applicable.

28 Screws and connections

This clause of Part 1 is applicable.

29 Clearances, creepage distances and solid insulation

This clause of Part 1 is applicable.

30 Resistance to heat and fire

This clause of Part 1 is applicable except as follows.

30.2.3 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 applicable.

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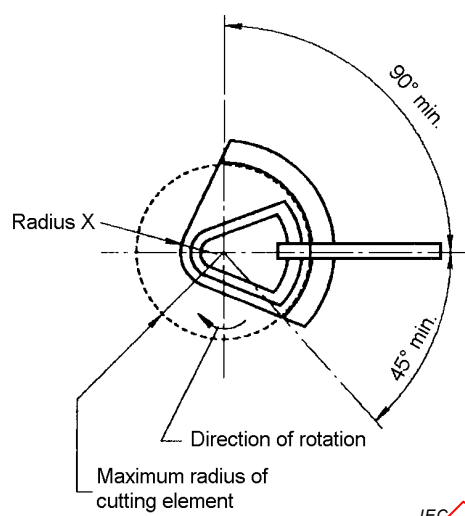


Figure 101a – Plane view

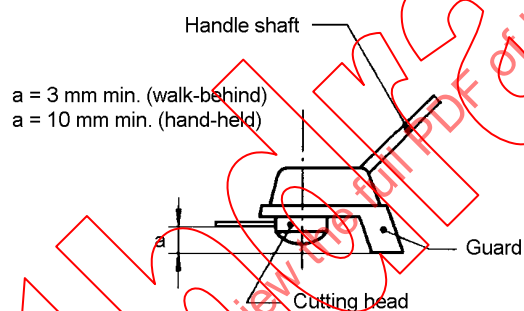


Figure 101b – Side view

NOTE 1 For reasons of clarity, any skids or wheels are not shown on the figure. The figure is not intended to govern design except as regards the dimensions and specific requirements shown.

NOTE 2 Figures are not to scale.

NOTE 3 If the direction of rotation is reversed, the 45° and 90° guard extensions shall be transposed.

Figure 101 – Guard, lawn trimmer

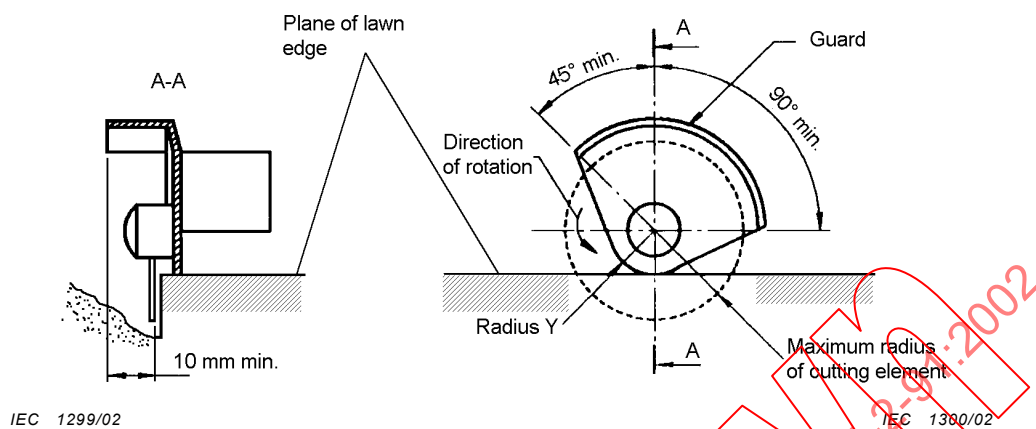


Figure 102a – View towards cutting means

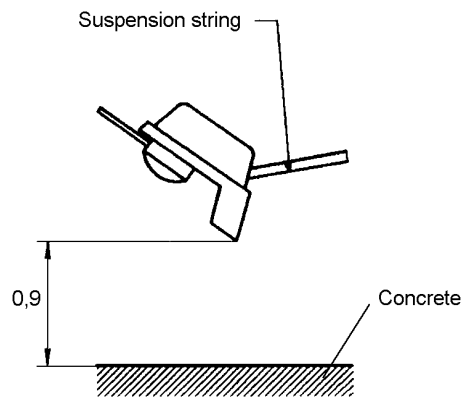
Figure 102b – Part section through axis of guard only

NOTE 1 For reasons of clarity, the handle and any skids or wheels are not shown on the figure. The figure is not intended to govern design except as regards the dimensions and specific requirements shown.

NOTE 2 Figures are not to scale.

NOTE 3 If the direction of rotation is reversed, the 45° and 90° guard extensions shall be transposed.

Figure 102 – Guard, lawn edge trimmer

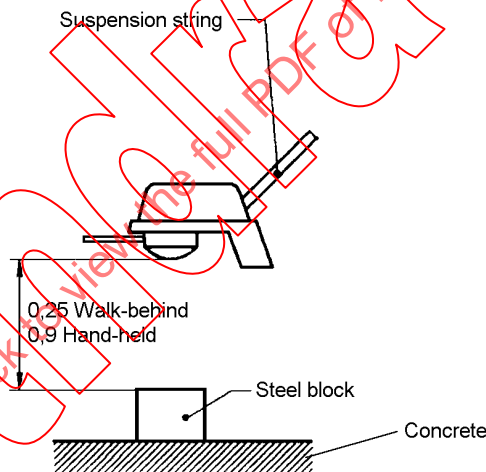


IEC 1301/02

Dimensions in metres

NOTE For the tests a string should be used to suspend the appliance so that the desired orientation of the appliance can be achieved. Cutting the string will allow the appliance to fall in the correct orientation to test the **guard of the cutting head**.

Figure 103 – Guard strength test (hand-held appliances)



IEC 1302/02

Dimensions in metres

NOTE For the tests a string should be used to suspend the appliance so that the desired orientation of the appliance can be achieved. Cutting the string will allow the appliance to fall in the correct orientation to test the **cutting head**.

Figure 104 – Cutting head strength test

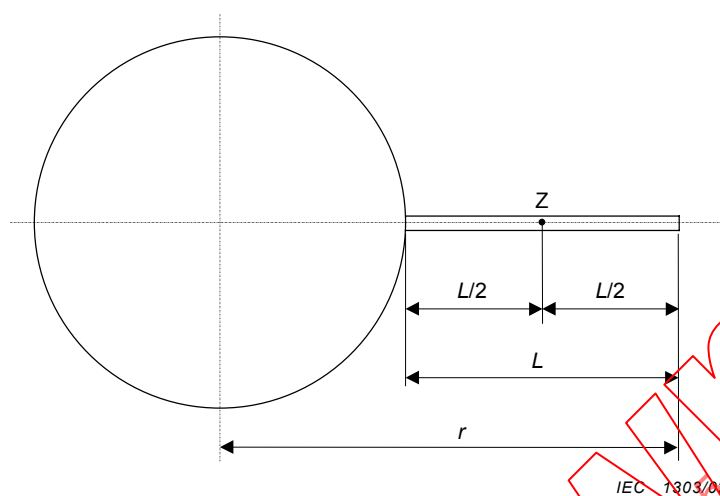


Figure 105a – Filament line

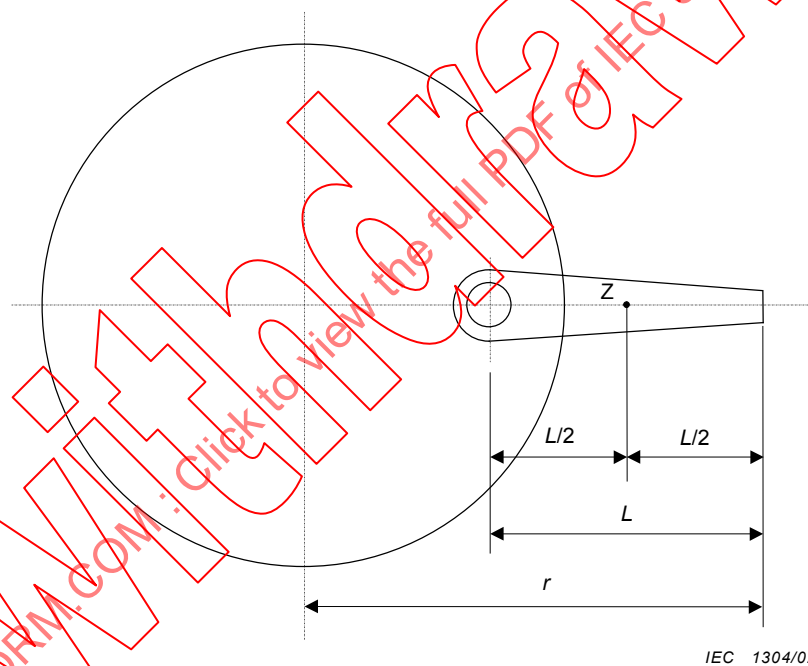


Figure 105b – Pivoting cutter

Figure 105 – Cutting means measurement (see 22.103)

Annexes

The annexes of Part 1 are applicable except as follows.

Annex D

Alternative requirements for protected motors

This annex of Part 1 is not applicable.

Annex I

Motors having basic insulation that is inadequate for the rated voltage of the appliance

This annex of Part 1 is not applicable.

Annex AA (normative)

Principles of guarding

NOTE The drawings in this annex have been taken from ISO 5395.

AA.1 Safety distances from dangerous parts

The safety distance is based on measurements from the location a person can occupy to start, mount or operate the appliance.

In those distances where other guarding requirements do not apply and where safety distances are used to provide personal protection, the clauses of this annex shall be followed.

AA.2 Reach round

When reaching edges in any position, the safety distance of freely articulating body parts is given in Table AA.1.

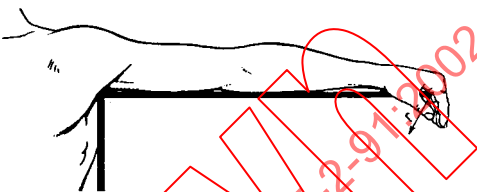
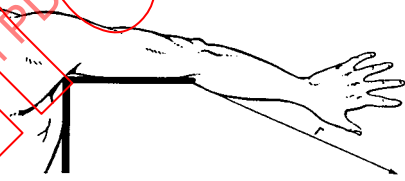
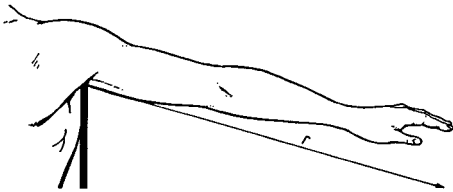
The radius of the movement, r , about a fixed edge is determined by the reach of given body parts. The safety distances assigned should be respected as a minimum if the body part concerned is not to be allowed to reach a danger point.

Of special importance is the danger area which can be reached when these body parts are introduced through slots.

When applying safety distances, it is to be assumed that the basic joint component of the relevant body part is in fixed contact with the edge. The safety distances apply only if it is ensured that further advance or penetration of the body part towards the danger point is excluded.

Table AA.1 – Extent of reach

Dimensions in millimetres

Body part	Safety distance, r mm	Illustration
Hand (from root of finger to fingertip)	≥ 120	
Hand (from waist to fingertip)	≥ 230	
Arm (from elbow to fingertip)	≥ 550	
Arm (from armpit to fingertip)	≥ 850	

AA.3 Reaching in and through elongated openings with parallel sides

Safety distances are given in Table AA.2, where

- a is the smaller dimension of the aperture;
- b is the safety distance to the danger point.