IEC 62841-4-4

Edition 1.1 2024-10
CONSOLIDATED VERSION

INTERNATIONAL STANDARD

colour inside

Electric motor-operated hand-held tools, transportable tools and lawn and garden machinery – Safety –
Part 4-4: Particular requirements for lawn trimmers, lawn edge trimmers, grass trimmers, brush cutters and brush saws

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This consolidated version of the official IEC Standard and its amendment has been prepared for user convenience.

IEC 62841-4-4 edition 1.1 contains the first edition (2020-11) [documents 116/468/FDIS and 116/479/RVD] and its amendment 1 (2024-10) [documents 116/806/FDIS and 116/829/RVD].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough

red text. A separate Final version with all changes accepted is available in this publication.

International Standard IEC 62841-4-4 has been prepared by IEC technical committee 116: Safety of motor-operated electric tools.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

This Part 4-4 is to be used in conjunction with the first edition of IEC 62841-1:2014.

This Part 4-4 supplements or modifies the corresponding clauses in IEC 62841-1, so as to convert it into the IEC Standard: Particular requirements for lawn trimmers, lawn edge trimmers, grass trimmers, brush cutters and brush saws.

Where a particular subclause of Part 1 is not mentioned in this Part 4-4, that subclause applies as far as reasonable. Where this standard states "addition", "modification" or "replacement", the relevant text in Part 1 is to be adapted accordingly.

The following print types are used:

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

The terms defined in Clause 3 are printed in **bold typeface**.

Subclauses, notes, tables and figures which are additional to those in Part 1 as well as Annexes of Part 1, except as described for Annex K and Annex L below, are numbered starting from 101.

Subclauses, notes, tables and figures in Annex K and Annex L which are additional to those in the main body of this Part 4-4 are numbered starting from 301.

A list of all parts of the IEC 62841 series, under the general title: *Electric motor-operated hand-held tools, transportable tools and lawn and garden machinery – Safety*, can be found on the IEC website.

The committee has decided that the contents of this document and its amendment will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

NOTE The attention of National Committees is drawn to the fact that equipment manufacturers and testing organizations may need a transitional period following publication of a new, amended or revised IEC publication in which to make products in accordance with the new requirements and to equip themselves for conducting new or revised tests.

It is the recommendation of the committee that the content of this publication be adopted for implementation nationally not earlier than 36 months from the date of publication.

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

The International Electrotechnical Commission (IEC) draws attention to the fact that it is claimed that compliance with this document may involve the use of patents concerning prevention of inadvertent starting given in Subclause 21.18.101.

IEC takes no position concerning the evidence, validity and scope of this patent right.

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ELECTRIC MOTOR-OPERATED HAND-HELD TOOLS, TRANSPORTABLE TOOLS AND LAWN AND GARDEN MACHINERY – SAFETY –

Part 4-4: Particular requirements for lawn trimmers, lawn edge trimmers, grass trimmers, brush cutters and brush saws

1 Scope

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

Addition:

This document applies to hand-held and **walk-behind lawn trimmers** and **lawn edge trimmers**, used by a standing operator for cutting grass, weeds or similar soft vegetation, and **grass trimmers**, **brush cutters** and **brush saws** used by a standing operator for cutting grass, weeds, brush, bushes, saplings and similar vegetation.

This document does not apply to

– hand-held machines having a mass of 18 kg or greater;
– self-propelled **lawn trimmers** or **lawn edge trimmers**;
– scissors type **lawn trimmers** and **lawn edge trimmers**;
– machines equipped with metallic **cutting accessories** consisting of more than one piece, e.g. pivoting chains or flail blades;
– edgers with rigid and/or metallic cutting devices.

NOTE 101 Freely pivoting non-metallic **cutting elements** are considered not to be rigid cutting devices.

NOTE 102 Edgers with rigid or metal cutting devices will be covered by a future part of IEC 62841-4.

NOTE 103 Annex EE provides an informative summary of characteristics for **lawn trimmers**, **lawn edge trimmers**, **grass trimmers**, **brush cutters** and **brush saws**.

Brush cutters and **brush saws** covered by this document are designed only to be operated with the machine to the right of the operator.

2 Normative references

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

Replacement of undated normative reference for ISO 3744:

ISO 3744:2010, *Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Engineering methods for an essentially free field over a reflecting plane*

Addition:

IEC 60664-3, *Insulation coordination for equipment within low-voltage systems – Part 3: Use of coating, potting or moulding for protection against pollution*

IEC 60664-4, *Insulation coordination for equipment within low-voltage systems – Part 4: Consideration of high-frequency voltage stress*

ISO 354:2003, *Acoustics – Measurement of sound absorption in a reverberation room*

ISO 683-4:2016, *Heat-treatable steels, alloy steels and free-cutting steels – Part 4: Free-cutting steels*

ISO 7918:1995, *Forestry machinery – Portable brush-cutters and grass-trimmers – Cutting attachment guard dimensions*

ISO 11201:2010, *Acoustics – Noise emitted by machinery and equipment – Determination of emission sound pressure levels at a work station and at other specified positions in an essentially free field over a reflecting plane with negligible environmental corrections*

ISO 22867:2021, *Forestry and gardening machinery – Vibration test code for portable hand-held machines with internal combustion engine – Vibration at the handles*

ISO 22868:~~2011~~2021, *Forestry and gardening machinery – Noise test code for portable hand-held machines with internal combustion engine – Engineering method (Grade 2 accuracy)*

3 Terms and definitions

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

3.16 *Addition:*

Note 101 to entry: Interchangeable **attachments** such as a lower shaft assembly or an interchangeable **guard** are considered not to be **detachable parts**.

Addition:

3.101
barrier
device attached to the machine, designed to maintain a minimum distance between the operator and the **cutting accessory** when the machine is being operated

3.102
blade thrust
sudden sideways, forward or backward motion of the machine, which may occur when the **cutting accessory** jams or catches on an object such as a sapling or a tree stump

3.103
brush cutter
machine with a rotating **cutting accessory** intended to cut weeds, scrub, brush, and similar vegetation

Note 101 to entry: See Figure 101.

3.104
brush saw
machine with a rotating circular metal **cutting accessory** having peripheral cutting teeth, designed to cut wood, such as small trees and saplings, by continuously removing material

Note 101 to entry: See Figure 102.

3.105
cutting accessory
rigid cutting device made of metal or plastic, used on **brush cutters** and **brush saws**

3.106
cutting element
single non-metallic filament line or freely pivoting non-metallic cutter

3.107
cutting head
support and retention system for the **cutting means**

Note 101 to entry: **Cutting heads** are used on **lawn trimmers**, **lawn edge trimmers** and **grass trimmers**.

3.108
cutting means
assembly of non-metallic filament line(s) or freely pivoting non-metallic cutter(s) that rotates about an axis perpendicular to the cutting plane, used to provide the cutting action by one or more **cutting elements**

Note 101 to entry: **Cutting means** are used on **lawn trimmers**, **lawn edge trimmers** and **grass trimmers**.

3.109
grass trimmer
machine with a **cutting means**, intended to cut small weeds, grass or similar soft vegetation, where the **cutting means** operates in a plane approximately parallel to the ground

Note 101 to entry: See Figure 103.

3.110
hand-held trimmer
lawn trimmer or **lawn edge trimmer** which is supported by hand, possibly assisted by wheel(s), skids or harness, etc. and constructed such that it cannot maintain its operating position without being held by an operator

3.111
lawn edge trimmer
machine with a **cutting means** for cutting grass or similar soft vegetation where the **cutting means** operates in a plane approximately perpendicular to the ground

Note 101 to entry: See Figure 104.

Note 102 to entry: The maximum kinetic energy for **cutting elements** on **lawn edge trimmers** is specified in 21.101.

3.112
lawn trimmer
machine with a **cutting means** for cutting grass or similar soft vegetation where the **cutting means** operates in a plane approximately parallel to the ground

Note 101 to entry: See Figure 105.

Note 102 to entry: The maximum kinetic energy for **cutting elements** on **lawn trimmers** is specified in 21.101.

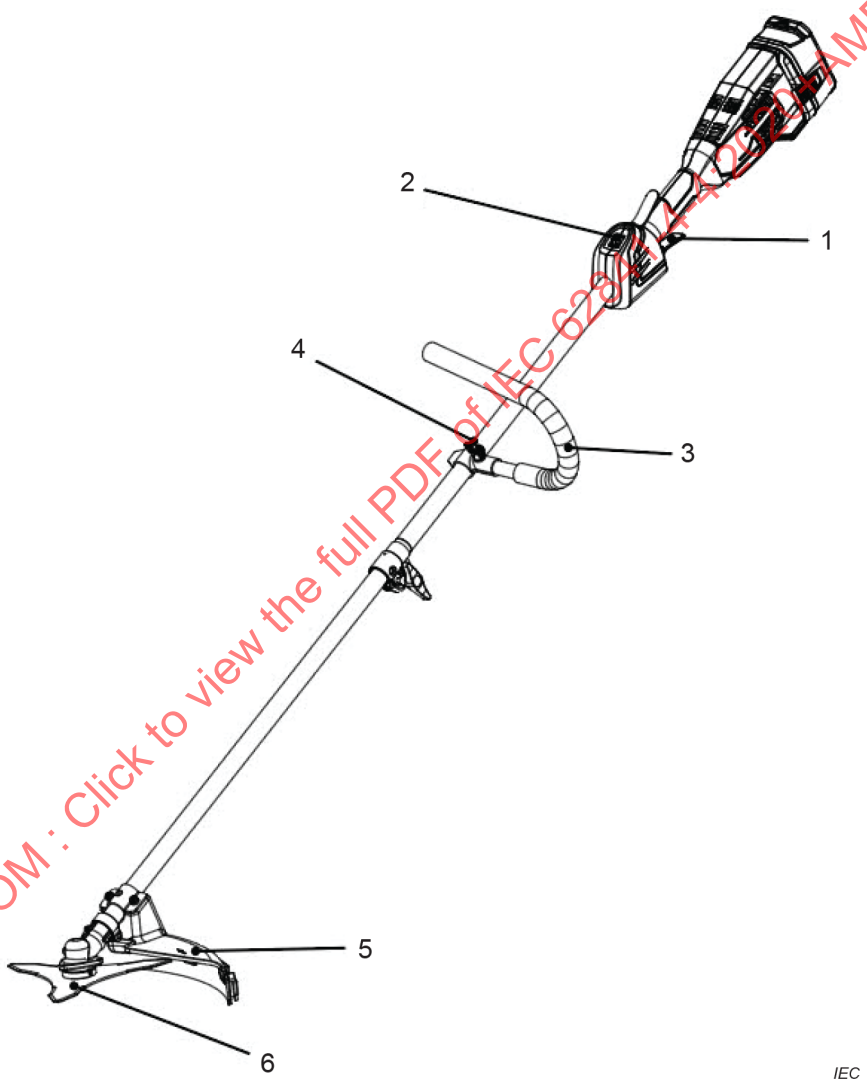
3.113
maximum speed
highest output speed attainable under all conditions of **normal use**, including no load

3.114
operator presence sensor
device to detect the presence of an operator's hand

3.115
shaft
element of the machine that distances the **cutting accessory** or **cutting means** from the handles

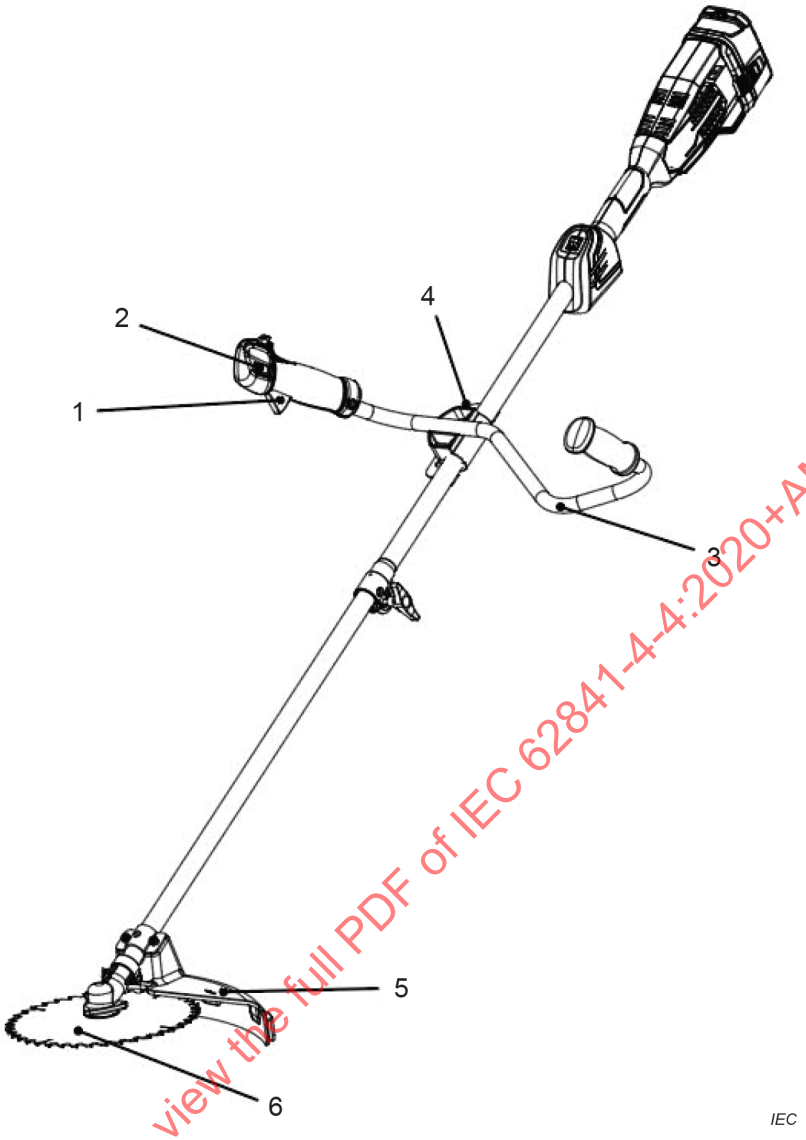
3.116
walk-behind trimmer
lawn trimmer or **lawn edge trimmer** which is ground supported, controlled by an operator walking behind and constructed such that it maintains its operating position without being held by an operator

Note 101 to entry: See Figure 106.



Key
1 **power switch**
2 lock-off device
3 **barrier**
4 suspension point
5 **cutting accessory guard**
6 **cutting accessory**

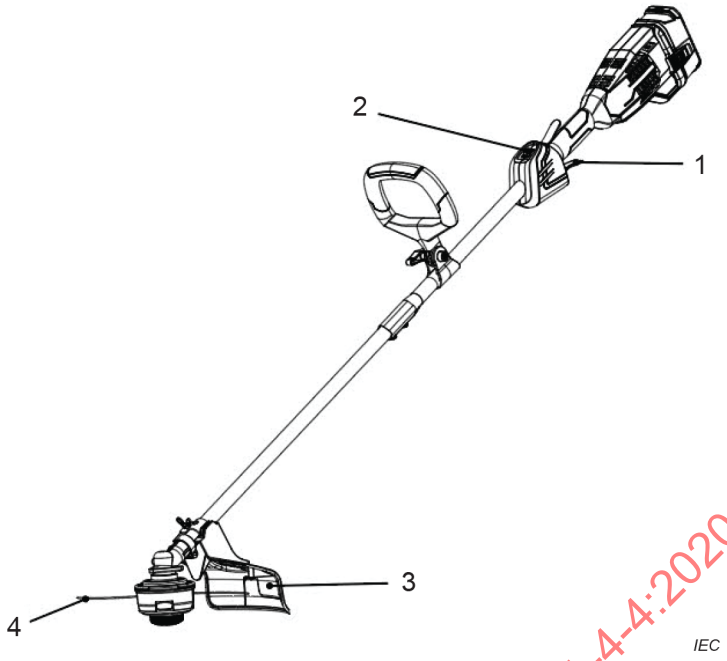
Figure 101 – Example of a brush cutter



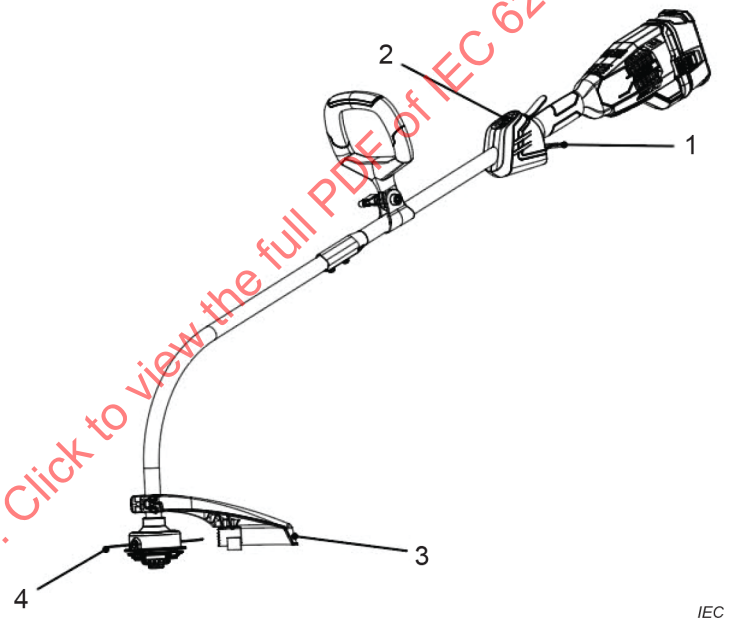
Key

1 **power switch**
2 lock-off device
3 **barrier**
4 suspension point
5 **cutting accessory guard**
6 **cutting accessory**

Figure 102 – Example of a brush saw



a) Grass trimmer with straight shaft

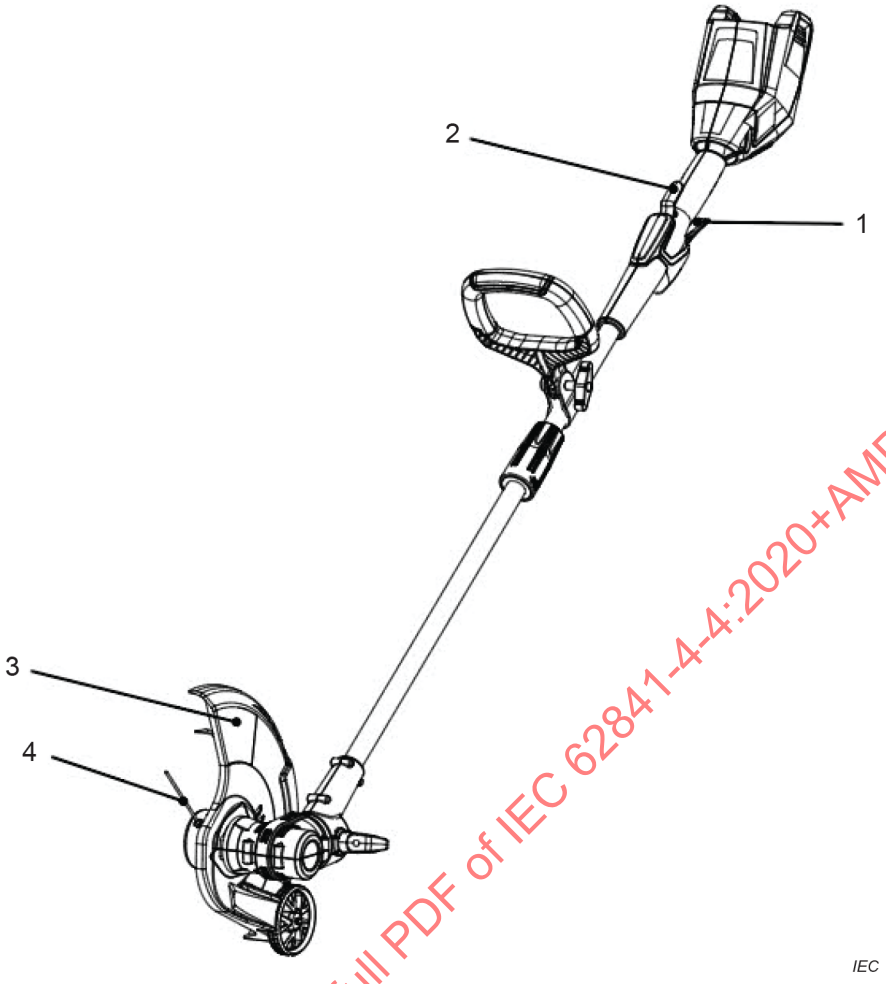


b) Grass trimmer with curved shaft

Key

1 **power switch**
2 lock-off device
3 **cutting means guard**
4 **cutting means**

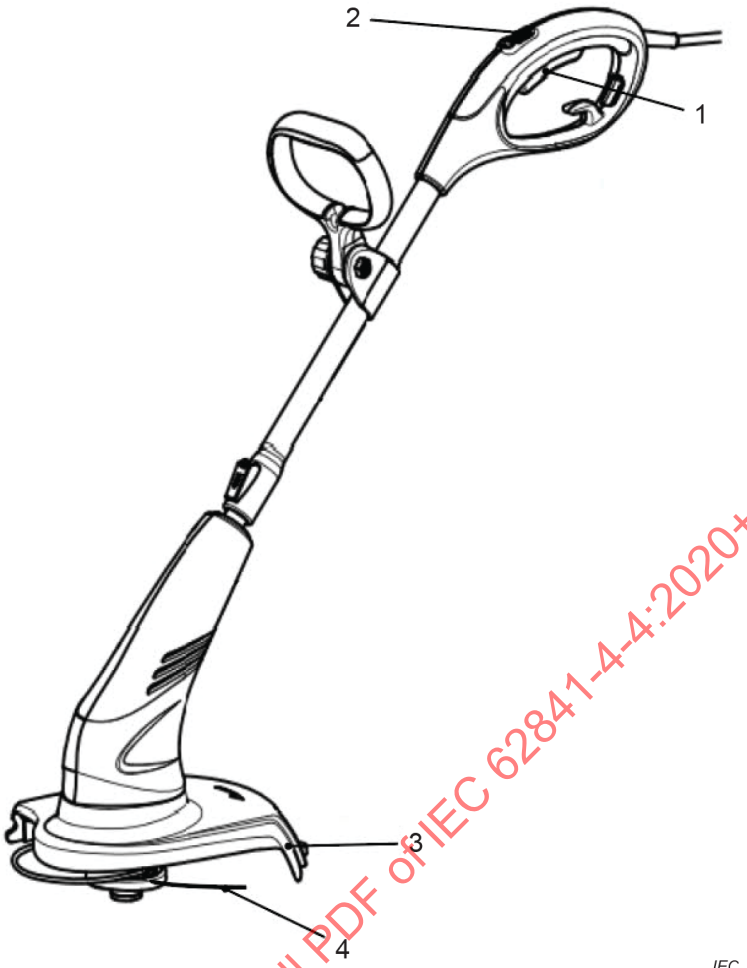
Figure 103 – Examples of grass trimmers



Key

1 **power switch**
2 lock-off device (if any)
3 **cutting means guard**
4 **cutting means**

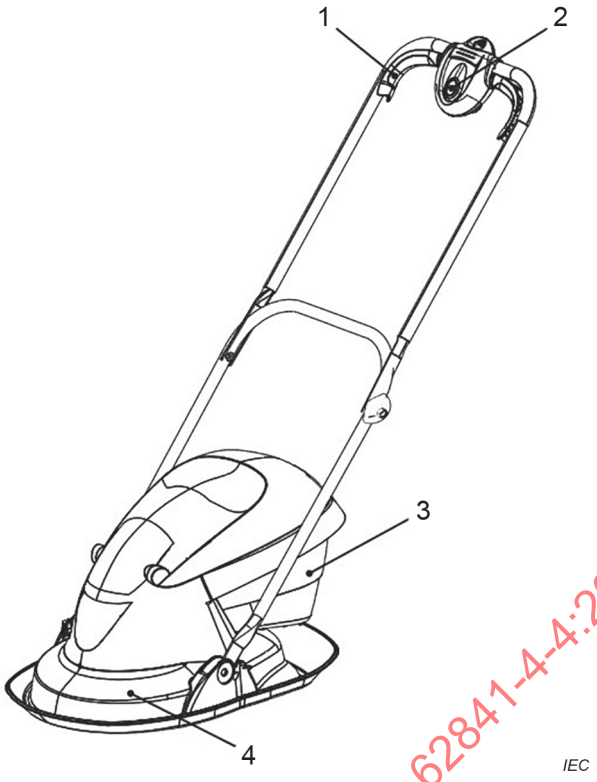
Figure 104 – Example of a lawn edge trimmer



Key

1 **power switch**
2 lock-off device (if any)
3 **cutting means guard**
4 **cutting means**

Figure 105 – Example of a lawn trimmer



Key

1 **power switch**
2 lock-off device (if any)
3 grass catcher (if any)
4 **cutting means guard**

Figure 106 – Example of a walk-behind trimmer

4 General requirements

This clause of Part 1 is applicable.

5 General conditions for the tests

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

5.4 *Addition:*

Handle positions that are used for storage or transportation purposes are not included in this requirement.

5.17 *Addition:*

*For **brush cutters** and **brush saws**, the mass of the machine includes the heaviest **cutting accessory** in accordance with 8.14.2 a) 101) and 8.14.2 a) 104), but excludes the **cutting accessory** cover, harness and hip pad, if any.*

*For **lawn trimmers**, **lawn edge trimmers** and **grass trimmers**, the mass of the machine includes the **cutting head***

- *with freely pivoting non-metallic cutters, if any; and*
- *with a spool for non-metallic filament line, if any;*
- *without the non-metallic filament line, if any;*

*and for **hand-held trimmers**, wheels or skids, if any.*

5.101 *The tests are carried out on the machine as supplied. However, a machine constructed as a single machine but supplied in an unassembled state is tested after assembly in accordance with 8.14.2.*

5.102 *Unless otherwise specified, for Clause 19 and Clause 21, machines are tested in each operating configuration as described in 8.14.2.*

5.103 *For tests that are performed at **maximum speed** and no load, the manufacturer may need to provide special hardware and/or software.*

6 Radiation, toxicity and similar hazards

This clause of Part 1 is applicable.

7 Classification

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

7.1 *Replacement:*

Machines shall be of one of the following classes with respect to protection against electric shock:

class II tool (machine), **class III tool** (machine)

Compliance is checked by inspection and by the relevant tests.

7.2 *Addition:*

Walk-behind trimmers that are a **class II tool** (machine) shall be classified at least as IPX4.

8 Marking and instructions

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

8.1 *Addition:*

Grass trimmers, **brush cutters** and **brush saws** shall be marked with the **maximum speed** of the spindle assigned by the manufacturer.

The **cutting head** for **grass trimmers** and the **cutting accessories** for **brush cutters** and **brush saws** shall be marked with their maximum permitted rotational speed.

8.2.101 Additional safety markings

8.2.101.1 General

Machines shall be marked with cautionary statements or instructions as specified in 8.2.101.2 to 8.2.101.8. A combination of ISO safety signs, such as eye, ear and head protection, is allowed. In addition, a combination of safety signs as specified in Figure AA.1, Figure AA.2 and Figure AA.3 is allowed.

Compliance is checked by inspection.

8.2.101.2 For all machines, unless otherwise specified:

– "Wear eye protection" or a relevant safety sign of ISO 7010 or one of the safety signs specified in Figure AA.4. This marking may be omitted for **walk-behind trimmers** with 360 degree guarding of the **cutting means**;

– "Wear ear protection" or a relevant safety sign of ISO 7010 or the safety sign specified in Figure AA.5. This marking may be omitted if the measured A-weighted emission sound pressure level at the operator position in accordance with Annex I does not exceed 85 dB(A);

– the primary direction of rotation of the spindle, by a legible and durable mark that is visible when operating the machine. This marking may be on the **guard**. This marking may be omitted for **walk-behind trimmers**, machines with no primary direction (i.e. dual direction) of rotation of the spindle, or machines with 360 degree guarding of the **cutting means**.

– "⚠WARNING – Keep bystanders away" or one of the safety signs specified in Figure AA.7;

– safety sign W017 of ISO 7010 (2011-05) in accordance with Table 2, if applicable.

8.2.101.3 For all hand-held machines with a degree of protection of less than IPX4:

– "Do not expose to rain" or the safety sign specified in Figure AA.6.

~~**8.2.101.4** For **lawn trimmers** and **lawn edge trimmers**:~~

~~– "⚠WARNING – Keep bystanders away" or one of the safety signs specified in Figure AA.7.~~

8.2.101.5 For **grass trimmers**, **brush cutters** and **brush saws**:

~~– "⚠WARNING – The distance between the machine and bystanders shall be at least 15 m", where "15 m" may be replaced by either "50 ft" or "15 m (50 ft)" or one of the safety signs specified in Figure AA.8;~~

– "⚠WARNING – Beware of thrown objects", or the safety sign specified in Figure AA.9.

8.2.101.6 For **brush cutters** and **brush saws**:

– "Wear head protection where there is a risk of falling objects" or a relevant safety sign of ISO 7010 or the safety sign specified in Figure AA.10;

– "Wear hand protection" or a relevant safety sign of ISO 7010 or the safety sign specified in Figure AA.11;

– "Wear slip-resistant footwear" or the safety sign specified in Figure AA.12;

– "⚠WARNING – Beware of blade thrust", or one of the safety signs specified in either Figure AA.13 or Figure AA.14.

8.2.101.7 For **grass trimmers** that cannot be converted to a **brush cutter** or **brush saw** in accordance with 8.14.2 a) 104):

– "Do not use metal blades", or the safety sign specified in Figure AA.15.

8.2.101.8 For mains supplied machines:

– "⚠WARNING – Remove plug from the mains immediately if the cable is damaged or cut" or the safety sign specified in Figure AA.16.

8.3.101 For **grass trimmers**, **brush cutters** and **brush saws**, the **cutting head** or **cutting accessory** shall be marked with the following information:

– intended direction of rotation, if any;

– name or trade mark of the manufacturer.

8.3.102 For **grass trimmers**, **brush cutters** and **brush saws**, where the minimum handle distance is not prevented by design, the machine shall be marked with an indication on the machine as to the placement of the handle to meet the minimum handle distance requirement of 19.102.1.2.

~~**8.4** *Replacement of the first paragraph:*~~

~~Markings specified in 8.1 to 8.3 shall not be on a **detachable part** of the machine, except for~~

~~– the marking of the primary direction of rotation of the spindle required in 8.2; and~~

~~– the markings required in 8.2, 8.2.101 and 8.3.101~~

~~which may be on the **guard**.~~

8.6 *Modification of the following unit:*

~~n_0 ..... **maximum speed**~~

n_0 **maximum speed** assigned by the manufacturer in accordance with 8.1

8.12 *Replacement of the first paragraph:*

Markings required by the standard shall be legible and durable. Signs shall be in contrast such as colour, texture, or relief, to their background such that the information or instructions provided by the signs are clearly legible when viewed with normal vision from a distance of

(500 ± 50) mm. Signs need not be in accordance with the colour requirements of ISO 3864-2. If markings are embossed, stamped, etched, engraved or moulded, contrasting colours are not required.

8.14.1 *Addition:*

The additional safety instructions as specified in 8.14.1.101 to 8.14.1.103 shall be given. This part may be printed separately from the "General Machine Safety Warnings".

NOTE 101 "General Machine Safety Warnings" are referred to as "General Power Tool Safety Warnings" in Part 1.

8.14.1.1 *Addition for item 2) c):*

For machines classified at least IPX4, the warning may be replaced as specified below.

c) **Do not operate the machine in rain or wet conditions.** *Water entering the machine may increase the risk of electric shock or malfunction that could result in personal injury.*

8.14.1.101 Lawn trimmer and lawn edge trimmer safety warnings

a) **Do not use the machine in bad weather conditions, especially when there is a risk of lightning.** *This decreases the risk of being struck by lightning.*

b) **Thoroughly inspect the area for wildlife where the machine is to be used.** *Wildlife may be injured by the machine during operation.*

c) **Thoroughly inspect the area where the machine is to be used and remove all stones, sticks, wires, bones, and other foreign objects.** *Thrown objects can cause personal injury.*

d) **Before using the machine, always visually inspect to see that the cutter and the cutter assembly are not damaged.** *Damaged parts increase the risk of injury.*

e) **Before use, check the supply cord and any extension cord for signs of damage or aging. Do not use the machine if the cord is damaged or worn. If the cord is damaged or worn during use, switch off the machine and do not touch the cord before disconnecting it from the supply.** *A damaged supply cord or extension cord may result in electric shock, fire and/or serious injury.*

f) **Check the grass collector frequently for wear or deterioration.** *A worn or damaged grass collector may increase the risk of personal injury*.

NOTE 101 The warning in item f) above is omitted if the machine does not have a provision for fitting a grass collector.

NOTE 102 The term "collector" can be replaced by the term "catcher" or "bag".

g) **Keep guards in place. Guards must be in working order and be properly mounted.** *A guard that is loose, damaged, or is not functioning correctly may result in personal injury*.

h) **Keep all cooling air inlets clear of debris.** *Blocked air inlets and debris may result in overheating or risk of fire*.

i) **Wear eye protection and ear protection.** *Adequate protective equipment will reduce personal injury.*

NOTE 103 The ear protection portion of the warning can be omitted if the measured A-weighted emission sound pressure level at the operator's ear in accordance with Annex I does not exceed 85 dB(A).

NOTE 104 The eye protection portion of the warning can be omitted for **walk-behind trimmers** with 360 degree guarding of the **cutting means**.

NOTE 105 The warning in item i) is omitted for **walk-behind trimmers** with 360 degree guarding of the **cutting means** and where the measured A-weighted emission sound pressure level at the operator's ear in accordance with Annex I does not exceed 85 dB(A).

j) **While operating the machine, always wear non-slip and protective footwear. Do not operate the machine when barefoot or wearing open sandals.** *This reduces the chance of injury to the feet from contact with the moving cutter.*

k) **Always wear clothing such as trousers that covers the operator's legs while operating the machine.** *Contact with the moving cutter or line may cause injury.*

l) **Keep bystanders away while operating the machine.** *Thrown debris can result in serious personal injury.*

m) **Do not operate the machine above waist height.** *This helps prevent unintended cutter contact and enables better control of the machine in unexpected situations.*

n) **Exercise caution when operating the machine in wet grass. Walk, never run.** *This reduces the risk of slipping and falling which may result in personal injury.*

o) ~~**Do not operate the machine on excessively steep slopes.** *This reduces the risk of loss of control, slipping and falling which may result in personal injury.*~~

p) **When working on slopes, always be sure of your footing, always work across the face of slopes, never up or down and exercise extreme caution when changing direction.** *This reduces the risk of loss of control, slipping and falling which may result in personal injury.*

q) **Keep all power cords and cables away from cutting area**. *Power cords or cables may be hidden in hedges or bushes and can be accidentally cut or damaged by the line or cutter.*

r) **Keep all parts of the body away from the moving trimmer cutter or line. Do not clear material from the machine until it has been disconnected from the power source.** *The moving trimmer cutter or line may result in serious personal injury.*

s) **Carry the machine with the machine switched off and away from your body.** *Proper handling of the machine will reduce the likelihood of accidental contact with a moving trimmer cutter or line.*

t) **Only use replacement cutting heads and trimmer cutters or lines specified by the manufacturer. Do not replace the trimmer cutters or lines with metal wires or blades.** *Incorrect replacement parts may cause loss of control, breakage and injury.*

8.14.1.102 Grass trimmer, brush cutter and brush saw safety warnings

a) **Do not use the machine in bad weather conditions, especially when there is a risk of lightning.** *This decreases the risk of being struck by lightning.*

b) **Thoroughly inspect the area for wildlife where the machine is to be used.** *Wildlife may be injured by the machine during operation.*

c) **Thoroughly inspect the area where the machine is to be used and remove all stones, sticks, wires, bones, and other foreign objects.** *Thrown objects can cause personal injury.*

d) **Before using the machine, always visually inspect to see that the cutter or blade and the cutter or blade assembly are not damaged.** *Damaged parts increase the risk of injury.*

e) **Before use, check the supply cord and any extension cord for signs of damage or aging. Do not use the machine if the cord is damaged or worn. If the cord is damaged or worn during use, switch off the machine and do not touch the cord before disconnecting it from the supply.** *A damaged supply cord or extension cord may result in electric shock, fire and/or serious injury.*

f) **Follow instructions for changing accessories.** *Improperly tightened blade securing nuts or bolts may either damage the blade or result in it becoming detached.*

g) **The rated rotational speed of the blade must be at least equal to the maximum rotational speed marked on the machine.** *Blades running faster than their rated rotational speed can break and fly apart.*

NOTE 101 This warning is omitted for **grass trimmers** that cannot be converted to a **brush cutter** or a **brush saw** in accordance with 8.14.2 a) 104).

NOTE 102 It is possible to replace the term "blade" with the term "cutter".

h) ~~**Wear eye, ear, head and hand protection.** *Adequate protective equipment will reduce personal injury by flying debris or accidental contact with the cutting line or blade.*~~

NOTE 103 The ear protection portion of the warning can be omitted if the measured A-weighted emission sound pressure level at the operator's ear in accordance with Annex I does not exceed 85 dB(A).

i) **While operating the machine, always wear non-slip and protective footwear. Do not operate the machine when barefoot or wearing open sandals.** *This reduces the chance of injury to the feet from contact with the moving ~~cutters or lines~~ cutter line or blade.*

~~NOTE 104 This warning is applicable for **grass trimmers** that cannot be converted to a **brush cutter** or **brush saw** in accordance with 8.14.2 a) 104).~~

j) ~~**While operating the machine, always wear safety footwear. Do not operate the machine when barefoot or wearing open sandals.** *This reduces the chance of injury to the feet from contact with a moving cutter, line or blade.*~~

~~NOTE 105 This warning is applicable for **brush cutters**, **brush saws** and **grass trimmers** that can be converted to a **brush cutter** or **brush saw** in accordance with 8.14.2 a) 104).~~

k) **While operating the machine, always wear long trousers.** *Exposed skin increases the likelihood of injury from thrown objects.*

l) **Keep bystanders away while operating the machine.** *Thrown debris can result in serious personal injury*.

m) **Always use two hands when operating the machine.** *Holding the machine with both hands will avoid loss of control.*

n) **Hold the machine by insulated gripping surfaces only, because the cutting line or blade may contact hidden wiring or its own cord.** *Cutting line or blades contacting a "live" wire may make exposed metal parts of the machine "live" and could give the operator an electric shock.*

o) **Always keep proper footing and operate the machine only when standing on the ground.** *Slippery or unstable surfaces may cause a loss of balance or control of the machine.*

p) **Do not operate the machine on excessively steep slopes.** *This reduces the risk of loss of control, slipping and falling which may result in personal injury.*

q) **When working on slopes, always be sure of your footing, always work across the face of slopes, never up or down and exercise extreme caution when changing direction.** *This reduces the risk of loss of control, slipping and falling which may result in personal injury.*

r) **Keep the supply cord away from the cutter, line or blade.** *A damaged supply cord may result in electric shock, fire and/or serious injury.*

NOTE 106 It is possible to replace the term "blade" with the term "cutter".

s) **Keep all parts of the body away from the cutter, line or blade when the machine is operating. Before you start the machine, make sure the cutter, line or blade is not contacting anything.** *A moment of inattention while operating the machine may result in injury to yourself or others.*

t) **Do not operate the machine above waist height.** *This helps prevent unintended cutter or blade contact and enables better control of the machine in unexpected situations.*

u) **When cutting brush or saplings that are under tension, be alert for spring back**. *When the tension in the wood fibres is released, the brush or sapling may strike the operator and/or throw the machine out of control.*

v) **Use extreme caution when cutting brush and saplings**. *The slender material may catch the blade and be whipped toward you or pull you off balance.*

w) **Maintain control of the machine and do not touch cutters, lines or blades and other hazardous moving parts while they are still in motion.** *This reduces the risk of injury from moving parts.*

x) **When clearing jammed material or servicing the machine, make sure all power switches are off and the power cord is disconnected.** *Unexpected starting of the machine while clearing jammed material or servicing may result in serious personal injury.*

y) **Carry the machine with the machine switched off and away from your body.** *Proper handling of the machine will reduce the likelihood of accidental contact with a moving cutter, line or blade.*

z) **When transporting or storing the machine, always fit the cover on metal blades.** *Proper handling of the machine will reduce the likelihood of accidental contact with the blade.*

NOTE 107 This warning is omitted for **grass trimmers** that cannot be converted to a **brush cutter** or **brush saw** in accordance with 8.14.2 a) 104).

aa) **Only use replacement cutters, lines, cutting heads and blades specified by the manufacturer.** *Incorrect replacement parts may increase the risk of breakage and injury.*

8.14.1.103 Blade thrust causes and related warnings

NOTE 101 The verbatim text of this subclause is omitted for **lawn trimmers**, **lawn edge trimmers** and **grass trimmers** that cannot be converted to a **brush cutter** or a **brush saw** in accordance with 8.14.2 a) 104).

Blade thrust is a sudden sideways, forward or backward motion of the machine, which may occur when the blade jams or catches on an object such as a sapling or a tree stump. It can be violent enough to cause the machine and/or operator to be propelled in any direction, and possibly lose control of the machine.

Blade thrust and its related hazards can be avoided by taking proper precautions as given below.

a) **Maintain a firm grip with both hands on the machine and position your arms to resist blade thrust. Position your body to the left side of the machine.** *Blade thrust can increase the risk of injury due to the machine moving unexpectedly. Blade thrust can be controlled by the operator if proper precautions are taken.*

b) **If the blade binds, or when interrupting a cut for any reason, switch the machine off and hold the machine motionless in the material until the blade comes to a complete stop. While the blade is binding, never attempt to remove the machine from the material or pull the machine backward while the blade is in motion, otherwise blade thrust may occur.** *Investigate and take corrective actions to eliminate the cause of blade binding.*

c) **Do not use blunt or damaged blades.** *Blunt or damaged blades increase the risk of jamming or catching on an object, resulting in blade thrust.*

d) **Always maintain good visibility of the material being cut.** *Blade thrust is more likely to occur in areas where it is difficult to see the material being cut.*

e) **If you are approached by another person while operating the machine, switch the machine off.** *There is an increased risk of injury to other persons being struck by the moving blade in the event of blade thrust.*

8.14.2 a) *Addition:*

For **lawn trimmers** and **lawn edge trimmers**:

101) Instructions for configuring the machine for each intended use, including handles, **guards**, grass catcher (if any) or **cutting means** adjustment;

102) Instructions on which types of **accessories** and **guards** to be used for the intended applications of the machine;

For **grass trimmers**, **brush cutters** and **brush saws**, according to the type of supplied **cutting accessory**:

103) Explanation of the safety devices that the **grass trimmer**, **brush cutter** or **brush saw** incorporates as part of the original equipment;

104) Instructions for configuring the machine for each intended use, as applicable, including any handle(s), **guard**, **barrier**, **cutting means** or **cutting accessory** adjustment, as applicable, and the method to reconfigure the machine, if applicable;

105) Instruction that the **cutting accessory guard** and handle adjustments should be made with the motor stopped and disconnected from the mains supply or **battery** removed;

106) Instructions on which combinations of **cutting means**, **cutting accessories** and **guards** to be used for the intended applications of the machine.

8.14.2 b) *Addition:*

101) Advice to inspect machine for damage upon striking a hard object or if there appears to be excessive vibration;

102) Recommendation for the use of a **residual current device** with a tripping current of 30 mA or less;

103) Instruction to keep hands away from any sharp device intended to limit the length of the filament line, if any;

104) Instruction on how to extend and/or replace **cutting element**(**s**), **cutting means** or **cutting accessory**, as applicable;

105) Instruction to secure the locking device(s) of any adjustable elements (e.g. extendable **shafts** and/or pivoting elements), if any;

106) Instruction on the normal position of use of the machine;

107) Instructions on starting and stopping techniques, with particular reference to safety;

108) Instructions on cutting techniques, including the materials that can be cut;

109) Instructions for the use and adjustment of handles;

110) Instructions for the use and adjustment of any provided shoulder harness in accordance with 21.106 and instructions for release or removal; if any;

111) Instructions not to simultaneously wear multiple belt harnesses or multiple shoulder harnesses;

112) Instructions, that when wearing a harness, no other wearable interferes with the release and removal of the harness;

113) Instructions on how to avoid situations which may be encountered while performing typical tasks, such as blockage of the **cutting accessory** or **cutting head**;

114) Instructions on how to clear blockages of the **cutting accessory** or **cutting head**;

115) Instruction to position the **supply cord** so that it will not be cut or caught on objects during operation;

116) Information on the **maximum speed** of the spindle assigned by the manufacturer, if required to be marked in accordance with 8.1;

8.14.2 c) *Addition:*

101) Advice to keep any ventilation openings clear of debris;

102) Recommendations for cleaning and maintenance before storage;

103) Instructions on the selection of replacement **cutting elements**, **cutting means**, **cutting heads** or **cutting accessories**, as applicable;

Additionally, for **brush cutters** and **brush saws**:

104) Instructions on sharpening and maintenance of the **cutting accessory** and/or a recommendation to have sharpening and maintenance of the **cutting accessory** performed by authorised service centres, with particular emphasis on the effects of **blade thrust** behaviour that may result if specifications are not followed. Or as an alternative, **cutting accessory** sharpening techniques, including the use of gloves;

105) Instruction on how to use the **cutting accessory** cover.

Replacement of NOTE:

NOTE In Europe (EN 62841-4-4), the following additional requirements apply:

Emissions

1) The noise emission, measured in accordance with Clause I.2, as follows:
   - A-weighted emission sound pressure level L_{pA} and its uncertainty K_{pA}, where L_{pA} exceeds 70 dB(A). Where L_{pA} does not exceed 70 dB(A), this fact shall be indicated;
   - for **lawn trimmers** and **lawn edge trimmers**, the A-weighted measured and guaranteed sound power levels L_{WA};
   - for **grass trimmers, brush cutters** and **brush saws**, the A-weighted sound power level L_{WA} and its uncertainty K_{WA}, where the A-weighted sound pressure level L_{pA} exceeds 80 dB(A);
   - C-weighted peak emission sound pressure value L_{pCpeak}, where this exceeds 63 Pa (130 dB in relation to 20 µPa).
2) Recommendation for the operator to wear hearing protection.
3) The vibration total value and its uncertainty measured in accordance with Clause I.3.

   When the vibration total value does not exceed 2,5 m/s^2, this shall be stated.

   When the vibration total value exceeds 2,5 m/s^2, its value shall be given in the instructions.
4) The following information:
   - that the declared vibration total value(s) has been measured in accordance with a standard test method and may be used for comparing one machine with another;
   - that the declared vibration total value(s) may also be used and the declared noise emission value(s) may also be used in a preliminary assessment of exposure.
5) A warning:
   - that the vibration emission during actual use of the machine can differ from the declared total value depending on the ways in which the machine is used; and
   - of the need to identify safety measures to protect the operator that are based on an estimation of exposure in the actual conditions of use (taking account of all parts of the operating cycle such as the times when the machine is switched off and when it is running idle in addition to the trigger time).

8.14.3 *Replacement:*

If information about the mass or weight of the machine is provided, it shall be

- for **lawn trimmers**, **lawn edge trimmers** and **grass trimmers**, the mass specified in 5.17; and
- for **brush cutters** and **brush saws**, the mass without the **cutting accessory**, **cutting accessory** cover, harness and hip pad, if any.

Compliance is checked by inspection.

9 Protection against access to live parts

This clause of Part 1 is applicable.

10 Starting

This clause of Part 1 is applicable.

11 Input and current

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

Addition:

*For **lawn trimmers**, **lawn edge trimmers** and **grass trimmers**, the **cutting head** is fitted for this test, but **cutting elements** are removed.*

*For **brush cutters** and **brush saws**, the **cutting accessory** is removed for this test.*

12 Heating

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

12.2 *Replacement:*

*For machines with one or more **rated voltages**, the machine is operated at each **rated voltage** under the load conditions specified in 12.2.1. Without any further alteration of the applied torque, the voltage is then adjusted to 0,94 times the **rated voltage** and 1,06 times the **rated voltage**.*

The temperatures are measured at the most unfavourable of the two voltage settings. The temperatures that are measured by means of thermocouples are taken while the machine is operating.

*For machines with a **rated voltage range**, the machine is operated*

– *at the lower limit of the **rated voltage range**, under the load conditions specified in 12.2.1, and without any further alteration of the applied torque, the voltage is then adjusted to 0,94 times the lower limit of the **rated voltage range**;*

and

– *at the upper limit of the **rated voltage range**, under the load conditions specified in 12.2.1, and without any further alteration of the applied torque, the voltage is then adjusted to 1,06 times the upper limit of the **rated voltage range**.*

The temperatures are measured at the most unfavourable of the two voltage settings. The temperatures that are measured by means of thermocouples are taken while the machine is operating.

12.2.1 *Replacement:*

The load conditions for the heating test of 12.2 are as follows:

The machine is loaded by the application of a torque until thermal equilibrium is reached.

*For **lawn trimmers**, **lawn edge trimmers** and **grass trimmers** that cannot be converted to a **brush cutter** or **brush saw** in accordance with 8.14.2 a) 104), at the manufacturer's discretion, the torque may be applied by either*

– *an external load; or*

– *extending or modifying the **cutting elements***

*such that when supplied at **rated voltage** the machine operates at **rated input** or **rated current**.*

*For **brush cutters**, **brush saws** and **grass trimmers** that can be converted to a **brush cutter** or **brush saw** in accordance with 8.14.2 a) 104), the torque is applied by means of an external load such that when supplied at **rated voltage** the machine operates at **rated input** or **rated current**.*

Replacement of Table 2:

Table 2 – Maximum outside surface temperature rises

Parts	Temperature rise[a] K
External enclosure, except handles held in **normal use**	60
Handles, knobs, grips, and the like which, in **normal use**, are continuously held:	
– of metal	30
– of porcelain or vitreous material	40
– of moulded material, rubber or wood	50
Handles, knobs, grips, and the like which, in **normal use**, are held for short periods only (e.g. switches):	
– of metal	35
– of porcelain or vitreous material	45
– of moulded material, rubber or wood	60
[a] Temperature rise limits are not applicable to the **cutting means** or **cutting accessory** drive enclosure, if it is marked with the safety sign W017 of ISO 7010 (2011-05).	

13 Resistance to heat and fire

This clause of Part 1 is applicable.

14 Moisture resistance

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

14.2 *Replacement of the first paragraph:*

The enclosure of the machine shall provide the degree of protection against moisture in accordance with the marking (other than IPX0) of the machine.

14.2.1 *Replacement:*

The machine is not connected to the supply. Machines fitted with an appliance inlet or cable coupler shall be tested without the mating connector in place.

*For a **walk-behind trimmer**, the machine is placed on a non-perforated turntable. The front to rear centreline of the machine is aligned with the pivot axis of the oscillating tube at the start of test.*

*For a **hand-held tool** (machine), the machine is placed in its normal rest position on a perforated turntable.*

The turntable is turned continuously at (1 ± 0,1) r/min.

***Detachable parts** are removed and subjected, if necessary, to the relevant treatment with the main part. Movable covers that are non-**detachable parts** and are not self-restoring are placed in the most unfavourable position.*

NOTE Examples of self-restoring covers include those that are spring loaded or close by gravity.

Air filters are not removed.

14.2.2 *Replacement of the last paragraph:*

*Immediately after the appropriate treatment, the machine shall withstand the electric strength test of Annex D between **live parts** and **accessible parts**, the test voltage being 2 500 V. Then the machine is connected to the supply. It shall not start with the **power switch** in the "off" position.*

*Afterwards, inspection shall show that there is no trace of water on insulation which could result in a reduction of **creepage distances** between bare conductors of different potential below the values specified in 28.1. For all instances where **creepage distances** could be reduced below the values specified in 28.1, a short circuit is introduced between adjacent conductors simultaneously. The machine is then evaluated for*

– *the risk of fire in accordance with item a) of 18.6.1; and*
– *the loss of any **SCF**, unless the machine is rendered into a safe state.*

15 Resistance to rusting

This clause of Part 1 is applicable.

16 Overload protection of transformers and associated circuits

This clause of Part 1 is applicable.

17 Endurance

This clause of Part 1 is applicable except as follows:

17.2 *Replacement:*

***Lawn trimmers**, **lawn edge trimmers** and **grass trimmers** are operated at **maximum speed**, with the **cutting means** adjusted to the maximum cutting length, if applicable.*

***Hand-held trimmers** are operated for 15 h at a voltage equal to 1,1 times the highest **rated voltage** or 1,1 times the upper limit of the **rated voltage range**, and then for 15 h at a supply voltage equal to 0,9 times the lowest **rated voltage** or 0,9 times the lower limit of the **rated voltage range**. The machine may be operated for a number of periods in order to achieve the 15 h operating time. For machines that can be operated in various positions in accordance with 8.14.2, the test may be conducted in any single orientation or distributed in various orientations for each 15 h test duration.*

***Walk-behind trimmers** are operated for 15 h at a voltage equal to 1,1 times the highest **rated voltage** or 1,1 times the upper limit of the **rated voltage range**, and then for 15 h at a supply voltage equal to 0,9 times the lowest **rated voltage** or 0,9 times the lower limit of the **rated voltage range**. The machine may be operated for a number of periods in order to achieve the 15 h operating time. During the test, the machine is placed in its normal operating position according to 8.14.2.*

***Grass trimmers**, **brush cutters** and **brush saws** are fitted with the **cutting means** or **cutting accessory**, as applicable, that results in the highest power input. The machine is then operated at **maximum speed** for 24 h at a voltage equal to 1,1 times the highest **rated voltage** or 1,1 times the upper limit of the **rated voltage range**, and then for 24 h at a supply voltage equal to 0,9 times the lowest **rated voltage** or 0,9 times the lower limit of the **rated voltage range**. The machine may be operated for a number of periods in order to achieve the 24 h operating time.*

During this test, replacement of the carbon brushes is allowed, and the machine is oiled and greased in accordance with 8.14.2 c) 1). If mechanical failure occurs and does not impair compliance with this standard, the part that failed may be replaced.

If the temperature rise of any part of the machine exceeds the temperature rise determined during the test of 12.1, forced cooling or rest periods may be applied, the rest periods being excluded from the specified operating time. If forced cooling is applied, it shall not alter the air flow of the machine or redistribute carbon deposits.

During these tests, overload protection devices incorporated in the machine shall not activate.

18 Abnormal operation

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

18.3 *Replacement:*

***Lawn trimmers**, **lawn edge trimmers** and **grass trimmers** incorporating a series motor are operated at a voltage equal to 1,3 times **rated voltage** for 1 min at no-load with the spool empty of any filament line and with any freely pivoting **cutting means** removed.*

***Brush cutters** and **brush saws** incorporating a series motor are operated at a voltage equal to 1,3 times **rated voltage** for 1 min at no-load with the **cutting accessory** removed.*

During the test, parts shall not be ejected from the machine. After this test, the machine need not be capable of further use.

An additional device incorporated in the machine to limit the speed may operate during the test.

18.5 *Replacement:*

Protection against electric shock shall not be impaired when a **class II tool** is subjected to running overload conditions.

*For **lawn trimmers**, **lawn edge trimmers** and **grass trimmers** that cannot be converted to a **brush cutter** or **brush saw** in accordance with 8.14.2 a) 104), with*

- *motors having electronically commutated stator windings, compliance is checked by the test of 18.5.4;*
- *series motors, compliance is checked by the test of 18.5.1;*
- *other motors, compliance is checked by the test of 18.5.3.*

*For **brush cutters**, **brush saws** and **grass trimmers** that can be converted to a **brush cutter** or **brush saw** in accordance with 8.14.2 a) 104), with*

- *motors having electronically commutated stator windings, compliance is checked by the test of 18.5.4;*
- *other motors, compliance is checked by the test of 18.5.3.*

18.5.1 *Addition:*

*The method described in 12.2.1 may be used to achieve the load of 160 % of **rated current**.*

18.5.2 This subclause of Part 1 is not applicable.

18.8 *Replacement of Table 4 by the following:*

Table 4 – Required performance levels

Type and purpose of SCF		Minimum performance level (PL)
Power switch – prevent unwanted switch-on		
	– **lawn trimmers**; – **lawn edge trimmers**; and – **grass trimmers** that cannot be converted to a **brush cutter** or a **brush saw**	a
	– **brush cutters**; – **brush saws**; and – **grass trimmers** that can be converted to a **brush cutter** or a **brush saw**	c
Power switch – provide desired switch-off		
	– **lawn trimmers**; – **lawn edge trimmers**; and – **grass trimmers** that cannot be converted to a **brush cutter** or a **brush saw**	a
	– **brush cutters**; – **brush saws**; and – **grass trimmers** that can be converted to a **brush cutter** or a **brush saw**	b
Starting current limitation as in 10.2		Not an **SCF**
Prevent exceeding thermal limits as in Clause 18		a
Overspeed prevention		
	For machines covered by 19.6 to prevent output speed above 130 % of **maximum speed** assigned by the manufacturer	a
	For machines other than those covered by 19.6 or with output speed increases that do not exceed 130 % of **maximum speed**: Any speed limiting device	Not an **SCF**
	If such overspeed would result in exceeding the 5 J kinetic energy limit as specified in 19.101.1.4 by more than 1,5 J	a
	For machines provided with a reverse rotation selector as specified in 21.18.103: Prevent reverse rotational speed exceeding 30 % of the **maximum speed**	b
	For machines if such overspeed would result in exceeding the 10 J kinetic energy limit as specified in 21.101 by more than 2 J	a
Provide desired direction of rotation		
	For machines covered by 19.101.1.3	a
	For machines covered by 19.101.1.4	a
	For machines covered by 19.101.2	a
	For machines covered by 21.104 that will not loosen due to a change in the direction of rotation	Not an **SCF**
	For machines covered by 21.104 that will loosen due to a change in the direction of rotation	b
Prevent drive to the **cutting accessory** as required in 19.105.3		a
De-energizing means, if any, as specified in 19.106		a
Lock-off function as required in 21.18.101		a
Visual or audible indicator as referenced in 21.18.101		Not an **SCF**
Operator presence sensor as in 21.18.102		a
~~Prevent self-resetting as required in 23.3~~		~~a~~

19 Mechanical hazards

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

19.1 *Addition:*

The requirements of this subclause do not apply to those moving parts and **guards** which are separately covered by 19.101.

The requirements of this subclause apply to all operating configurations as described in 8.14.2.

Machines that are intended to be configured as a **lawn trimmer** and a **lawn edge trimmer** in accordance with 8.14.2 a) 101) shall comply with the guarding requirements of 19.101.1 and 19.101.2 respectively.

19.3 This subclause of Part 1 is not applicable.

19.4 This subclause of Part 1 is not applicable.

Addition:

NOTE 101 Requirements for handles are given in 19.102.

19.5

Addition:

This subclause of Part 1 is not applicable for **walk-behind trimmers** with 360 degree guarding of the **cutting means**.

19.6 *Replacement:*

For **grass trimmers**, **brush cutters** and **brush saws**, the **maximum speed** of the spindle at **rated voltage** shall not exceed 110 % of the **maximum speed** marked as specified in 8.1.

*Compliance is checked by measuring the speed of the spindle with the most unfavourable **cutting means** or **cutting accessory** fitted, as applicable, in accordance with 8.14.2 a) 106).*

19.7 This subclause of Part 1 is not applicable.

19.8 This subclause of Part 1 is not applicable.

19.101 Guarding of cutting means and cutting accessories

19.101.1 Lawn trimmers

19.101.1.1 General

Lawn trimmers shall be guarded such as to minimise the likelihood of debris being ejected outward towards the operator during use as specified in

– 19.101.1.2; and

– either 19.101.1.3 or 19.101.1.4, depending on the energy of the **cutting element** calculated as in 21.101.

19.101.1.2 Within the required coverage area, the **guard** shall extend below the plane of the **cutting means** by at least

– 3 mm for **walk-behind trimmers** where the **guard** has 360° of coverage; and
– 10 mm for other **lawn trimmers**.

See dimension "*a*" in Figure 107 b).

Compliance is checked by inspection and by measurement.

19.101.1.3 The angular coverage of the **guard**, as measured from the projection of the axis of the **shaft** onto the plane of the rotating **cutting means** shall be

– at least 45° on the side where the direction of rotation is away from the operator; and
– at least 75° on the side where the direction of rotation is towards the operator; and
– at least 135° of total coverage.

The vertices of these angles lie on the axis of the **cutting head** spindle. The **guard** shall cover, from above and to the operator side, the area beyond 80 % of the largest radius of the **cutting means**. See Figure 107 a).

Compliance is checked by inspection and by measurement.

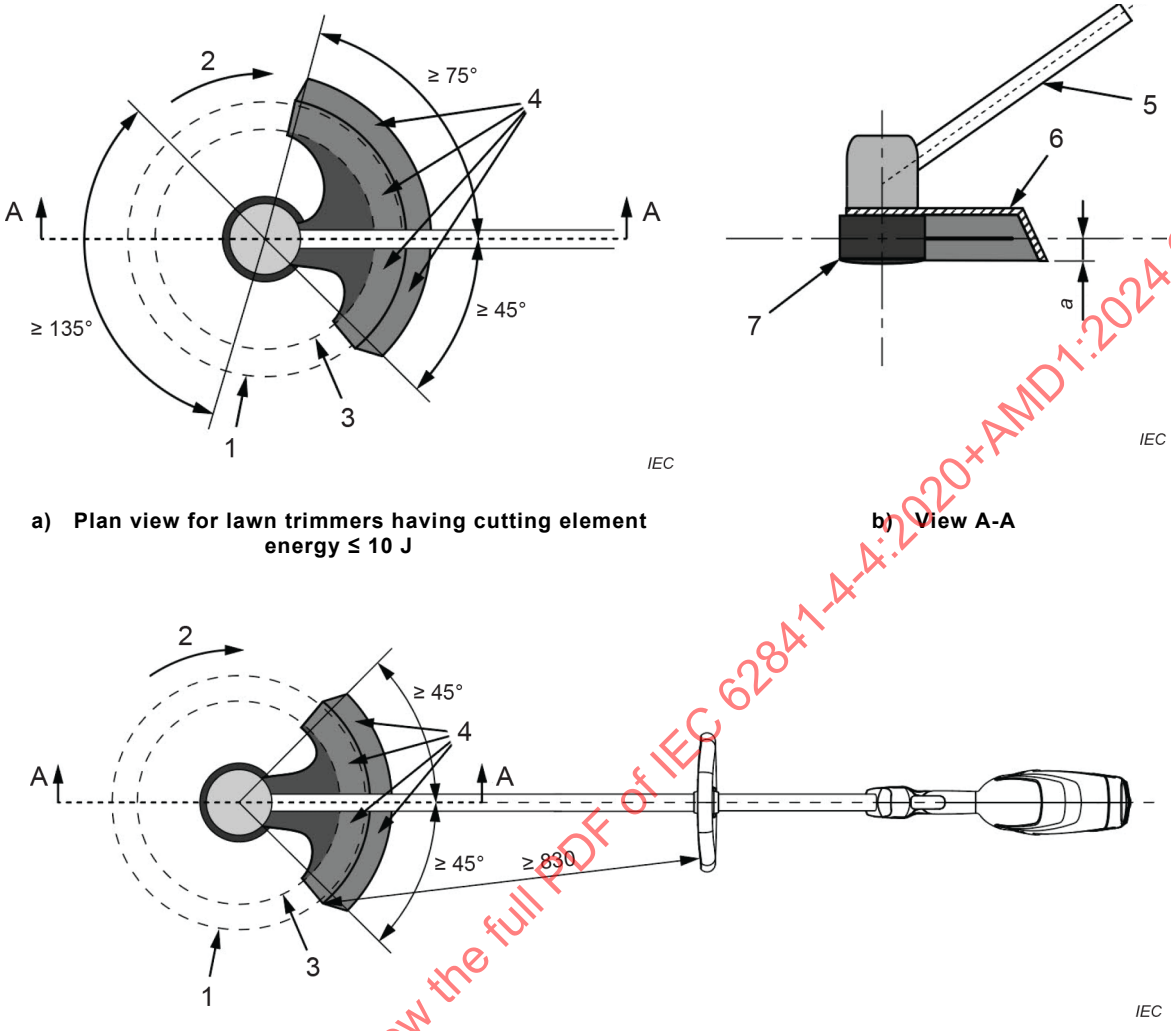
19.101.1.4 For machines where the energy of the **cutting element** calculated as in 21.101 is less than 5 J, the angular coverage of the **guard**, as measured from the projection of the axis of the **shaft** onto the plane of the rotating **cutting means** shall be at least 45° on either side provided that:

– the **lawn trimmer** possesses a front handle where the minimum chain distance from the front handle to the nearest unguarded point of the **cutting means** is at least 830 mm as shown in Figure 107 c), with the front handle adjusted to the nearest position to the **cutting means** in accordance with 8.14.2 b); or
– the distance from the **guard** to the nearest point of the **power switch** as measured in 21.102 is at least 1 250 mm.

The vertices of these angles lie on the axis of the **cutting head** spindle. See Figure 107 c).

Compliance is checked by inspection and by measurement.

Linear dimensions in millimetres



a) **Plan view for lawn trimmers having cutting element energy ≤ 10 J**

b) **View A-A**

c) **Plan view for lawn trimmers having cutting element energy < 5 J**

Key

1 outer radius of **cutting means**
2 direction of rotation
3 80 % of the radius of the **cutting means**
4 area of the **guard** beyond 80 % of the largest radius of the **cutting means**
5 **shaft**
6 **guard**
7 **cutting head**
a distance of **guard** extension from the plane of **cutting means**

NOTE 101 For reasons of clarity, any skids or wheels are not shown in the figure. The figure is not intended to govern design except as regards the dimensions and specific requirements shown.

NOTE 102 Figures are not to scale.

Figure 107 – Minimum guard coverage, lawn trimmer (see 19.101.1)

19.101.2 Lawn edge trimmers

Lawn edge trimmers shall be guarded, as a minimum, to the extent shown in Figure 108. The outer edge of the **guard** shall extend beyond the plane of the **cutting means** by at least 10 mm. If, with the **lawn edge trimmer** in its normal position of use in accordance with 8.14.2 b) 106), the angle of the axis of the **shaft**, θ, is less than 45° to the plane of the **cutting means** (see Figure 109), then the **guard** shall cover the **cutting means** as follows:

For the case where the direction of rotation is 1 (see Figure 110), then $\beta \geq 45°$ and either:

– $h \geq 0{,}78 \times r$; or

– $\alpha \geq 135° - \beta$, provided that $\alpha \geq 75°$.

For the case where the direction of rotation is 2 (see Figure 110);

– $\alpha \geq 0°$, and

– $\beta \geq 75°$

where r, h, α and β are as follows:

– r is the radius of the circle formed by the **cutting means**;

– h is the distance measured from the ground to the centre of the **cutting means** when the front of the **power switch** is positioned (775 ± 15) mm above the ground and the rear of the **guard** is in contact with the ground, as shown in Figure 110. If the **lawn edge trimmer** has wheels or other components that are not part of the guarding that prevent this arrangement, those components are removed for the measurement;

– α is the angle of the end of the **guard** on the side of the operator measured from the axis of the **shaft** (see Figure 110); and

– β is the angle of the end of the **guard** away from the operator measured from the axis of the **shaft** (see Figure 110).

If, with the **lawn edge trimmer** in its normal position of use in accordance with 8.14.2 b) 106), the angle of the axis of the **shaft**, θ, is greater or equal to 45° to the plane of the **cutting means** (see Figure 109 a) and Figure 109 b)), then the **guard** shall cover the **cutting means** by at least the angles α and β as follows:

– $\alpha \geq 45°$, and

– $\beta \geq 45°$ (see Figure 111)

where

– α is the angle of the end of the **guard** on the side of the operator measured from the axis of the **shaft** (see Figure 111); and

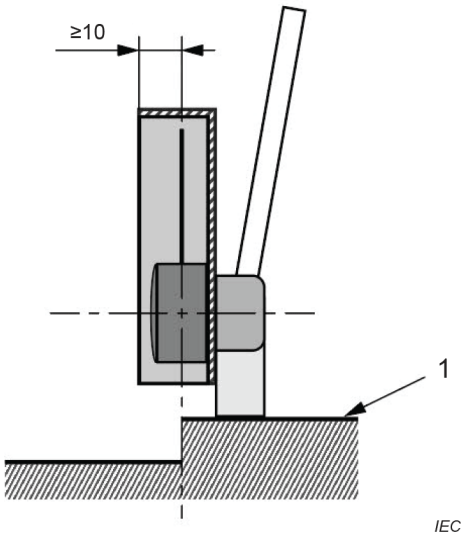
– β is the angle of the end of the **guard** away from the operator measured from the axis of the **shaft** (see Figure 111).

For **lawn edge trimmers**, irrespective of the angle of the axis of the **shaft**, θ, where the axis of the **shaft** is not straight or does not intersect the axis of rotation for the **cutting means**, the angles α, β, and θ shall be measured using an axis created from the centre of rotation of the **cutting means** to the nearest point of the **power switch**.

The guarding requirements above may be fulfilled by a combination of elements such as support wheels, debris deflectors and the like.

Compliance is checked by inspection and by measurement in all normal positions of use in accordance with 8.14.2 b) 106).

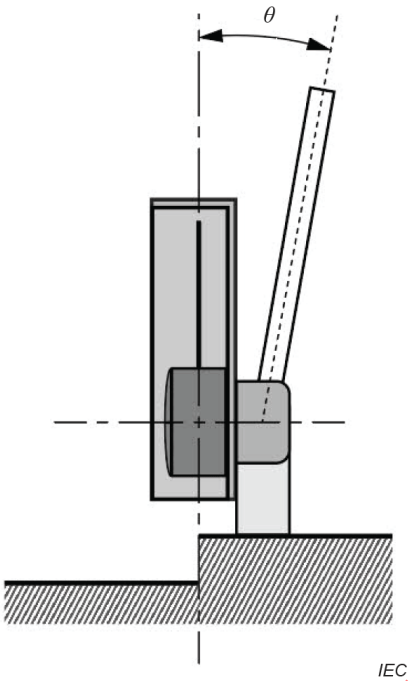
Dimensions in millimetres



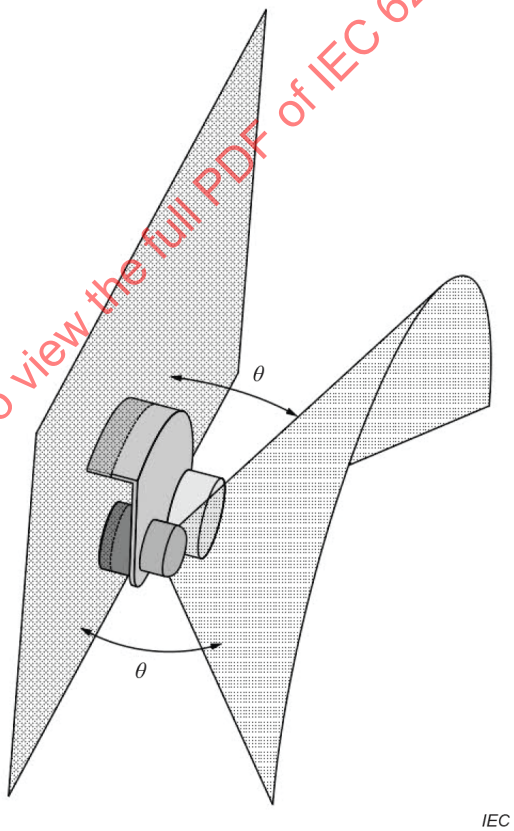
Key

1 representation of the ground in **normal use**

Figure 108 – Cross-sectional view of lawn edge trimmer cutting means guard



a) Front view



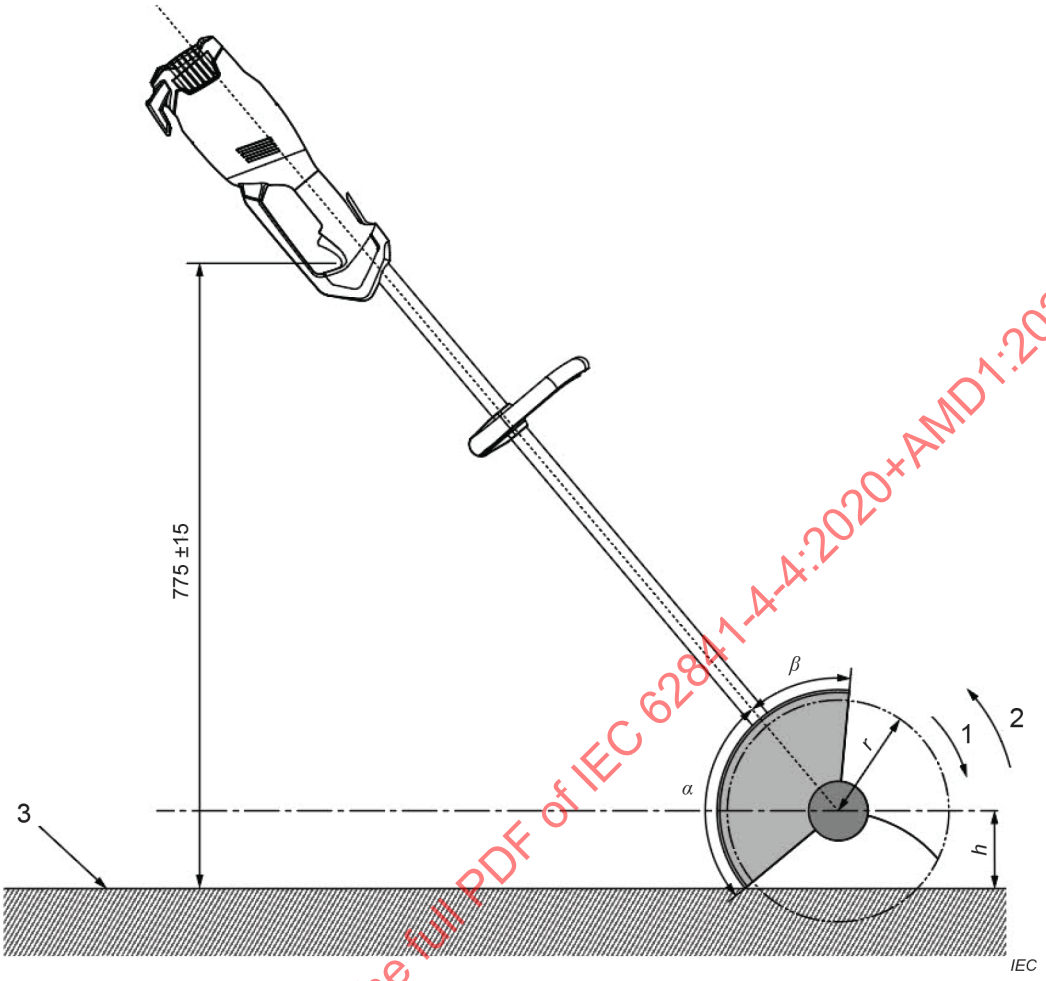
b) Isometric view

Key

θ angle of the axis of the **shaft** to the plane of the **cutting means**

Figure 109 – Shaft angle measurement

Dimensions in millimetres



Key

1 direction of rotation of **cutting means**

2 direction of rotation of **cutting means**

3 representation of the ground in **normal use**

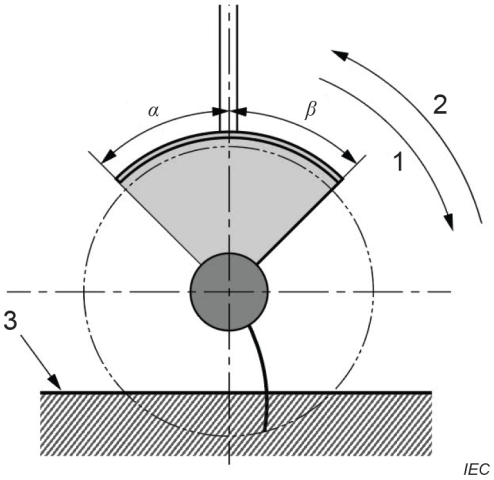
α angle of the end of the **guard** on the side of the operator measured from the axis of the **shaft**

β angle of the end of the **guard** away from the operator measured from the axis of the **shaft**

h distance measured from the ground to the centre of the **cutting means**

r radius of the circle formed by the **cutting means**

Figure 110 – Lawn edge trimmer guarding when *θ* < 45°



Key

1 direction of rotation of **cutting means**

2 direction of rotation of **cutting means**

3 representation of the ground in **normal use**

α angle of the end of the **guard** on the side of the operator measured from the axis of the **shaft**

β angle of the end of the **guard** away from the operator measured from the axis of the **shaft**

Figure 111 – Lawn edge trimmer guarding when $\theta \geq 45°$

19.101.3 Grass trimmers, brush cutters and brush saws

Grass trimmers, **brush cutters** and **brush saws** shall be provided with a **guard**, to protect the user against unintentional contact with the **cutting means** or **cutting accessory**, as applicable, and from thrown objects.

The **guard** shall comply with ISO 7918:1995.

Compliance is checked by inspection and by measurement.

19.101.4 Guard requirements

The **guards** specified in 19.101.1~~, 19.101.2~~ and 19.101.~~3~~2 shall be

– imperforate in the area of the **guard** beyond 80 % of the radius of the largest **cutting means** ~~or **cutting accessory**~~ that can be used with the **guard** in accordance with 8.14.2 a), and

– permanently attached or secured ~~by screws, nuts or snap fits~~ to prevent removal without the aid of a tool, by means such as screws, nuts or snap fits.

The **guard** specified in 19.101.3 shall be permanently attached or secured to prevent removal without the aid of a tool, by means such as screws, nuts or snap fits.

Compliance is checked by inspection and by measurement.

19.102 Handles

19.102.1 General

The handle(s) specified in 19.102.1.1 and 19.102.1.2 shall be designed in such a way that each one can be grasped with one hand and while wearing gloves. Handles shall be suitably shaped to be grasped securely and have a perimeter *P* between 65 mm and 170 mm as illustrated in Figure 112 a), Figure 112 b) and Figure 112 c). The perimeter is determined by a

chain measurement with the **power switch**, if any, fully depressed. The gripping length *L* of the handle shall be at least 100 mm.

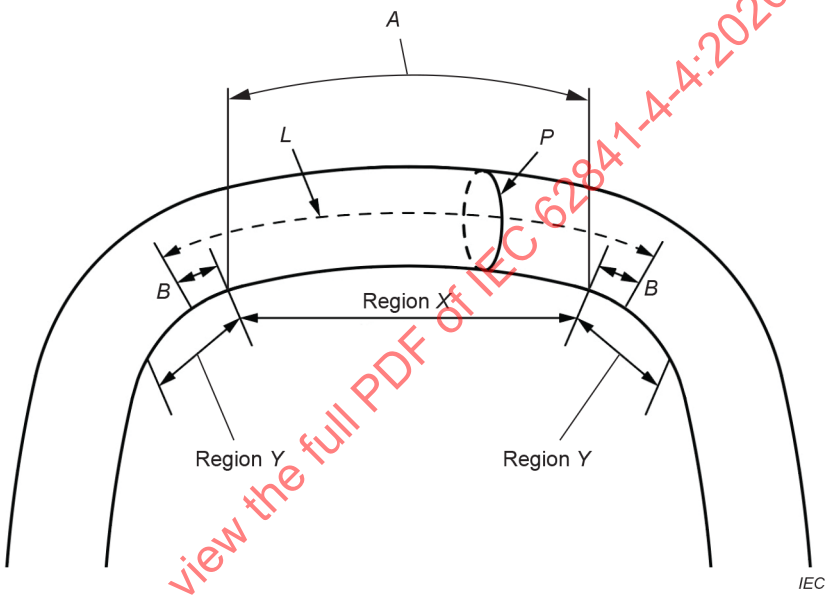
A **shaft** or a part containing the motor may be considered a handle, provided it

– complies with the dimensions for a handle specified in 19.102.1.1 and 19.102.1.2; and
– is identified as a handle in accordance with ~~8.14.2 b) 109)~~ 8.14.2 b) 6) of Part 1.

If applicable, the part of the handle containing the **power switch** shall be counted as part of the handle gripping length.

If there are finger grips or similar superimposed profiles, the handle gripping length shall not be measured along the surface, but only the arc or straight line distance of the gripping surface, as applicable, shall be taken into account.

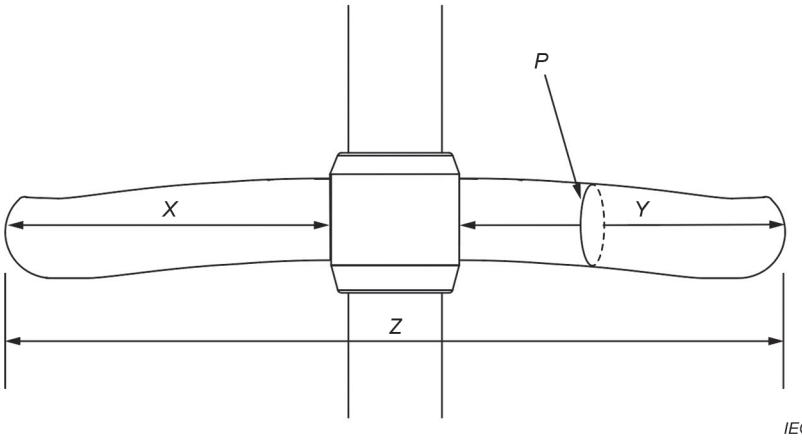
Compliance is checked by inspection and by measurement.



Key

A gripping length in region *X*
B transition radius length in region *Y*
L gripping length
P perimeter

a) Gripping length of a bail or closed handle



Key

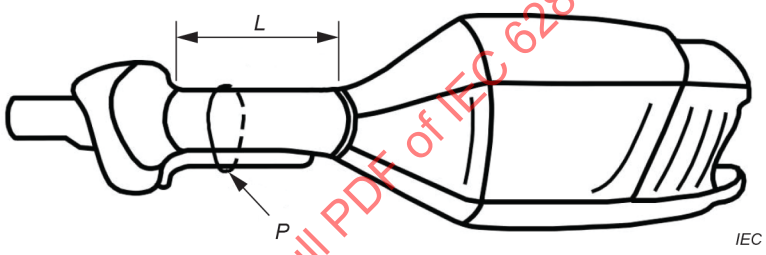
P perimeter of handle (not including the support)

X part of gripping length

Y part of gripping length

Z complete length

b) Gripping length of a ~~straight~~ handle supported centrally (i.e. T-type)



Key

L maximum gripping length

P perimeter

c) Determination of gripping length and perimeter dimension of a handle formed by the shaft

Figure 112 – Measurement of handle gripping length

19.102.1.1 Lawn trimmers and lawn edge trimmers

Hand-held trimmers and **walk-behind trimmers** shall have at least one handle.

All **hand-held 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 with the handles positioned in accordance with 8.14.2 b) 109).

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

Compliance is checked by inspection and by measurement.

19.102.1.2 Grass trimmers, brush cutters and brush saws

Grass trimmers, **brush cutters** and **brush saws** shall be provided with at least two handles ~~or grasping surfaces~~ to provide safe control.

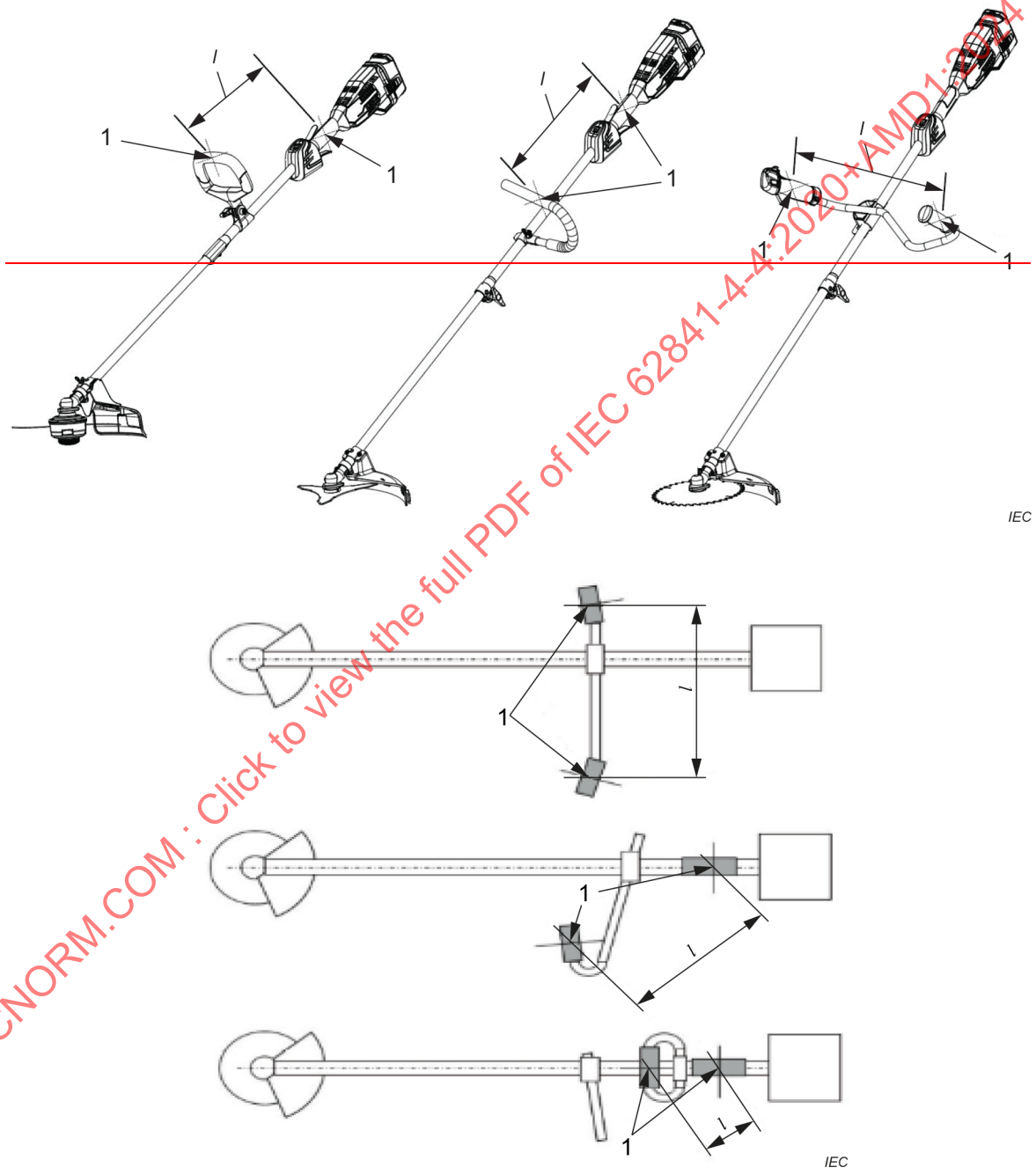
The distance *l* between the centre of the handles (see Figure 113) shall be at least

– 250 mm for **grass trimmers** and **brush cutters**; and

– 500 mm for **brush saws**.

The handles of **grass trimmers**, **brush cutters** and **brush saws** shall be adjustable so that a suitable ergonomic working position can be achieved. An adjustment below the minimum distance *l* shall be prevented by design or the machine shall be marked in accordance with 8.3.~~101~~102.

Compliance is checked by inspection, by measurement and by test.



Key

1 centre of the handle

l distance between handles

Figure 113 – Measurement of distance between handles for grass trimmers, brush cutters and brush saws

19.102.2 Dimensions of bail or closed handles

On bail or closed handles, the gripping length is related to the inner width of the gripping surface. There shall be a minimum radial clearance of 25 mm around the gripping length.

If a bail or closed handle is used, the gripping length *L* in Figure 112 a) shall be measured using lengths *A* and *B* as follows:

– the length *A* is measured within region *X* where the radius is at least 100 mm;
– the length(s) *B* are measured within region(s) *Y* where the transition radius is less than 100 mm, but each length *B* cannot exceed 10 mm in each region Y of the gripping surface.

NOTE 101 Bail or closed handles are also known as U-shaped handles.

Compliance is checked by inspection and by measurement.

19.102.3 Dimensions of ~~straight~~ handles supported centrally (T–type)

If a ~~straight~~ handle is supported centrally (i.e. T-type), there shall be a minimum radial clearance of 25 mm around the gripping length. The gripping length shall be calculated as follows (see Figure 112 b)):

– for handles with a perimeter *P* (not including the support) of less than 80 mm, the gripping length is the sum of the two parts of the gripping length *X* + *Y* on either side of the support;
– for handles with a perimeter *P* (not including the support) of 80 mm or more, the gripping length is the complete length *Z* from end to end.

Compliance is checked by inspection and by measurement.

19.103 Barrier and distance to cutting accessory

Brush cutters and **brush saws** shall be equipped with a **barrier**, located on the same side as the operator position (i.e. on the left side of the machine), to prevent an unintentional contact with the **cutting accessory** during operation. This function can also be performed by the handle assembly. See Figure 114.

The straight line distance

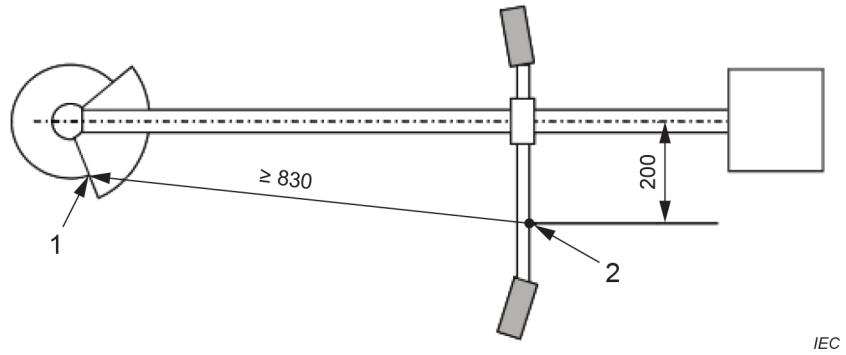
– from a point on the rear of the **barrier** 200 mm perpendicular to the centreline of the **shaft** (2)
– to the nearest unguarded point of the **cutting accessory** (1)

shall be at least 830 mm. The point (1) on the **cutting accessory** may or may not be located on the edge of the **cutting accessory**, depending on the geometry of the **cutting accessory guard**. See Figure 114.

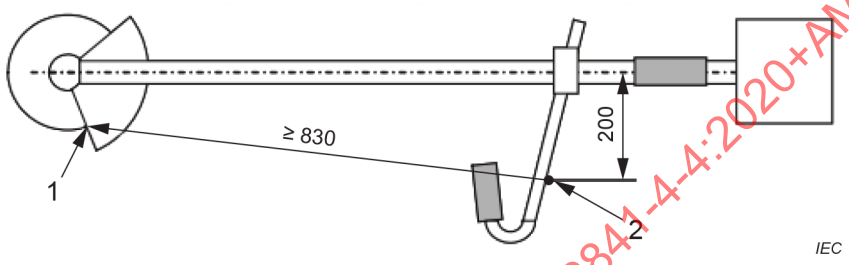
Barriers that are independent of the handle assembly and are removable, in accordance with 8.14.2, shall be fixed by systems that can be opened or removed only with the aid of a tool. The fastenings for **barriers** which are independent of the handle assembly shall remain attached to the **barrier** and/or the machine when the **barrier** is removed.

Compliance is checked by inspection and by measurement.

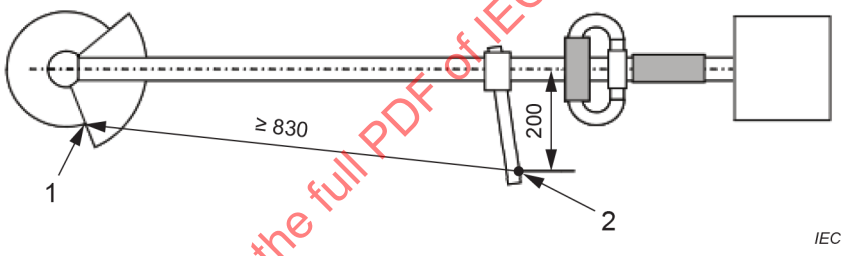
Dimensions in millimetres



a) Bicycle-type handle serving as a barrier



b) Front and rear handles with front handle serving as a barrier



c) Front and rear handle with separate barrier

Key

1 unguarded point of the **cutting accessory**

2 rear of the handle bar/**barrier**

Figure 114 – Examples of brush cutters and brush saws with different handle and barrier configurations: Measurement of distance to cutting accessory

19.104 Thrown objects test

For **grass trimmers**, **brush cutters** and **brush saws**, the **cutting means guard** and the **cutting accessory guard** shall be designed and constructed in such a way as to minimize the risk of injury from thrown objects in **normal use**.

Compliance is checked by the test of Annex BB.

No more than three penetrations in the target zone are allowed. If more than three penetrations occur, the test has to be repeated five times with no more than three penetrations in each of these tests.

*No cracks or breakages of the **guard** are allowed.*

19.105 Telescopic shafts

19.105.1 All machines equipped with telescopic **shafts** shall be provided with end stops that prevent the telescopic **shafts** from becoming separated or damaged.

Compliance is checked by the following test.

*The **shaft** is adjusted to its maximum possible length whilst overriding any locking mechanism or detent, if possible. One end of the **shaft** is fixed and a tensile force of (210 ± 10) N is applied to the other end for 1 min.*

After the test, parts of the machine shall not have separated or be permanently deformed and the machine shall comply with the acceptance criteria of 20.1.

*The **shaft** is then adjusted to its shortest possible length whilst overriding any locking mechanism or detent, if possible. A compressive force of (210 ± 10) N is applied instead of the tensile force for 1 min.*

After the test, the machine shall comply with the acceptance criteria of 20.1 and shall not have separated or permanently deformed to a degree that the mechanical safety of the machine as required by this standard is impaired as a result of the applied force.

19.105.2 **Brush cutters** and **brush saws** equipped with telescopic **shafts** shall be provided with locking detents that, when engaged, prevent

– relative movement or rotation of the **shaft** elements; and
– **shaft** elements and other parts from becoming separated or damaged.

Compliance is checked by the following test.

*The **shaft** length is adjusted to its maximum locking detent length in accordance with 8.14.2 b). One end of the **shaft** is fixed, while the other end is subjected, in turn, to the following:*

– *a tensile force of (210 ± 10) N for 1 min;*
– *a compressive force of (210 ± 10) N for 1 min; and*
– *a torque of (6 ± 1) Nm in both directions.*

During the test, there shall be no

– *relative linear movement of **shaft** elements exceeding 10 mm;*
– *relative rotation of **shaft** elements exceeding 5°.*

*The test is then repeated for all other **shaft** locking detent lengths in accordance with 8.14.2 b).*

19.105.3 **Brush cutters** and **brush saws** equipped with telescopic **shafts** shall be so designed that the drive to the **cutting accessory** is possible only when the **shaft** is adjusted to a configuration that fulfils the dimensional requirements of 19.103.

Compliance is checked by inspection, by measurement and by functional test.

19.106 Grass catcher and guards

If a **lawn trimmer** or **lawn edge trimmer** is fitted with a grass catcher in accordance with 8.14.2, it shall be designed so that either

– the requirements of 19.101 are fulfilled after removal of the grass catcher; or

– the machine is provided with a means that de-energizes the **cutting means** after removal of the grass catcher.

NOTE 101 An example of a **lawn trimmer** with a grass catcher is shown in Figure 106.

Compliance is checked by inspection.

20 Mechanical strength

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

20.1 *Replacement:*

Machines shall have adequate mechanical strength, and shall be so constructed that they withstand rough handling that may be expected.

Compliance is checked by the tests specified in 20.2, 20.3 and 20.4.

*Immediately after the tests, the machine shall withstand the electric strength test as specified in Annex D between **live parts** and **accessible parts**, and **live parts** shall not have become accessible, as specified in Clause 9.*

*Damage to the finish, small dents and cracks which do not reduce **creepage distances** or **clearances** below the values specified in 28.1, or small chips which do not adversely affect protection against shock or moisture are neglected. Damage to the **cutting means**, **cutting means guard**, **cutting head**, **cutting accessory** or **cutting accessory guard**, as applicable, during the test of 20.3.1 are ignored.*

NOTE The strength and rigidity of the **cutting means guard** and the **cutting head** are covered in 20.101. The strength and rigidity of the **cutting accessory guard** and the **cutting accessories** are covered in 20.102.

The mechanical safety of the machine as required by this standard shall not be impaired.

If a decorative cover is backed by an inner cover, a fracture of the decorative cover is neglected when the inner cover withstands the test after removal of the decorative cover.

20.3 *Replacement:*

*For **hand-held trimmers**, **grass trimmers**, **brush cutters** and **brush saws**, 20.3.1 applies.*

*For **walk-behind trimmers**, 20.3.2 applies.*

*Compliance of **cutting means guards** is checked by the tests of 20.101 and the compliance of **cutting heads** is checked by the tests of 20.102.*

20.3.1 *Replacement:*

*Machines, except for **walk-behind trimmers**, are dropped three times in total on a concrete surface from a height of 1 m.*

*The machine is configured for use according to 8.14.2 a), fitted with the **cutting head** or **cutting accessory** and placed on the concrete surface in a stable resting position.*

For the first drop, the machine is lifted vertically by 1 m and allowed to drop onto the concrete surface.

For the second drop:

– *the machine is placed on the concrete surface as in the first test;*
– *the machine is lifted vertically by 1 m; then*
– *the machine is rotated about its longitudinal axis approximately 90° in the most unfavourable direction prior to dropping onto the concrete surface.*

For the third drop:

– *the machine is placed on the concrete surface as in the first test;*
– *the machine is lifted vertically by 1 m; then*
– *the machine is rotated about its longitudinal axis approximately 180° prior to dropping onto the concrete surface.*

Secondary impacts shall be avoided.

NOTE A method for avoiding secondary impacts is tethering.

For machines with handles having a storage configuration in accordance with 8.14.2 b) 109), the three drops are repeated on a separate sample with the handle adjusted to the storage configuration.

~~*In addition, **grass trimmers**, **brush cutters** and **brush saws** are subjected to three impacts that result from the machine being tipped over to strike a concrete surface, from the vertical standing position with the **cutting head** or the **cutting accessory** downwards. The sample is rotated to its three most unfavourable positions prior to being released.*~~

~~*Each drop shall be conducted on a separate machine. At the manufacturer's request, each drop may be conducted on the same machine.*~~

Each drop shall be conducted on a separate sample, unless a single sample can be subjected to multiple drops without failure. If a sample has been subjected to multiple drops and fails, then the drop in the orientation that resulted in the failure is repeated using a new sample. If the new sample passes the test for the drop in that orientation, then the requirements for the drop in that orientation are considered to be fulfilled. The test is continued in this manner until all drops in each of the three orientations are completed.

20.5 *Addition:*

This subclause of Part 1 is not applicable for **lawn trimmers**, **lawn edge trimmers** and **grass trimmers** that cannot be converted to a **brush cutter** or **brush saw** in accordance with 8.14.2 a) 104).

This subclause of Part 1 is applicable for **grass trimmers** that can be converted to a **brush cutter** or **brush saw** in accordance with 8.14.2 a) 104), **brush cutters** and **brush saws**, except as follows:

NOTE 101 Requirements for handle insulation on **grass trimmers** that can be converted to a **brush cutter** or **brush saw** in accordance with 8.14.2 a) 104), **brush cutters** and **brush saws** are covered in 21.30.

~~For **grass trimmers, brush cutters** and **brush saws**, any insulation covering metal handles shall be suitable for temperatures foreseen in **normal use**.~~

For **grass trimmers**, **brush cutters** and **brush saws**, if a pliable insulation material is used

– to cover a tubular shaped metal handle, and
– is relied upon to fulfil the requirements of this subclause,

it shall be suitable for temperatures foreseen in **normal use** and shall have adequate mechanical strength in order to provide insulation between the grasping area and the **cutting device**. This requirement is not applicable for metal handles that are isolated by insulating barrier(s) from accessible metal parts that can become live by the **cutting device** in accordance with 21.30.

NOTE 102 Examples of pliable insulation material include foam, heat shrink and elastomeric tubing.

NOTE 103 Examples of a tubular shaped metal handle include those with a round, oval or square cross section.

Compliance is checked by the following test:

A separate sample of the covered part shall be conditioned for 168 h at a temperature of

– *(25 ± 2) K higher than the maximum temperature measured during the test of Clause 12; or*
– *(70 ± 2) °C*;

whichever is higher.

After conditioning, the sample shall be allowed to attain approximately ambient temperature.

The insulating covering shall not

– *have peeled off;*
– *be able to move longitudinally; or*
– *have shrunk to such an extent that the required insulation is not given.*

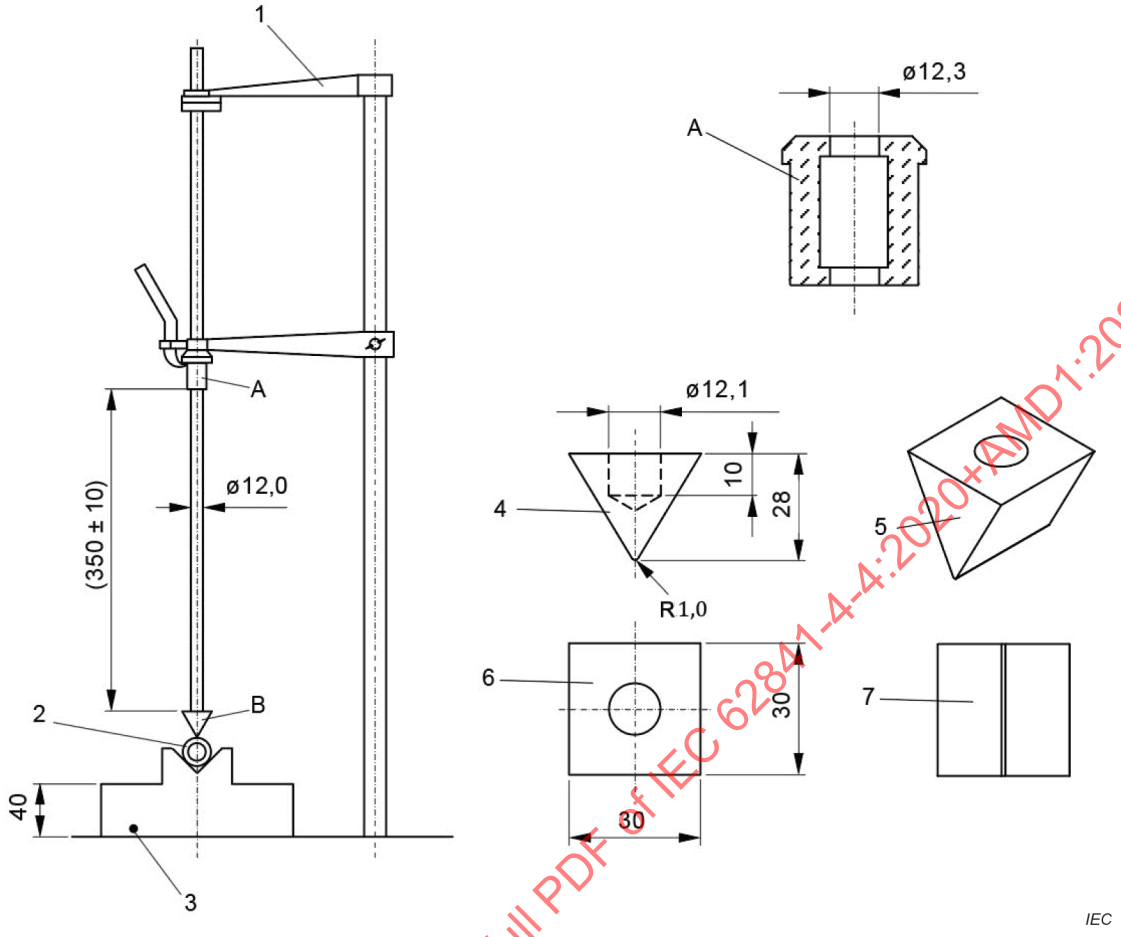
After this, the sample shall be maintained for 4 h at a temperature of (−10 ± 2) °C and then immediately subjected to an impact applied by means of an apparatus (see Figure 115) with a weight "A" having a mass of 300 g and falling from a height of 350 mm on to a chisel "B" of hardened steel, the edge of which is placed on the sample. One impact shall be applied to each place where the covering is likely to be weak or damaged. The distance between the impact points shall be at least 10 mm.

After this, an electric strength test is carried out according to Clause D.2 using 1 250 V a.c. between

– *the handles and grasping surfaces in contact with foil; and*
– *the spindle of the machine and any surface within 300 mm of the spindle of the machine.*

During this test, no flashover or breakdown shall occur.

Dimensions in millimetres



Key

A weight with mass of (300 ± 5) g
B chisel made of hardened steel
1 fixing arm
2 sample
3 base having a mass of at least 10 kg
4 chisel detail
5 chisel isometric view
6 chisel plan view
7 chisel bottom view

Figure 115 – Impact test apparatus for handle insulation

20.101 Strength of lawn trimmers, lawn edge trimmers and grass trimmers

20.101.1 General

The mechanical strength of **lawn trimmers**, **lawn edge trimmers** and **grass trimmers** shall be adequate for **normal use**.

Compliance is checked by the tests given in 20.101.2 to 20.101.6.

20.101.2 Cutting means guard drop test

*The strength of the **cutting means guards** of **hand-held trimmers** and **grass trimmers** are tested by means of the following drop test.*

*One sample of the complete machine without the **supply cord** is dropped three times so that the **guard** falls through a vertical distance of (900 ± 10) mm onto a smooth horizontal concrete surface. A string may be used to suspend the machine so that the desired orientation of the machine is achieved. Cutting the string will allow the machine to fall in the correct orientation to test the **guard** of the **cutting head** (see Figure 116).*

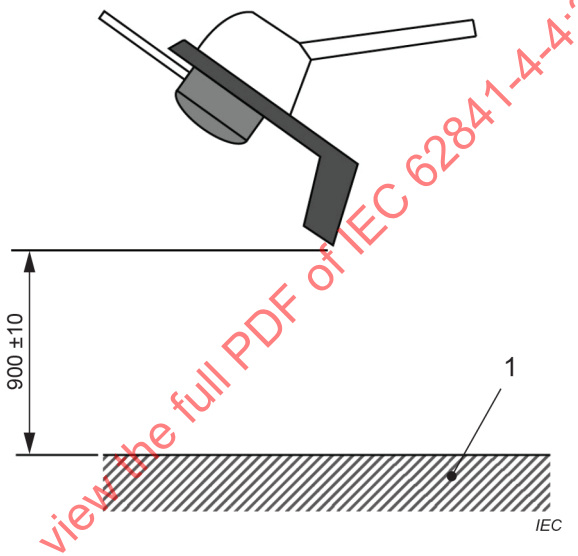
Secondary impacts shall be avoided.

NOTE A method for avoiding secondary impacts is tethering.

If the machine has a provision for fitting a grass catcher, the test is performed with the grass catcher fitted and then repeated with the grass catcher removed. Damage to the grass catcher is considered not to be a failure of this test.

*After the tests, the **guard** shall not have become detached nor shall it show any visible cracks. Screws and retaining clips shall still be secure.*

Dimensions in millimetres



Key

1 concrete surface

Figure 116 – Cutting means guard drop test

20.101.3 Cutting means guard rigidity

*For **hand-held trimmers** and **grass trimmers**, the rigidity of the **cutting means guard** is checked by applying a force, at any point, equivalent to the weight of the machine in the most unfavourable direction for 30 s.*

*During the test, the **guard** shall not have become detached, nor shall it show any visible cracks. After the test, the **guard** shall not have distorted permanently to the extent that the **guard** does not comply with this document.*

20.101.4 Strength of the cutting head

The mechanical strength of the **cutting head** on **hand-held trimmers**, **walk-behind trimmers** and **grass trimmers** shall be adequate for **normal use**.

Compliance is checked by the test given below.

*One sample of the complete machine 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 A (see Figure 117) is*

– *(900 ± 10) mm for **hand-held trimmers** and **grass trimmers**; and*

– *(250 ± 10) mm for **walk-behind trimmers**.*

*A string may be used to suspend the machine so that the desired orientation of the machine is achieved. Cutting the string will allow the machine to fall in the correct orientation to test the **cutting head** (see Figure 117).*

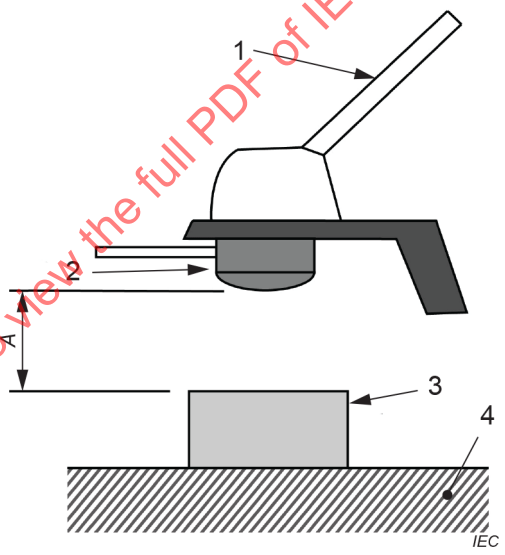
Damage to other parts during this test shall be ignored.

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

*If the machine is operable, then immediately following the test, the machine shall be run at its highest attainable speed for 30 s both with and without **cutting means**.*

*If the machine 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 machine. This new machine is then run at its **maximum speed** for 30 s both with and without **cutting means**.*

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



Key

1 **shaft**
2 **cutting head**
3 steel block
4 rigid support for steel block
A distance from **cutting head** to steel block

Figure 117 – Cutting head strength test

20.101.5 Mechanical strength of grass catchers

Grass catchers, if any, shall have adequate mechanical strength.

Compliance is checked by the test of 20.3.2.

20.101.6 Mechanical strength of non-metallic pivoting cutters

Pivoting cutters, employed as **cutting means** for **grass trimmers**, shall have adequate mechanical strength.

Compliance is checked by the following test.

NOTE 101 It is important to take proper precautions to ensure operator safety during this test.

The tests are done at an ambient temperature of (25 ± 10) °C.

*The cutters shall not break apart when the **cutting head** is impacted once against a steel rod of diameter (25 ± 1) mm according to Annex CC.*

*The same pivoting cutters shall then not break or crack when operated at **maximum speed** for 30 s.*

No part shall have broken off a pivoting cutter, reducing its total length by more than 1 mm.

20.102 Strength of brush cutters and brush saws

20.102.1 General

The mechanical strength of **brush cutters** and **brush saws** shall be adequate for **normal use**.

Compliance is checked by the tests given in 20.102.2 to 20.102.4.

20.102.2 Cutting accessory guard strength

20.102.2.1 The strength of the **cutting accessory guards** specified in accordance with 8.14.2 shall be adequate.

*Compliance is checked by the tests specified in 20.102.2.2, 20.102.2.3 and 20.102.2.4. During the test, the **cutting accessory guard** shall not break or show cracking visible with normal vision. After the test, the **cutting accessory guard** dimensions shall comply with ISO 7918:1995.*

20.102.2.2 *The **cutting accessory** is removed prior to the test. The sample is conditioned for a minimum of 4 h at a **guard** temperature of*

- *(40 ± 2) °C; and*
- *(0 ± 3) °C.*

It is not required to heat up or cool down the entire machine.

*The machine is mounted on a swivel bracket at the end of the machine furthest away from the **cutting accessory**, with the **cutting accessory guard** in its lowest suspended position (see Figure 118).*

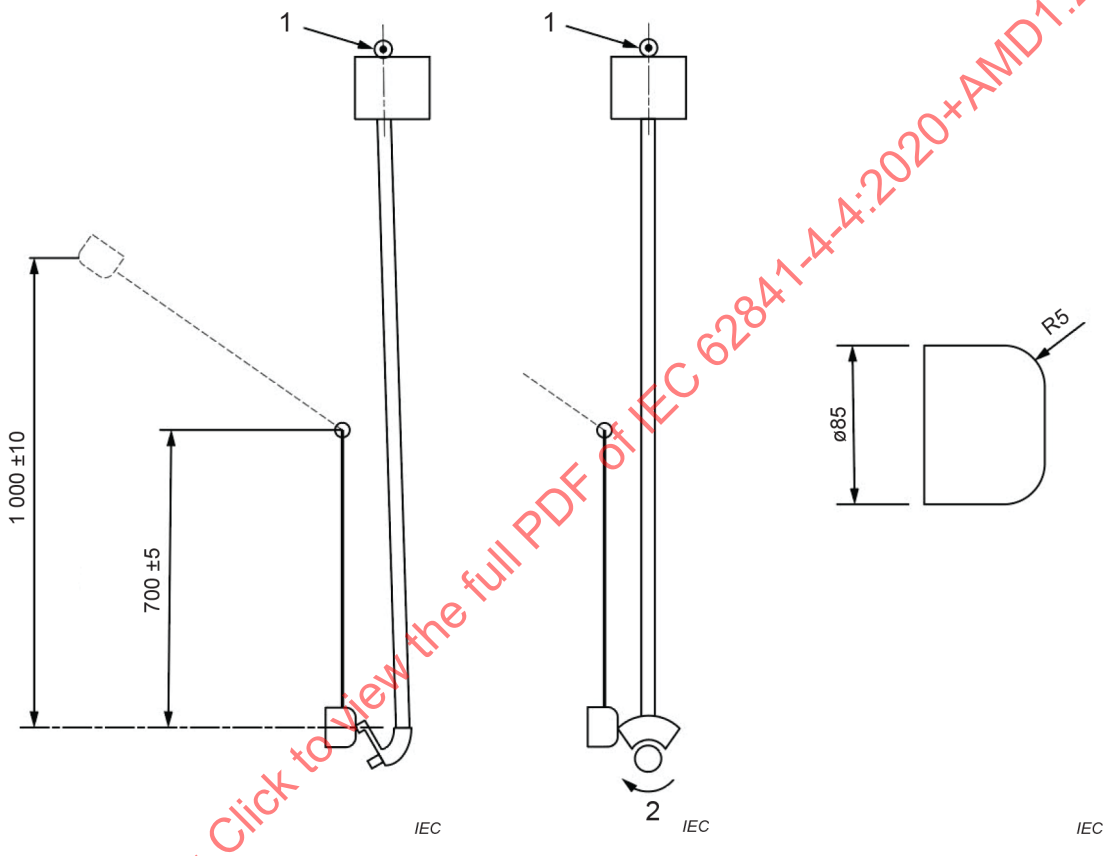
*The **cutting accessory guard** is subjected to a total of 50 blows at each temperature from a steel hammer suspended on a pendulum length of (700 ± 5) mm. The pendulum arm shall be as light as possible. The weight of the hammer shall correspond to a potential energy of the total pendulum system of (25 ± 0,5) J with the hammer raised to a height of 1 000 mm.*

20.102.2.3 *The hammer is raised to a height of (1 000 ± 10) mm above the point of impact with the **cutting accessory guard** and allowed to fall so that it strikes the **cutting accessory guard** rear edge (see Figure 118 a)). The test is conducted so that the rear edge of the*

cutting accessory guard *is subjected to a total of 25 blows conducted in succession as quickly as possible after the temperature conditioning for each temperature specified in 20.102.2.2.*

20.102.2.4 *The hammer is raised to a height of (1 000 ± 10) mm above the point of impact with the* ***cutting accessory guard*** *and allowed to fall so that it strikes the* ***cutting accessory guard*** *from the side where the* ***cutting accessory*** *rotates towards the* ***guard*** *(see Figure 118 b)). The test is conducted so that the side of the* ***cutting accessory guard*** *is subjected to a total of 25 blows conducted in succession as quickly as possible after the temperature conditioning for each temperature specified in 20.102.2.2.*

Dimensions in millimetres



a) Rear edge impact **b) Side impact** **c) Hammer**

Key

1 swivel bracket

2 direction of rotation

Figure 118 – Cutting accessory guard test

20.102.3 Cutting accessory guard rigidity

The rigidity of the ***cutting accessory guard*** *is checked by applying a force, at any point, equivalent to the weight of the machine in the most unfavourable direction for 30 s.*

During the test, the ***guard*** *shall not have become detached, nor shall it show any visible cracks. After the test, the* ***guard*** *shall not have distorted permanently and the screws and retaining clips shall still be secure.*

20.102.4 Strength of cutting accessory

The mechanical strength of the **cutting accessory** shall be adequate for **normal use**.

Compliance is checked by the following test.

NOTE 101 It is important to take proper precautions to ensure operator safety during this test.

The tests are done at an ambient temperature of (25 ± 10) °C.

*The **cutting accessory** shall not break or crack when impacted once against a steel rod of diameter (25 ± 1) mm according to Annex CC.*

*The same **cutting accessory** shall then, without any adjustments, not break or crack when operated at **maximum speed** for 5 min.*

*If the machine is not operable, this may be accomplished by assembling the **cutting accessory** to a new machine sample or to an external driving device.*

The final verification for cracks shall be done by visual inspection using normal vision.

*These requirements are applicable to all **cutting accessories** specified in accordance with 8.14.2.*

21 Construction

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

21.17.1 *Addition:*

This subclause of Part 1 is also applicable for an **operator presence sensor** ~~that either functions as a lock-off device or is locked off as a switch.~~ whose motion is mechanically obstructed and either

– functions as a lock-off device; or
– is locked off by the lock-off device.

21.17.1.3 *Replacement of Table 7:*

Table 7 – Switch trigger force

Trigger type	Force N
Single finger trigger (trigger length < 30 mm)	100
Multi finger trigger (trigger length ≥ 30 mm)	150
Operator presence sensor	100

21.18 *Replacement:*

Requirements for **power switches** for all machines are specified in 21.18.1.

Additional requirements for **power switches** for **lawn trimmers** and **lawn edge trimmers** are specified in 21.18.1.2 or 21.18.101.

Additional requirements for **power switches** for **grass trimmers**, **brush cutters** and **brush saws** are specified in 21.18.101.

21.18.1 *Replacement:*

The **power switch** required by 21.17 shall be a **momentary power switch** without a lock-on device, which can be switched on and off by the user without the need to release any of the handle(s) identified in accordance with ~~8.14.2 b) 109)~~ 8.14.2 b) 6) of Part 1.

The **cutting means** or **cutting accessory** shall operate within 1 s after actuation of the **power switch**, provided the lock-off device, if applicable, has been first actuated.

NOTE The up to 1 s delay provides an allowance for a self-checking function of electronic controls.

Compliance is checked by inspection, by measurement and by manual test.

21.18.1.1 This subclause of Part 1 is not applicable.

21.18.1.2 *Replacement:*

For **lawn trimmers** and **lawn edge trimmers**, **power switch** triggers shall be so located, designed or guarded that inadvertent operation is unlikely to occur.

It shall not be possible to start the machine when a rigid sphere with a diameter of (100 ± 1) mm is applied to the **power switch** in any direction with a single linear motion. Alternatively, the requirements of 21.18.101 shall be fulfilled.

Compliance is checked by inspection and by manual test.

21.18.2 This subclause of Part 1 is not applicable.

21.18.2.1 to **21.18.2.4** These subclauses of Part 1 are not applicable.

21.18.101 Inadvertent starting prevention

Grass trimmers, **brush cutters** and **brush saws** shall be provided with a **power switch** having a lock-off device such that at least two separate and dissimilar actions are required before drive to the **cutting means** or **cutting accessory** is possible. It shall not be possible to achieve these actions with a single grasping motion or a straight line motion within any grasping surface identified in accordance with 8.14.2 a).

Drive to the **cutting means** or **cutting accessory** shall only be enabled when the lock-off device is operated prior to the **power switch**.

It shall not be necessary to sustain the actuation of the lock-off device until the **power switch** is activated, provided:

– the **power switch** or an **operator presence sensor** (if any) is activated within 5 s of the release of the lock-off device; and
– there is a visual or audible indication as soon as the lock-off actuator is released and continues at least until the **power switch** or **operator presence sensor** (if any) is activated;

or

– an **operator presence sensor** (if any) is activated prior to the release of the actuator of the lock-off device.

NOTE 101 The visual or audible indication is intended to only indicate the state of the machine.

After the **power switch** is released, the machine shall return to the original locked state (i.e. at least two separate and dissimilar actions are required before drive to the **cutting means** or **cutting accessory** is possible)

– within 5 s; or

– no later than when the **cutting means** or **cutting accessory** has come to a complete stop,

whichever is longer, unless

– an **operator presence sensor** is provided; and

– the hand is not released from the **operator presence sensor**.

Compliance is checked by inspection, by measurement and by manual test.

*Additionally, for lock-off devices that are actuated in a direction generally perpendicular to the ~~longitudinal vertical plane~~ surrounding surface of the machine, (see Figure 119), and that are located within any gripping surface of handle(s) or grasping surface(s) identified in accordance with ~~8.14.2 a)~~ 8.14.2 b) 6) of Part 1, to determine if it is possible to actuate the locked-off control (i.e. the **power switch** or the **operator presence sensor**, as applicable) and the lock-off device with a single grasping motion or a straight line motion, compliance is checked by the following test:*

~~*With the **power switch** in the "off" position, a 25 mm diameter x 75 mm long steel rod with a force not exceeding 20 N is applied to the lock-off device in any direction. The steel rod shall be applied such that its cylindrical surface bridges the surface of the lock-off device and any surface adjacent to the lock-off device. During the test, it shall not be possible to actuate the **power switch** with a force not exceeding 20 N.*~~

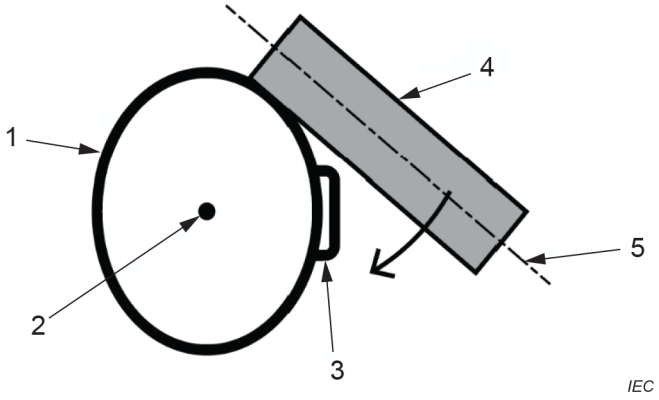
*With the **power switch** or the **operator presence sensor**, as applicable, in the "off" position, the lock-off device shall not be actuated by the cylindrical face of a 25 mm diameter × 75 mm long steel rod when applied with a force not exceeding 20 N. The axis of the rod is applied perpendicular to the axis of the handle and is:*

– *first rotated around the handle, see Figure 122, and*

– *then applied in the direction perpendicular to the handle axis, see Figure 123,*

while bridging the handle surface and surface of the lock-off device and any surface adjacent to the lock-off device. When applying the steel rod, the circular end faces and edges shall not be used for probing.

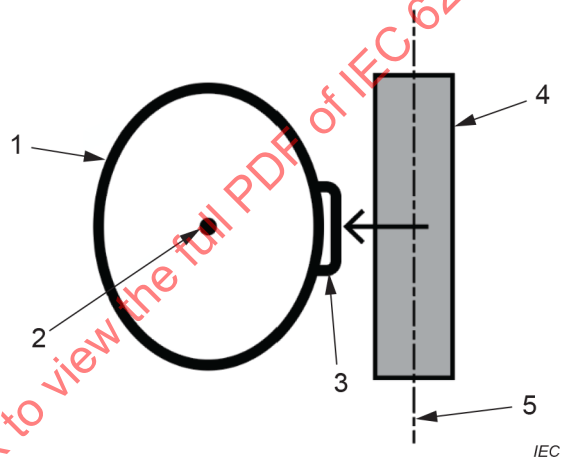
During the test, it shall not be possible to actuate the locked-off control by applying a force as specified in Table 7.



Key

1 **handle**
2 **handle axis**
3 lock-off device
4 steel rod
5 steel rod axis

Figure 122 – Application of steel rod when rotated around the handle



Key

1 **handle**
2 **handle axis**
3 lock-off device
4 steel rod
5 steel rod axis

Figure 123 – Application of steel rod when applied in the direction perpendicular to the handle axis

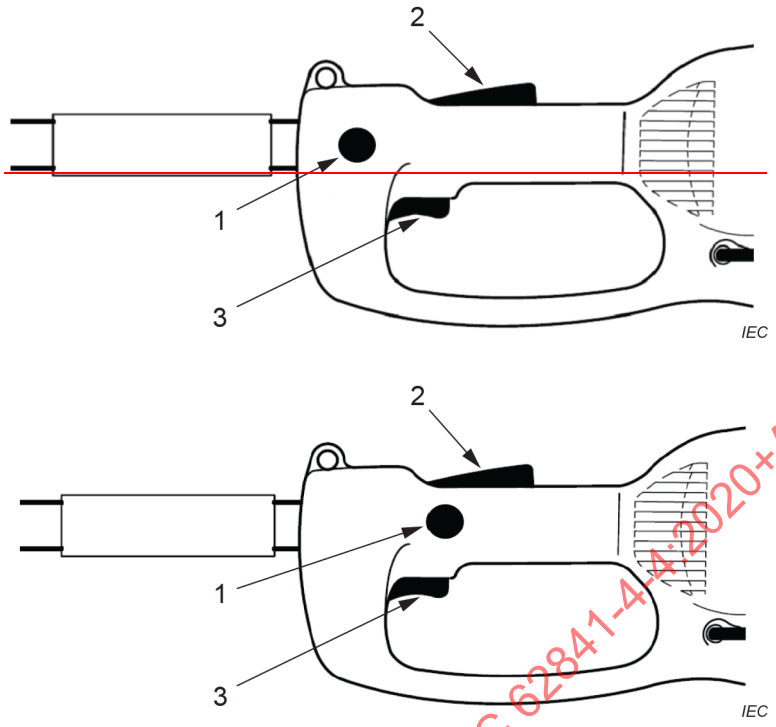
21.18.102 Operator presence sensor

The **operator presence sensor,** if any, shall be incorporated in the handle or grasping surface associated with the **power switch**.

The function of the **operator presence sensor** may be achieved by one or any combination of mechanical, electrical or electronic means.

NOTE 101 An example of an **operator presence sensor** is shown in Figure 119.

Compliance is checked by inspection.



Key

1 lock-off device

2 **operator presence sensor**

3 **power switch**

Figure 119 – Example of an operator presence sensor

21.18.103 Reverse rotation selector

If the machine is provided with a reverse rotation selector, it shall permit reverse rotation of the **cutting means** or **cutting accessory** at a rotational speed

– no greater than 30 % of the **maximum speed** in the primary rotation direction; or

– up to **maximum speed**, provided the machine when operating in the reverse rotation direction, fulfils all of the requirements of this standard.

Compliance is checked by inspection, by measurement and by relevant tests.

21.30 *Replacement:*

For **grass trimmers** that can be converted to a **brush cutter** or **brush saw** in accordance with 8.14.2 a) 104), **brush cutter~~s~~** and **brush saw~~s~~**, handles, as specified in the instruction manual in accordance with ~~8.14.2 b) 109)~~ 8.14.2 b) 6) of Part 1, shall be formed of insulating material or, when of metal, shall be either adequately covered by insulating material or their **accessible parts** shall be separated by insulating barrier(s) from metal parts that ~~may~~ can become live by the spindle or any surface within 300 mm of the spindle. ~~These insulating barriers are not to be regarded as **basic insulation**, **supplementary insulation** or **reinforced insulation**.~~

Compliance is checked by inspection and by the tests of 20.5.

21.35 This subclause of Part 1 is not applicable.

21.101 Lawn trimmer and lawn edge trimmer cutting elements

For **lawn trimmers** and **lawn edge trimmers**, the **cutting means** shall consist of one or more non-metallic **cutting elements** mounted on or emerging from a **cutting head**.

Compliance is checked by inspection and by functional test.

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

– a non-metallic filament line; or

– a non-metallic freely pivoting cutter.

Machines 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 incorporate a means to automatically limit the filament line to its correct operating length after the line has been extended and/or the machine is operated.

Compliance is checked by inspection.

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

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

$$kinetic\ energy = \tfrac{1}{2} mv^2$$

where

m is the mass of the length *L* of the conditioned **cutting element**, in kilograms (see Figure 120), where **cutting elements** of hygroscopic material are stored for at least seven days in a humidity cabinet under the same conditions as those required for the test of 14.1 before carrying out the test and measurement;

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

Therefore: $v = 0{,}104\ 7\ n\ (r - (L/2))$

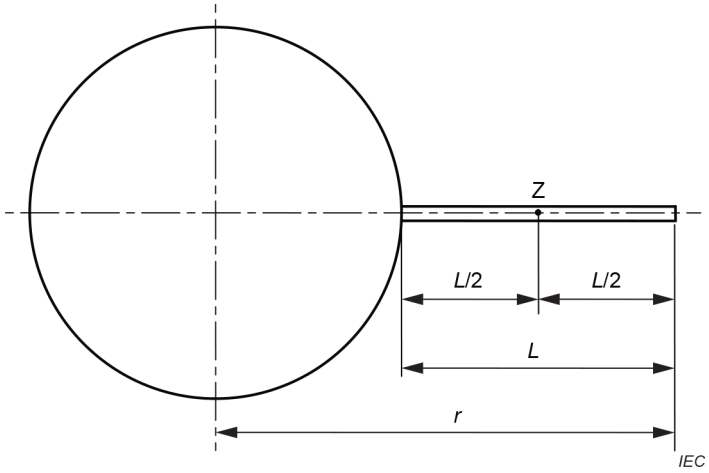
where

n is the **maximum speed** of the machine, in revolutions per minute;

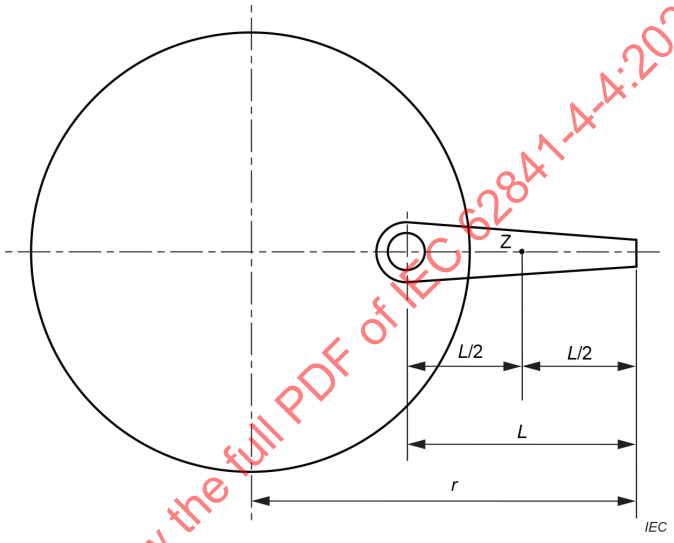
r is the distance from the axis of rotation of the **cutting head** to the outer tip of the **cutting means**, in metres;

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

Compliance is checked by measurement and by calculation.



a) Filament line



b) Pivoting cutter

Key

L length of the **cutting element**

r distance from the axis of rotation of the **cutting head** to the outer tip of the **cutting means**

Z point which is half-way along the length *L* of the **cutting element**

Figure 120 – Lawn trimmer and lawn edge trimmer cutting means measurement

21.102 Lawn trimmer, ~~and~~ lawn edge trimmer ~~cutting elements~~ and grass trimmer distances to guard

For **lawn trimmers** and **lawn edge trimmers**, the minimum distance from the **guard** specified in 19.101 to the nearest point of the **power switch** shall be at least 600 mm with the handle adjusted to its shortest operating position in accordance with 8.14.2 b) 109).

NOTE 101 Minimum distance requirements for **lawn trimmers** with a **guard** in accordance with Figure 107 c) are specified in 19.101.1.4.

For **grass trimmers**, the minimum distance from the **guard** specified in 19.101 to the nearest point of the **power switch** shall be at least 750 mm with the handle adjusted to its shortest operating position in accordance with 8.14.2 b) 109).

Compliance is checked by measurement.

21.103 Lawn edge trimmer cutting head ground contact

Lawn edge trimmers shall be designed so as to prevent contact of the **cutting head** with the ground during **normal use**. This may be fulfilled by the design of the **guard** specified in 19.101.2.

Compliance is checked by the following test.

*A **lawn edge trimmer** with its **cutting means** removed is placed on a flat level surface such that the plane of the **cutting means** is perpendicular to the surface. With the machine in any operating configuration in accordance with 8.14.2 b), there shall be no contact between the **cutting head** and the surface.*

21.104 Cutting head and cutting accessory retention

Machines shall be provided with a means for securing the **cutting head** and **cutting accessory** to prevent loosening during use.

For machines not provided with a reverse rotation selector, the **cutting head** or **cutting accessory** may be retained by a thread that is self-tightened by the driving torque of the spindle.

For machines that are provided with a reverse rotation selector, the retention system shall not allow relative motion exceeding 15° of the **cutting head** or **cutting accessory** and its retainer in either direction upon application of a torque applied to the **cutting head** or **cutting accessory**.

*Compliance is checked by inspection and by the following test for all **cutting heads** and **cutting accessories**, except for those that are only retained by a thread that is self-tightened by the driving torque of the spindle:*

*a) The **cutting head** or **cutting accessory** is installed in accordance with 8.14.2.*

b) The spindle of the machine is locked.

*c) A torque of 5 Nm is applied for 5 s to the **cutting head** or a torque of 15 Nm is applied for 5 s to the **cutting accessory**, as applicable.*

The test is conducted five times in each direction of rotation.

21.105 Grass trimmer cutting means

21.105.1 The **cutting means** of **grass trimmers** 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.

21.105.2 A **cutting element** shall consist of one of the following:

– a non-metallic filament line; or

– a non-metallic freely pivoting cutter.

Grass trimmers using one or more flexible **cutting elements** of continuous filament line (e.g. wound on a spool contained either in the **cutting head** or other **attachment**) shall incorporate a means to automatically limit the filament line to its correct length after the line has been extended and/or the machine is operated.

Compliance is checked by inspection and by functional test.

21.106 Shoulder harness

Walk-behind trimmers do not require a harness to be provided.

Hand-held trimmers and **grass trimmers**, having a mass below 7 kg, do not require a harness to be provided.

Hand-held trimmers and **grass trimmers** having a mass of 7,0 kg to 8,5 kg shall at least be provided with a single shoulder harness.

Brush cutters having a mass of 8,5 kg or less shall at least be provided with a single shoulder harness.

Hand-held trimmers, grass trimmers and **brush cutters** having a mass exceeding 8,5 kg shall be provided with a double shoulder harness and a hip pad. The hip pad shall be made of flexible material and designed to be attached to either the machine or the harness, in order to cushion the operator from impacts caused by the machine and to reduce the transmission of vibrations.

All **brush saws** shall be provided with a double shoulder harness and a hip pad. The hip pad shall be made of flexible material and designed to be attached to either the machine or the harness, in order to cushion the operator from impacts caused by the machine and to reduce the transmission of vibrations.

Any shoulder harness provided with the machine shall be adjustable to the size of the operator and its operation shall be in accordance with 8.14.2 b) 110) and shall be

– designed in a way for easy removal; or
– equipped with a quick release mechanism that ensures that the machine can be removed or released quickly from the operator.

A quick release mechanism, if provided, shall be positioned either at the connection between the machine and harness or between the harness and operator. The quick release mechanism shall only allow separation by deliberate action of the operator.

If a quick release mechanism is provided, it shall be possible to open it while under the weight of the machine. It shall require the use of only one hand and have no more than two release points.

NOTE 101 An example of a release point is a buckle that requires squeezing between a thumb and finger before releasing, e.g. side release buckles.

NOTE 102 Examples of shoulder harnesses that are designed in a way for easy removal include

– a single shoulder harness; or
– a double shoulder harness where the left and right shoulder straps are not connected to each other in front of the operator's body; or
– a double shoulder harness with a strap(s) connecting the left and right shoulder straps that can be released under the load of the machine by using one hand and has no more than two release points.

Compliance is checked by inspection, by measurement and by functional test using the heaviest machine configuration as identified in 8.14.2.

21.107 Balance

21.107.1 Machines intended to be used with a harness in accordance with 8.14.2 b) 110), except for machines as specified in 21.107.2, shall be provided with at least one suspension point for attaching the harness. The suspension point(s) shall be designed such that the machine is balanced when it is suspended.

Compliance is checked by inspection, by measurement and by the following test, with the lightest and heaviest machine configurations in accordance with 8.14.2. If the machine is provided with more than one suspension point or if the suspension point is adjustable, the most favourable suspension point or position is selected for each test.

~~*The effect of any **supply cord** shall be negated either by positioning it so it does not influence the test or by cutting it off at the point where it exits the machine.*~~

*For machines provided with an appliance inlet or a **supply cord** with a length between 0,2 m and 0,5 m, a mass of (300 ± 20) g is suspended from either*

– *the appliance inlet; or*
– *the **supply cord** plug; or*
– *any **supply cord** retaining device in accordance with 8.14.2,*

whichever is the most unfavourable.

*For machines provided with a **supply cord** with a length not less than 0,6 m, the **supply cord** is placed resting on the ground.*

The suspension point is positioned at a vertical distance of (775 ± 25) mm above the ground, the machine is suspended from this point and the following dimensional requirements shall be fulfilled:

– *for **hand-held trimmers** and **grass trimmers**: a distance from the ground to the nearest point of the **cutting means** or **cutting accessory** shall be (150 ± 150) mm; and*
– *for **brush cutters** and **brush saws**: a distance from the ground to the nearest point of the ~~blade~~ **cutting accessory** shall be (200 ± 100) mm.*

21.107.2 **Grass trimmers**, **brush cutters** and **brush saws** intended to be used with a harness in accordance with 8.14.2 b) 110), and designed to be supported by the ground shall be provided with at least one suspension point to which the harness is attached, so the ground contact force is not greater than 20 N.

*Compliance is checked by inspection, by measurement and by the following test with the lightest and heaviest **cutting means** or **cutting accessories** specified in accordance with 8.14.2.*

~~*The effect of any **supply cord** shall be negated either by positioning it so it does not influence the test or by cutting it off at the point it exits the machine.*~~

A mass of (300 ± 20) g is suspended from either

– *the appliance inlet; or*
– *the **supply cord** plug; or*
– *any **supply cord** retaining device in accordance with 8.14.2,*

whichever is the most unfavourable.

If the machine is provided with more than one suspension point or if the suspension point is adjustable, the most favourable suspension point or position is selected for each test.

The force applied to the ground by the machine is measured.

21.108 Cutting accessory cover

Machines with a metallic **cutting accessory** shall be provided with a cover, which shall be so designed that it remains attached to the **cutting accessory** during transport and storage.

Compliance is checked by inspection.

22 Internal wiring

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

22.6 *Addition:*

For machines without rotation limiting end stops, the rotatable parts of the machine are subjected to 2 000 continuous rotations in each direction with any intermediate locking detents disabled.

For machines with rotation limiting end stops, the rotatable parts of the machine are subjected to 2 000 cycles stop to stop, with any intermediate locking detents disabled.

For machines with rotation limiting end stops, after the 2 000 cycles are completed, each end stop shall be subjected to a gradually applied torque of 6 Nm for 1 min. The end stop shall not allow the rotating element to go beyond the limits of its intended travel.

NOTE 101 Intermediate locking detents are not considered to be rotation limiting end stops.

23 Components

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

23.1.10.1 *Replacement of the sixth paragraph:*

Switches shall further be classified as follows with respect to endurance:

– **power switches** for **grass trimmers**, **brush cutters** and **brush saws**: for 50 000 operating cycles;

– **power switches** for **lawn trimmers** and **lawn edge trimmers**: for 10 000 operating cycles;

– **power switches** which possess series electronics in addition shall also endure 1 000 operating cycles with the electronics bypassed;

NOTE Switches without any declared endurance with the electronics bypassed have been tested, by default, to 1 000 operating cycles in accordance with IEC 61058-1:2008.

– switches other than **power switches**, such as speed selector switches, which are likely to be switched under electrical load: for 1 000 operating cycles. However, this test is not required, if the requirements of this standard are met with the switch short-circuited;

– switches other than **power switches** that either

- are intended for operation without electrical load, and which can be operated only with the aid of a tool or are interlocked so that they cannot be operated under electrical load; or
- provide a motor direction reversing function; or
- are switches for 20 mA load as classified in 7.1.2.6 of IEC 61058-1:2008

are not required to possess any particular endurance characteristic.

23.1.10.2 *Replacement of the third paragraph:*

Power switches *for* ***grass trimmers***, ***brush cutters*** *and* ***brush saws*** *are tested for 50 000 operating cycles.* ***Power switches*** *for* ***lawn trimmers*** *and* ***lawn edge trimmers*** *are tested for 10 000 operating cycles.*

23.3 ~~*Addition:*~~

~~This subclause is not applicable for **lawn trimmers**, **lawn edge trimmers** and **grass trimmers** that cannot be converted to a **brush cutter** or a **brush saw**.~~

~~For **brush cutters**, **brush saws** and **grass trimmers** that can be converted to a **brush cutter** or a **brush saw**, protection devices (e.g. overload or over-temperature protection devices) or circuits that switch off the machine shall be of the non-self-resetting type.~~

This subclause of Part 1 is not applicable.

24 Supply connection and external flexible cords

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

24.1 *Replacement:*

Lawn trimmers and **lawn edge trimmers** shall be provided with one of the following means of connection to the supply:

– an appliance inlet having at least the same degree of protection against moisture as marked in accordance with 8.1 for the machine; or

– a **supply cord** with a length between 0,2 m and 0,5 m and fitted with a plug or other connector having at least the same degree of protection against moisture as marked in accordance with 8.1 for the machine; or

– a **supply cord** with a minimum length of 6 m and fitted with a plug.

Grass trimmers, **brush cutters** and **brush saws** shall be provided with one of the following means of connection to the supply:

– an appliance inlet having at least the same degree of protection against moisture as marked in accordance with 8.1 for the machine; or

– a **supply cord** with a length between 0,2 m and 0,5 m and fitted with a plug or other connector having at least the same degree of protection against moisture as marked in accordance with 8.1 for the machine.

Plugs, connectors and appliance inlets shall be suitable for the ratings of the machine.

Appliance inlets shall not allow the introduction of a connector complying with the standard sheets of IEC 60320 except for IEC 60320-2-3, unless the machine is rated IPX0.

Compliance is checked by inspection and by measurement.

The cord is measured from where it exits the machine to where it enters the plug. The length of a cord guard projecting from the body of the machine or from the body of the plug is included in the measurement when determining the length of the cord.

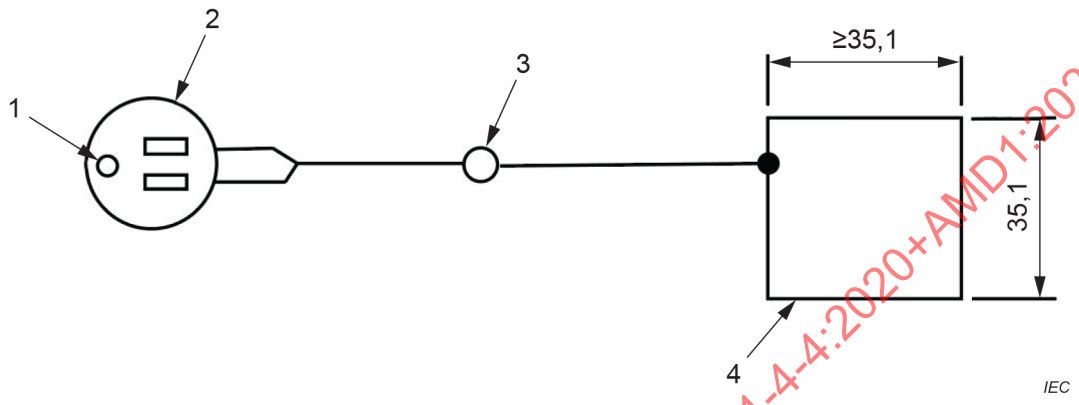
NOTE In Canada and the United States of America, the following additional conditions apply:

The appliance inlet or the attachment plug on the **supply cord** shall be constructed so that, when inserted in the connector of an extension cord, the blades will not be energized until they are inaccessible to contact.

Compliance is checked by the following test.

The receptacle shall be connected to the extension cord of the test assembly illustrated in Figure 121 with the plug inserted in the receptacle as far as possible. The plug shall be withdrawn not more than the distance necessary to permit the test probe to be inserted between the plug body and the extension cord receptacle. The test probe shall be inserted with a force of 18 N (4,1 lb) or less, until the probe contacts one blade of the plug. While the probe is in contact with the blade, the electrical continuity shall be determined by an ohmmeter or similar instrument between the contacts of the extension cord receptacle and the test probe. The test probe shall not contact any current-carrying blade of the attachment plug while the plug is conductively connected to the connector of the extension cord. The test shall be repeated for the other blade of the attachment plug.

Dimensions in millimetres



Key

1 GH (grounding open)

2 extension cord receptacle (three wire grounded)

3 continuity tester

4 test probe made of 1,5 mm thick metal

Figure 121 – Test assembly for accessibility of attachment plug blades

24.2 *Addition:*

A **type Z attachment** is allowed on **lawn trimmers** and **lawn edge trimmers**. A **type Z attachment** is not allowed on **grass trimmers**, **brush cutters** and **brush saws**.

24.4 *Replacement of NOTE 1 and NOTE 2:*

NOTE 1 In the United States of America, the following conditions apply:

Supply cords shall be not lighter than type SJOW, SJTW, or the equivalent that is oil and weather resistant in accordance with the National Electrical Code, ANSI/NFPA 70.

Attachment plugs and cords shall be equal to or greater than the rating of the machine.

NOTE 2 In Canada, the following conditions apply:

Supply cords shall be not lighter than type SJOW, SJTW, or the equivalent that is oil and weather resistant in accordance with the Canadian Electrical Code, Part 1.

24.13 *Modification:*

This requirement applies to **supply cords** and **interconnection cords**.

Replacement of Table 9:

Table 9 – Pull and torque value

Mass of machine as specified in 5.17 kg	**Pull** N	**Torque** Nm
All machines	100	0,35

25 Terminals for external conductors

This clause of Part 1 is applicable.

26 Provision for earthing

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

26.1 *Replacement:*

Machines shall have no provision for protective earthing.

Compliance is checked by inspection.

26.2 to **26.5** These subclauses of Part 1 are not applicable.

27 Screws and connections

This clause of Part 1 is applicable.

28 Creepage distances, clearances and distances through insulation

Replacement:

28.1 **Creepage distances** and **clearances** shall not be less than the values in millimetres shown in Table 12. The values specified in Table 12 do not apply to cross-over points of motor windings.

The values in Table 12 are equal or larger than the values required by IEC 60664-1, when all the following:

– an overvoltage category II;
– a material group III;
– a pollution degree 1 for parts protected against deposition of dirt and for lacquered or enamelled windings;
– a pollution degree 3 for other parts;
– inhomogeneous electric field;
– transient overvoltages originating in the equipment not exceeding 4 000 V

are applied.

Protection against deposition of dirt may be achieved through the use of

– encapsulation with a minimum thickness of 0,5 mm; or

– protective coatings that prevent the combined deposition of fine particles and moisture on surfaces between conductors. Requirements for these types of protective coatings are described in IEC 60664-3; or

– enclosures that prevent the ingress of dust by means of filters or seals, provided that no dust is generated within the enclosure itself.

NOTE 1 An example of encapsulation is potting.

If a resonance voltage occurs between the point where a winding and a capacitor are connected together, and metal parts which are separated from **live parts** by **basic insulation** only, the **creepage distance** and **clearance** shall not be less than the values specified for the value of the voltage imposed by the resonance, these values being increased by 4 mm in the case of **reinforced insulation**.

Compliance is checked by measurement.

For machines provided with an appliance inlet, the measurements are made with an appropriate connector inserted. For other machines, they are made on the machine as delivered.

For machines provided with belts, the measurements are made with the belts in place, and the devices intended for varying the belt tension adjusted to the most unfavourable position within their range of adjustment, and also with the belts removed.

Movable parts are placed in the most unfavourable position; nuts and screws with non-circular heads are assumed to be tightened in the most unfavourable position.

*The **clearances** between terminals and accessible metal parts are also measured with the screws or nuts unscrewed as far as possible, but the **clearances** shall then be not less than 50 % of the value shown in Table 12.*

Table 12 – Minimum creepage distances and clearances

Dimensions in millimetres

Distances	Class III tools (machines)		Other machines					
			Working voltage ≤ 130 V		Working voltage > 130 V and ≤ 280 V		Working voltage > 280 V and ≤ 480 V	
	Creepage distance	Clear-ance	Creepage distance	Clear-ance	Creepage distance	Clear-ance	Creepage distance	Clear-ance
Between parts of different potential [a]:								
– if lacquered or enamelled windings or if protected against deposition of dirt	1,0	1,0	1,0	1,0	2,0	2,0	2,0	2,0
– if not protected against deposition of dirt	2,0 [c]	1,5	2,0 [b]	1,5	3,0 [b]	2,5	8,0 [e]	3,0
Between **live parts** and other metal parts over **basic insulation**:								
– if the **live parts** are lacquered or enamelled windings [d] or if protected against deposition of dirt	–	–	1,0	1,0	2,0	2,0	2,0	2,0
– if not protected against deposition of dirt	–	–	2,4 [c]	1,5	4,0 [c]	3,0	8,0 [e]	3,0
Between **live parts** and other metal parts over **reinforced insulation**:								
– if the **live parts** are lacquered or enamelled windings or protected against deposition of dirt	–	–	5,0	5,0	6,0	6,0	10,0 [e]	6,0
– for other **live parts** not protected against deposition of dirt	–	–	5,0	5,0	8,0	8,0	16,0 [e]	8,0
Between metal parts separated by **supplementary insulation**	–	–	2,5	2,5	4,0	4,0	8,0 [e]	4,0

[a] The **clearances** specified do not apply to the air gap between the contacts of thermal controls, **protective devices**, switches of micro-gap construction, and the like, or to the air gap between the current-carrying members of such devices where the **clearance** varies with the movement of the contacts.

[b] These **creepage distances** are slightly lower than suggested by IEC 60664-1. **Creepage distances** between parts of different potential (functional insulation) are only associated to fire hazard, not to electric shock hazard. As products in the scope of IEC 62841 are products supervised during **normal use**, lower distances are justified.

[c] These **creepage distances** may be reduced to values in accordance with IEC 60664-1, if the insulation parts are of material group II or lower.

[d] Windings are considered to have **basic insulation** if they are wrapped with tape and then impregnated, or if they are covered with a layer of self-hardening resin, and if, after the test of 14.1, an electric strength test as specified in Clause D.2 is withstood, the test voltage being applied between the conductors of the winding and metal foil in contact with the surface of the insulation.

It is sufficient that the wrapping and impregnation, or the layer of self-hardening resin, cover the windings only at places where it is not possible to obtain the **creepage distance** or **clearance** specified for lacquered or enamelled windings.

[e] These **creepage distances** are valid for frequencies up to 30 kHz. For higher frequencies, creepage distances shall be in accordance with IEC 60664-4. **Creepage distances** and **clearances** can be reduced in accordance with IEC 60664-1 if the insulation parts are of material group II or lower and/or for **working voltages** ≤ 400 V, however they shall not be lower than the values required in the column "**Working voltage** > 130 V and ≤ 280 V".

Distances through slots or openings in external parts of insulating material are measured to metal foil in contact with the accessible surface; the foil is pushed into corners and the like by means of the test probe B of IEC 61032:1997, but it is not pressed into openings.

If necessary, a force is applied to any point on internal wiring and bare conductors, other than those of heating elements, to any point on uninsulated metal capillary tubes of ***thermostats*** *and similar devices, and to the outside of metal enclosures, in an endeavour to reduce the* ***creepage distances*** *and* ***clearances*** *while taking the measurements.*

The force is applied by means of the test probe B of IEC 61032:1997, and has a value of:

– *2 N for internal wiring and bare conductors and for uninsulated capillary tubes of* ***thermostats*** *and similar devices;*

– *30 N for enclosures.*

The way in which ***creepage distances*** *and* ***clearances*** *are measured is indicated in Annex A.*

For machines having parts with ***double insulation*** *where there is no metal between* ***basic insulation*** *and* ***supplementary insulation****, the measurements are made as though a metal foil were present between the two insulations.*

Means provided for fixing the machine to a support are considered to be accessible.

Creepage distances *and* ***clearances*** *within optocouplers are not measured if the individual insulations are adequately sealed, and if air is excluded between individual layers of the material.*

For parts of different potential, including conductive patterns on printed circuit boards, except for external mains connection, ***creepage distances*** *and* ***clearances*** *smaller than the minimum values specified*

– *in Table 12; or*

– *for conductive patterns on printed circuit boards as specified below*

are allowed, provided

– *the requirements of Clause 18 are met if these* ***creepage distances*** *and* ***clearances*** *are short-circuited in turn; or*

– *for* ***electronic circuits****, they comply with 18.6 and 18.8.*

For conductive patterns on printed circuit boards, except at their edges, the minimum ***creepage distances*** *and* ***clearances*** *in Table 12 between parts of different potential may be reduced, as long as the peak value of the voltage stress does not exceed:*

– *150 V per mm with a minimum value of 0,2 mm, if protected against the deposition of dirt;*

– *100 V per mm with a minimum value of 0,5 mm, if not protected against the deposition of dirt.*

When the limits mentioned above lead to higher values than those of Table 12, the values of Table 12 apply.

NOTE 2 The above values are equal to or larger than the values required by IEC 60664-3.

28.2 Depending on the **working voltage**, the distance through insulation shall be as follows:

– For **working voltages** up to and including 130 V, the distance through insulation between metal parts shall not be less than 1,0 mm, if they are separated by **supplementary insulation**, and not be less than 1,5 mm, if they are separated by **reinforced insulation**.

– For **working voltages** over 130 V, the distance through insulation between metal parts shall not be less than 1,0 mm, if they are separated by **supplementary insulation**, and not be less than 2,0 mm, if they are separated by **reinforced insulation**.

– For all **working voltages**, the distance through **reinforced insulation** used between enamelled or lacquered windings and accessible metal shall not be less than 1,0 mm.

The required distance through insulation may be achieved through several thicknesses of solid insulation layers that may have intervening air between the layers such that the sum of the thicknesses of the solid insulation equals the required thickness.

This requirement does not apply, if either a) or b) is fulfilled.

a) The insulation is applied in thin sheet form, other than mica or similar scaly material, and consists:

   – for **supplementary insulation**, of at least two layers, provided that any one of the layers withstands the electric strength test prescribed for **supplementary insulation**;

   – for **reinforced insulation**, of at least three layers, provided that, when any two of the layers are placed in contact, they withstand the electric strength test prescribed for **reinforced insulation**.

   The test voltage is applied between the outer surfaces of the layer, or of the two layers, as applicable.

b) The **supplementary insulation** or the **reinforced insulation** is inaccessible and meets the following condition:

   The insulation, after having been conditioned for seven days (168 h) in an oven maintained at a temperature equal to 50 K greater than the maximum temperature rise determined during the test of Clause 12 withstands an electric strength test as specified in Annex D, this test being made on the insulation both at the temperature occurring in the oven, and at approximately room temperature.

Compliance is checked by inspection and by measurement.

For optocouplers, the conditioning procedure is carried out at a temperature of 50 K in excess of the maximum temperature rise measured on the optocoupler during the tests of Clause 12 and Clause 18, the optocoupler being operated under the most onerous conditions which occur during these tests.

Annexes

The annexes of Part 1 are applicable except as follows:

Annex I
(informative)

Measurement of noise and vibration emissions

NOTE In Europe (EN 62841-4-4), Annex I is normative.

I.2 Noise test code (grade 2)

This clause of Part 1 is applicable except as follows:

I.2.2 Sound power level determination

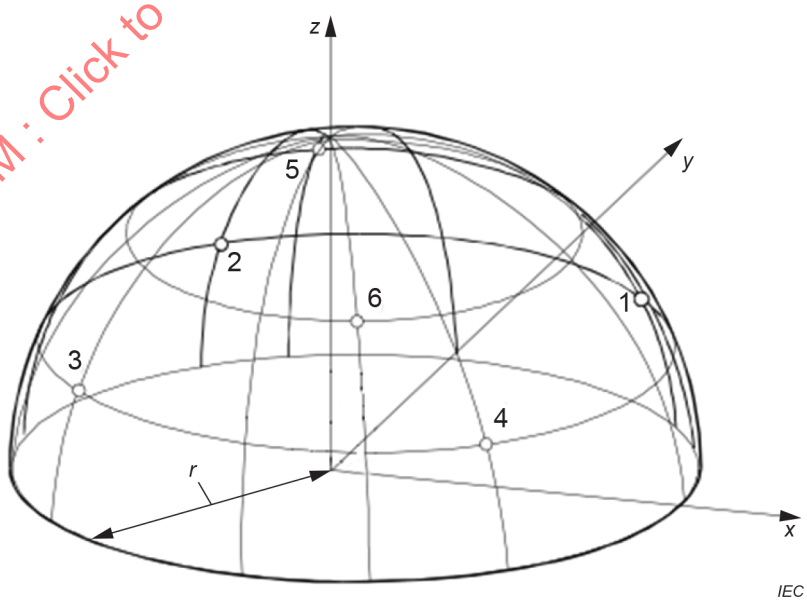
I.2.2.1 General

Replacement:

The sound power level shall be measured using a hemispherical measurement surface according to Figure I.101. The acoustic environment, instrumentation, quantities to be measured, quantities to be determined, and the measurement procedure are specified in ISO 3744:2010.

The sound power level shall be given as A-weighted sound power level in dB reference 1 pW. The A-weighted sound pressure levels, from which the sound power is to be determined, shall be measured directly, and not calculated from frequency band data. Measurements shall be made outdoors or indoors in an essentially free field.

NOTE In Europe, for **grass trimmers** with a **cutting element** having a kinetic energy of not more than 10 J, **lawn trimmers** and **lawn edge trimmers**, the determination of the sound power level in accordance with I.2.2.4 also provides the basis for the determination of the A-weighted measured and guaranteed sound power level L_{WA} required by the European Directive 2000/14/EC and its amendments.



Key

r radius of hemisphere

Figure I.101 – Microphone positions on the hemisphere (see Table I.101)

I.2.2.2 This subclause of Part 1 is not applicable.

I.2.2.3 This subclause of Part 1 is not applicable.

I.2.2.4 Lawn and garden machinery

Replacement:

The test environment outdoors shall be a flat open space (a slope, if any, not exceeding 5/100), visibly free of sound-reflecting objects (building, trees, poles, sign boards, etc.) within a circular area with a radius equal to approximately three times the radius of the hemispherical measurement surface used.

For the determination of sound power level, ISO 3744:2010 shall be used subject to the following modifications:

– the microphone array shall be six microphone positions according to Figure I.101 and Table I.101;
– for outdoor and indoor measurements, the reflecting surface shall be replaced by an artificial surface according to I.2.2.101 or a natural ground surface according to I.2.2.102. Reproducibility of results using natural grass or other organic material is likely to be worse than that required for Grade 2 of accuracy. In case of dispute, measurements shall be carried out in the open air and on the artificial surface according to I.2.2.101;
– the measurement surface shall be a hemisphere with a radius, r, for which r = 4 m;
– for measurements outdoors, K_{2A} = 0 dB;
– for measurements outdoors, the environmental conditions shall be within the limits specified by the manufacturers of the measuring equipment. The ambient air temperature shall be in the range from 5 °C to 30 °C and the wind speed shall be less than 5 m/s. A wind screen shall be used whenever the wind speed exceeds 1 m/s;
– for measurements indoors, the environment shall be according to ISO 3744:2010 and the value of K_{2A}, determined without artificial surface and in accordance with Annex A of ISO 3744:2010, shall be ≤ 2 dB, in which case K_{2A} shall be disregarded.

The artificial surface, if used, is placed so that its geometrical centre also coincides with the origin of the coordinate system of the microphone positions.

The measurement is carried out without an operator.

NOTE It is likely that the results from conducting tests using an operator will not achieve Grade 2 accuracy.

The A-weighted sound power level, L_{WA}, in dB shall be calculated in accordance with 8.2.5 of ISO 3744:2010, as follows:

$$L_{WA} = \overline{L_{pA}} + 10\lg\left(\frac{S}{S_0}\right)\ \text{dB} \qquad \text{(I.101)}$$

With $\overline{L_{pA}}$ determined from

$$\overline{L_{pA}} = 10\lg\left[\frac{1}{6}\sum_{i=1}^{6} 10^{0{,}1L'_{pA,i}}\right] - K_{1A} - K_{2A}\ \text{dB}$$

where

$\overline{L_{pA}}$ is the surface time averaged sound pressure level according to 8.2.4 of ISO 3744:2010, in dB;

$L'_{pA,i}$ is the A-weighted sound pressure level measured at the i^{th} microphone position, in dB;

K_{1A} is the background noise correction, A-weighted;

K_{2A} is the environmental correction, A-weighted, according to the requirements of this noise test code K_{2A} = 0 dB;

S is the area of the measurement surface, in m^2;

S_0 = 1 m^2.

For the hemispherical measurement surface, the area S of the measurement surface is calculated as follows:

$$S = 2\pi r^2$$

where the radius of the hemisphere r = 4 m

so, from equation (I.101)

$$L_{WA} = \overline{L_{pA}} + 20 \text{ dB}$$

Three consecutive tests shall be carried out and the result of the test L_{WA} shall be the arithmetic mean, rounded to the nearest decibel, of the three tests.

Table I.101 – Co-ordinates of microphone positions

Position No.	*x*	*y*	*z*
1	+0,655 *r*	+0,655 *r*	~~0,38 *r*~~1,5 m
2	−0,655 *r*	+0,655 *r*	~~0,38 *r*~~1,5 m
3	−0,655 *r*	−0,655 *r*	~~0,38 *r*~~1,5 m
4	+0,655 *r*	−0,655 *r*	~~0,38 *r*~~1,5 m
5	−0,~~28~~27 *r*	+0,65 *r*	0,71 *r*
6	+0,~~28~~27 *r*	−0,65 *r*	0,71 *r*

I.2.2.101 Requirements for an artificial surface

The artificial surface shall have absorption coefficients as given in Table I.102, measured in accordance with ISO 354:2003.

Table I.102 – Absorption coefficients

Frequencies Hz	Absorption coefficients	Tolerance
125	0,1	±0,1
250	0,3	±0,1
500	0,5	±0,1
1 000	0,7	±0,1
2 000	0,8	±0,1
4 000	0,9	±0,1

The artificial surface shall be placed on a hard, reflecting surface and have a size of at least 3,6 m × 3,6 m placed at the centre of the test environment. The construction of the supporting structure shall be such that the requirements for the acoustic properties are also met with the absorptive material in place. The structure shall support the operator to avoid compression of the absorbing material.

NOTE 101 See Annex DD for an example of a material and construction which can be expected to fulfil these requirements.

I.2.2.102 Requirements for a natural ground surface

The test environment, within a circular area with a radius equal to approximately the radius of the hemispherical measurement surface used, shall be covered with high-quality natural grass. Before the measurements are taken, the grass shall be cut with a lawnmower to a height of cut as near as possible to 30 mm. The surface shall be clean of grass clippings and debris and shall be visibly free of moisture, frost, or snow.

I.2.3 Emission sound pressure level determination

This subclause of Part 1 is applicable, except as follows:

I.2.3.1 This subclause of Part 1 is not applicable.

I.2.3.2 This subclause of Part 1 is not applicable.

I.2.3.3 Lawn and garden machinery

Replacement:

The A-weighted emission sound pressure level at the operating position, L_{pA}, shall be determined according to ISO 11201:2010, grade 2, subject to the following modifications:

– the test environment outdoors shall be a flat open space (a slope, if any, not exceeding 5/100), visibly free of sound-reflecting objects (building, trees, poles, sign boards, etc.) within a circular area with a radius equal to approximately three times the radius of the hemispherical measurement surface used;

– for outdoor and indoor measurements, the reflecting surface shall be replaced by an artificial surface according to I.2.2.101 or a natural ground surface according to I.2.2.102. Reproducibility of results using natural grass or other organic material is likely to be worse than that required for Grade 2 of accuracy. In case of dispute, measurements shall be carried out in the open air and on the artificial surface according to I.2.2.101;

– for measurements outdoors, K_{2A} = 0 dB;

– for measurements outdoors, the environmental conditions shall be within the limits specified by the manufacturers of the measuring equipment. The ambient air temperature shall be in the range from 5 °C to 30 °C and the wind speed shall be less than 5 m/s. A wind screen shall be used whenever the wind speed exceeds 1 m/s;

– for measurements indoors, the environment shall be according to ISO 3744:2010 and the value of K_{2A}, determined without artificial surface and in accordance with Annex A of ISO 3744:2010, shall be ≤ 2 dB, in which case K_{2A} shall be disregarded.

The artificial surface, if used, is placed so that its geometrical centre also coincides with the origin of the coordinate system of the microphone positions.

Tests are repeated to attain the required grade of accuracy, and until four consecutive A-weighted results give values within not more than 2 dB. The arithmetic average of these is the measured A-weighted emission sound pressure level of the machine.

The installation and mounting conditions for the determination of emission sound pressure level at the work station shall be the same as for the determination of the sound power level. The measurement is conducted without an operator.

For **hand-held trimmers**, **grass trimmers**, **brush cutters** and **brush saws**, the microphone is positioned according to ~~B.2.3 of ISO 22868:2011, but with the exception that the microphone shall be located (1 650 ± 10) mm above the ground~~ ISO 22868:2021, B.2.3.

For **walk-behind trimmers**, the microphone is located (1 650 ± 10) mm above the ground and positioned vertically above the centre of the handle where an operator would normally hold the handle and shall be angled at 45°, pointing towards the **cutting means**.

I.2.4 Installation and mounting conditions of the power tools during noise tests

Replacement:

The machine under test shall be a new, normal production machine and be equipped with **cutting means** or **cutting accessories** which affect the acoustic properties, as specified in 8.14.2.

If a grass catcher is provided or available, the test is performed with the grass catcher fitted and empty.

Prior to commencing testing, the machine (including any required ancillary equipment) shall be set up for **normal use** as specified in 8.14.2. Automatic line feeders, if any, shall be disabled.

Except as otherwise specified for **walk-behind trimmers**, the installation and mounting conditions for A-weighted sound power and sound pressure level measurement for **lawn trimmers**, **grass trimmers**, **brush cutters** and **brush saws** shall be in accordance with ~~Clause B.2 of ISO 22868:2011~~ ISO 22868:2021, Clause B.2, as far as applicable to electric powered machines. If the machine is equipped with a means to automatically cut non-metallic filament line to a maximum length**,** the length of the ~~rotating **cutting means**~~ filament line shall be adjusted to be (5 ± 1) mm less than the maximum length.

NOTE The mounting conditions for **lawn trimmers** are considered to be those applicable to **grass trimmers**.

If due to the geometry of the machine, the dimensional requirements of ~~B.2.1 of ISO 22868:2011~~ ISO 22868:2021, B.2.1 cannot be fulfilled, the height of the suspension point or rear handle may be adjusted as necessary to ensure that dimension *H* is maintained and the angle between the plane of the **cutting means** and the ground is no greater than 20°. Care shall be taken to make sure that the **cutting means** does not make contact with the artificial surface or the grass of a natural surface.

Hand-held **lawn edge trimmers** shall be mounted in a similar way to **brush cutters** but with the plane of the **cutting means** perpendicular to the ground and positioned as close as possible to the test surface. Care shall be taken to make sure that the **cutting means** does not make contact with the artificial surface or the grass of a natural surface.

For **walk-behind trimmers**, the machine is placed on the surface in such a way that the projection of the geometrical centre of the main parts (excluding handle, grass catcher, etc.) coincides with the origin of the coordinate system of the microphone positions. The longitudinal axis of the machine shall be aligned with the x-axis.

If the maximum height of cut of the machine is greater than 30 mm, the height of cut shall be adjusted to the lowest position provided, but not lower than 30 mm. If the maximum height of cut of the machine is less than 30 mm, the height of cut shall be adjusted to the highest position provided. The height of cut shall be adjusted with the machine resting on a hard, flat surface. If necessary, the handle shall be supported in a position representative of **normal use** by a suitable fixture incorporating a flexible mount that avoids any structural resonance.

I.2.5 Operating conditions

Replacement:

The operating conditions shall be the same for the determination of both sound power level and emission sound pressure level at the work station.

Mains powered machines shall be operated at **rated voltage** or if they have a **rated voltage range**, at the highest voltage.

For all machines except for machines powered by **integral batteries**, the machine is fitted with the **cutting means** or **cutting accessory** and operated for 10 min at **maximum speed** at no-load prior to the test.

For **battery** powered machines, the test shall be conducted with a **fully charged battery** at the beginning of the measurements.

The machine noise emission is then measured with the **cutting means** or **cutting accessory** fitted to the machine and operated at **maximum speed** at no load.

NOTE As it is difficult to apply or simulate load to **lawn trimmers**, **lawn edge trimmers**, **grass trimmers**, **brush cutters** and **brush saws** in laboratories and test results have shown that the process noise has no significant influence on the noise results, the measurements are conducted with no load only.

During measurements, the machine shall operate under stable conditions. Once the noise emission is steady, the measurement time interval shall be at least 15 s. If measurements are to be made in octave or one-third octave frequency bands, the minimum period of observation shall be 30 s for the frequency bands centred on or below 160 Hz, and 15 s for the frequency bands centred on or above 200 Hz.

I.3 Vibration

This clause of Part 1 is applicable except as follows:

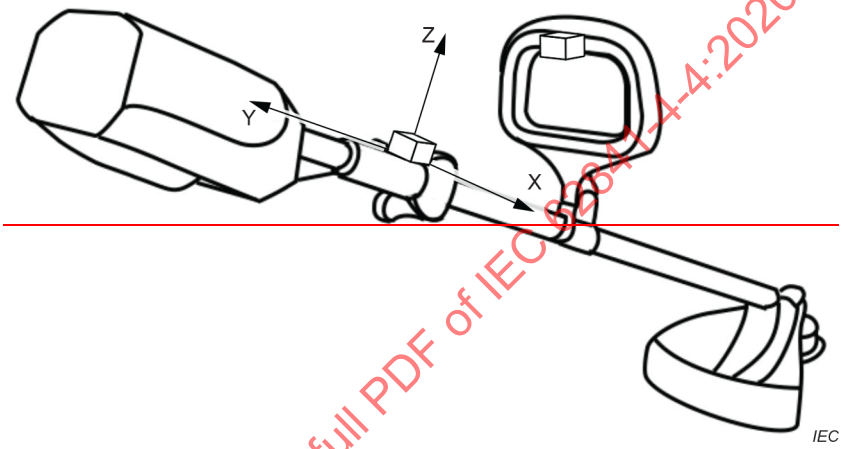
I.3.3.2 Location of measurement

Addition:

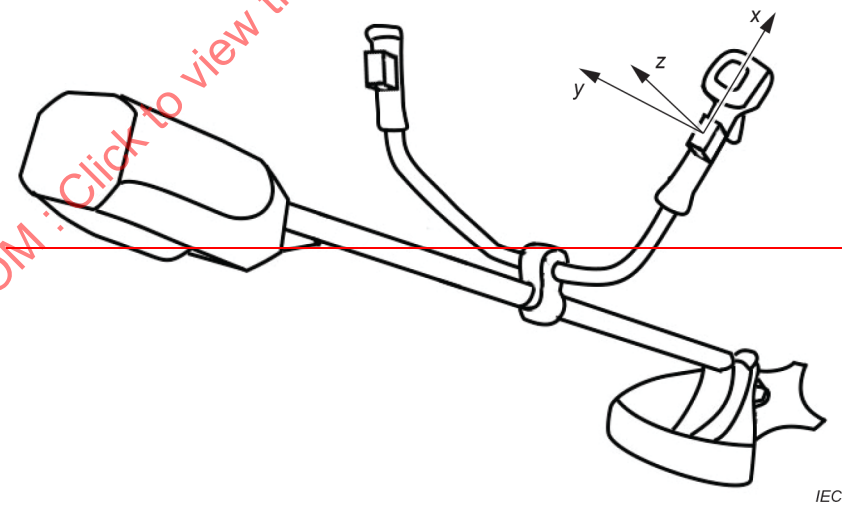
~~A maximum of two transducers shall be used for hand-arm vibration. The transducer(s) for the hand-arm vibration measurements shall be placed where an operator holds the handle(s). The operator(s) shall be in the normal operating position. Figure I.102 and Figure I.103 give examples for the positions of the transducers for hand-held and walk-behind machines.~~

For hand-held machines, the position of the transducers shall be as specified in ISO 22867:2021, Clause B.1. The term 'throttle trigger' shall be taken to mean the **power switch**.

For walk-behind machines, the transducer(s) shall be placed where an operator holds the handle(s). The operator(s) shall be in the normal operating position. Figure I.103 gives examples for the positions of the transducers.



~~a) Example of positions of transducers on a grass trimmer~~



~~b) Example of positions of transducers on a brush cutter~~

~~**Figure I.102 – Examples of positions of transducers (hand-held machines)**~~

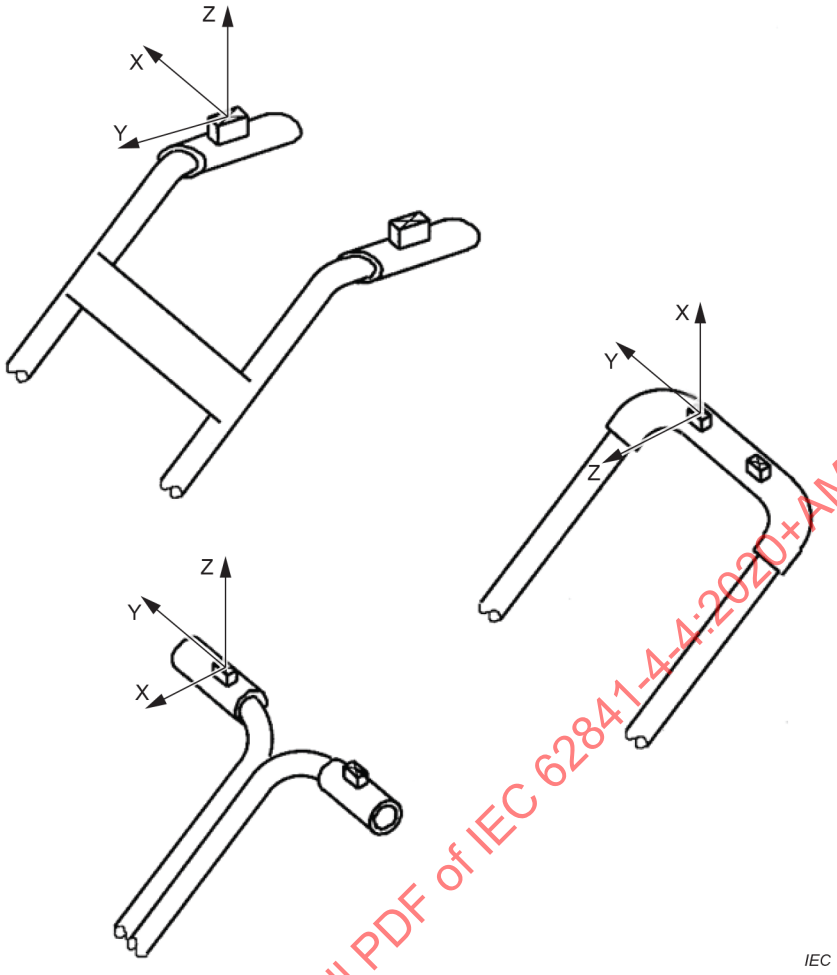


Figure I.103 – Examples of positions of transducers (walk-behind machines)

I.3.5.1 *Replacement of the last paragraph:*

During the measurements, the hands of the operator shall hold the machine in accordance with 8.14.2 b) 109) in a stationary position.

I.3.5.2 Attachment, workpiece and task

Addition:

The vibration emission is measured with all **cutting means** or **cutting accessories** specified in accordance with 8.14.2 fitted to the machine and including all other **attachments** specified in accordance with 8.14.2 by the manufacturer giving the highest vibration levels. The configuration of the machine tested shall be recorded.

Prior to commencing testing, the machine shall be set up for **normal use** as specified in 8.14.2.

If a grass catcher is provided or available, the test is performed with the grass catcher fitted and empty.

I.3.5.3 Operating conditions

Replacement:

Prior to the test, the machine is fitted with the **cutting means** or **cutting accessory** and operated for 10 min at **maximum speed** at no-load.

The vibration emission is measured with the machine stationary with the **cutting means** or **cutting accessory** fitted to the machine, operated at **maximum speed** at no load and held as in **normal use** as specified in 8.14.2.

NOTE As it is difficult to apply or simulate load to **lawn trimmers, lawn edge trimmers, grass trimmers, brush cutters and brush saws** in laboratories and test results have shown that the load has no significant influence on the vibration results, the measurements are conducted with no load only.

If the machine is equipped with a means to automatically cut non-metallic filament line to a maximum length, the length of the rotating **cutting means** shall be adjusted to be (5 ± 1) mm less than the maximum length.

Adjustable handles of machines shall be set to suit the operator(s).

For **walk-behind trimmers**, the cutting height shall be set to 30 mm or the next higher cutting position when set on a hard level surface. Machines with a maximum cutting height setting of 30 mm or less shall be set at their maximum height setting. Measurements shall be carried out on a surface in accordance with Clause BB.1.

Before starting the test, the machine shall be operated at no load for a period of at least 1 min.

I.3.6.1 Reported vibration values

Addition:

Each test measurement is made after the machine has been switched on for a minimum of 2 s or until **maximum speed** of the **cutting means** is achieved, whichever is longer. The vibration measurement is then conducted over a minimum of 8 s.

I.3.6.2 Declaration of the vibration total value

Addition:

The vibration total value a_h of the handle with the highest emission and the uncertainty K shall be declared.

Annex K
(normative)

Battery tools and battery packs

All clauses of the main body of this Part 4-4 apply unless otherwise specified in this annex. If a clause is stated in this annex, its requirements replace the requirements of the main body of this Part 4-4 unless otherwise specified. Subclauses, notes, tables and figures which are additional to those in the main body of this Part 4-4 are numbered starting from 301.

K.1 Scope

Addition:

NOTE 301 In Europe (EN 62841-4-4), this document does not apply to **grass trimmers**, **brush cutters** and **brush saws** equipped with **integral batteries**.

K.3 Terms and definitions

This clause of Part 4-4 is applicable, except as follows:

Replacement of 3.63 of Part 1:

K.3.63
working voltage
voltage, without the effect of transient voltages, across any insulation or between any parts of different potential when the tool is supplied by (a) **fully charged battery**(**ies**) and operating at no-load, or with the tool in the "off" condition, whichever is greater

Addition:

K.3.301
code protected disabling device
device which, when activated, prevents operation of the machine and requires a coded input (such as via a keypad) before it is deactivated and the machine can operate

Note 301 to entry: See K.21.302.2.3.

K.3.302
removable disabling device
detachable part, such as for example a key, which prevents operation of the machine when it is removed

Note 301 to entry: See K.21.302.2.2.

K.3.303
switched circuit
circuit that is a low-power circuit when the **power switch** is in the "off" position

Note 301 to entry: The requirements for a low-power circuit are given in Annex H.

K.5.17 *Addition:*

*The mass of the machine includes the heaviest **detachable battery pack**(**s**), but does not include any **separable battery pack**(**s**), in accordance with K.8.14.2 e) 2).*

K.5.207 *Addition to Part 1:*

*For tests that are conducted at **maximum speed***

– *the **battery** shall be replaced with a **fully charged battery** as needed in order to maintain the speed of the **cutting means** or **cutting accessory** to be not less than 90 % of **maximum speed**; or*

– *the machine may be powered by an external power source maintained at the nominal voltage of the **battery**.*

K.7.1 This subclause of Part 4-4 is not applicable.

K.7.2 This subclause of Part 4-4 is not applicable.

K.8.1 Machines shall be marked with the IP number according to the degree of protection against ingress of water other than IPX0. If the first numeral for the IP numbering is omitted, the omitted numeral shall be replaced by the letter X, for example IPX5.

Grass trimmers, **brush cutters** and **brush saws** shall be marked with the **maximum speed** of the spindle assigned by the manufacturer.

The **cutting head** for **grass trimmers** and the **cutting accessories** for **brush cutters** and **brush saws** shall be marked with their maximum permitted rotational speed.

Compliance is checked by inspection.

K.8.2 *Addition:*

Machines with a **detachable battery pack** or a **separable pack** shall be marked with the following safety warning:

– "⚠WARNING – Disconnect battery before maintenance" or the safety sign specified in Figure AA.17.

Machines with a **removable disabling device** shall be marked with the following safety warning:

– "⚠WARNING – Remove the disabling device before maintenance" or the safety sign specified in Figure AA.18.

Machines with a **code protected disabling device** shall be marked with the following safety warning:

– "⚠WARNING – Operate the disabling device before maintenance" or the safety sign specified in Figure AA.19.

K.8.4 *Replacement of the first and second paragraph of Part 1:*

Markings specified in K.8.1, K.8.2 and in K.8.3 of Part 1 shall not be on a **detachable part** of the machine.

Markings specified in K.8.2 shall be clearly discernible from the outside of the machine. Markings specified in K.8.3 of Part 1 shall be visible with any **separable battery pack** or **detachable battery pack** removed. Other markings on the machine may be visible after removal of a cover, if necessary.

K.8.14.1.101 Lawn trimmer and lawn edge trimmer safety warnings

Modification:

Item e) is not applicable.

K.8.14.1.102 Grass trimmer, brush cutter and brush saw safety warnings

Modification:

Items e), r) and x) are not applicable.

Replacement of item n):

n) **Hold the machine by the insulated gripping surfaces only, because the cutting line or blade may contact hidden wiring.** *Cutting line or blades contacting a "live" wire may make exposed metal parts of the machine "live" and could give the operator an electric shock.*

Addition:

bb) **When clearing jammed material or servicing the machine, make sure the switch is off and the battery pack is removed.** *Unexpected starting of the machine while clearing jammed material or servicing may result in serious personal injury.*

NOTE 301 The above warning is omitted for machines with **integral batteries**.

cc) **When clearing jammed material or servicing the machine, make sure the switch is off and the machine is disabled.** *Unexpected starting of the machine while clearing jammed material or servicing may result in serious personal injury.*

NOTE 302 The above warning is omitted for machines with **detachable battery packs** and **separable battery packs**.

NOTE 303 In Europe (EN 62841-4-4), the above warning is omitted for **grass trimmers**, **brush cutters** and **brush saws**.

K.8.14.2 b) *Modification:*

Items 102) and ~~116~~115) are not applicable.

Addition:

301) Instructions for the use and adjustment of any means of support for **separable battery packs** in accordance with K.21.301 and instructions for release or removal.

K.8.14.2 c) *Addition:*

301) For machines with **integral batteries**, instructions on how to disable the machine during maintenance or servicing.

K.8.14.3 If information about the mass or weight of the machine is provided, it shall be

– for **lawn trimmers**, **lawn edge trimmers** and **grass trimmers**, the mass specified in K.5.17, excluding the **battery** (except for **integral batteries**); and

– for **brush cutters** and **brush saws**, the mass without the **battery** (except for **integral batteries**), **cutting accessory**, **cutting accessory** cover, harness and hip pad, if any.

If information about the mass or weight of the **battery(ies)** is provided, it shall cover the range of specified **batteries**.

Compliance is checked by inspection.

K.11 Input and current

This clause of Part 4-4 is not applicable.

K.12.1 *Replacement of this subclause of Part 1:*

Battery machines and **battery** packs shall not attain excessive temperatures.

Compliance is checked by determining the temperature rise of the various parts under the following conditions:

*For **walk-behind trimmers**, the test is conducted with the machine placed on an unperforated flat horizontal surface and if the cutting height is adjustable, at both the minimum and maximum cutting height.*

*All machines are fitted with the **cutting means** or **cutting accessory** and operated at **maximum speed** at no-load until maximum temperature is reached or the machine no longer operates due to the **battery** being discharged.*

*The most unfavourable conditions are determined using the **cutting means** or **cutting accessory** in accordance with 8.14.2, which yields the highest temperature on the surface of the external enclosure.*

*During the test, **protective devices** shall not operate. The temperature rises shall not exceed the values shown in Table 2.*

K.12.2 This subclause of Part 4-4 is not applicable.

K.12.2.1 This subclause of Part 4-4 is not applicable.

K.14 Moisture resistance

This clause of Part 4-4 is not applicable, except as follows:

K.14.301 Battery-powered lawn trimmer, lawn edge trimmer, grass trimmer, brush cutter and brush saw moisture resistance

K.14.301.1 The enclosure of the machine shall provide the degree of protection against moisture in accordance with the marking (other than IPX0) of the machine.

Compliance is checked by the appropriate treatment specified in K.14.301.3, with the machine conditioned as in K.14.301.2.

K.14.301.2 *The machine is tested with **detachable battery pack(s)** or **separable battery pack(s)** fitted. A second machine is then tested with any **detachable battery pack(s)** or **separable battery pack(s)** removed. The machine is switched off during the test.*

*For a **walk-behind trimmer**, the machine is placed on a non-perforated turntable. The front to rear centreline of the machine is aligned with the pivot axis of the oscillating tube at the start of test.*

For hand-held machines, the machine is placed in its normal rest position on a perforated turntable.

The turntable is turned continuously at (1 ± 0,1) r/min.

Detachable parts *are removed and subjected, if necessary, to the relevant treatment with the main part. Movable covers that are non-****detachable parts*** *and are not self-restoring are placed in the most unfavourable position.*

NOTE Examples of self-restoring covers include those that are spring loaded or close by gravity.

Batteries *with a classification greater than IPX0 are tested separately according to their rating.*

Air filters are not removed.

K.14.301.3 *Machines other than IPX0 are subjected to tests of IEC 60529:2013 as follows:*

– *IPX1 machines are subjected to the test described in 14.2.1;*
– *IPX2 machines are subjected to the test described in 14.2.2;*
– *IPX3 machines are subjected to the test described in 14.2.3;*
– *IPX4 machines are subjected to the test described in 14.2.4;*
– *IPX5 machines are subjected to the test described in 14.2.5;*
– *IPX6 machines are subjected to the test described in 14.2.6;*
– *IPX7 machines are subjected to the test described in 14.2.7. For this test, the machine is immersed in water containing approximately 1,0 % NaCl.*

For machines with ***integral batteries****, if any, and when the test is carried out with the* ***detachable battery pack(s)*** *installed or* ***separable battery pack(s)*** *connected, if any, during and after the appropriate treatment, the machine shall not start with the* ***power switch*** *in the "off" position.*

When the test is carried out without the ***detachable battery pack(s)*** *inserted or* ***separable battery pack(s)*** *connected, the* ***detachable battery pack(s)*** *is inserted or the* ***separable battery pack(s)*** *is connected at the end of the treatment. The machine shall not start with the* ***power switch*** *in the "off" position with the* ***detachable battery pack(s)*** *installed or* ***separable battery pack(s)*** *connected.*

Afterwards, inspection shall show that there is no trace of water on insulation which could result in a reduction of ***creepage distances*** *between bare conductors below the values specified in K.28.1. For all instances where creepage distances could be reduced below the values specified in K.28.1, a short circuit is introduced between adjacent conductors simultaneously. The machine is then evaluated for*

– *the risk of fire in the machine in accordance with item f) of K.18.1; and*
– *the loss of any* ***SCF****, unless the machine is rendered into a safe state.*

Batteries *shall not exhibit* ***fire*** *or* ***explosion****.*

K.17.2 This subclause of Part 4-4 is not applicable.

K.18.3 This subclause of Part 4-4 is not applicable.

K.18.5 This subclause of Part 4-4 is not applicable.

K.18.5.1 This subclause of Part 4-4 is not applicable.

K.18.8 *Addition to Table 4:*

Table 4 – Required performance levels

Type and purpose of SCF	Minimum Performance Level (PL)
Any **disabling device** as in K.21.302.2	Not an **SCF**

K.19.1 *Modification:*

This subclause of Part 4-4 is not applicable for covers for **battery**(**ies**) or **battery compartments**.

K.20.1 Machines and **battery** packs shall have adequate mechanical strength, and shall be so constructed that they withstand rough handling that may be expected.

Compliance is checked by the tests of 20.2 and K.20.3.1.

*Following the test, the machine shall not catch fire and the **battery** pack shall not catch **fire** or explode and shall meet the requirements of Clause K.9, and Clause K.19 and either K.18.1 f) or K.28.1.*

*Damage to the finish, small dents and cracks which do not reduce **creepage distances** or **clearances** below the values specified in K.28.1, or small chips which do not adversely affect protection against shock or moisture are neglected. Damage to the **cutting means**, **cutting means guard**, **cutting head**, **cutting accessory** or **cutting accessory guard**, as applicable, during the test of K.20.3.1 are ignored.*

NOTE 101 The strength and rigidity of the **cutting means guard** and the **cutting head** are covered in 20.101. The strength and rigidity of the **cutting accessory guard** and the **cutting accessories** are covered in 20.102.

If a decorative cover is backed by an inner cover, a fracture of the decorative cover is neglected when the inner cover withstands the test after removal of the decorative cover.

*In addition, the following applies for lithium-ion **batteries** after the test of K.20.3.1:*

- *the open circuit voltage of the **battery** shall not be less than 90 % of the voltage measured immediately prior to the test;*
- *the **battery** shall demonstrate normal discharging and recharging after the test;*
- *there shall be no damage to the **cell** vent that impairs compliance with K.21.202.*

K.20.3 *For **hand-held trimmers**, **grass trimmers**, **brush cutters** and **brush saws**, K.20.3.1 applies.*

*For **walk-behind trimmers**, K.20.3.2 of Part 1 applies.*

*Compliance of **cutting means guards** is checked by the tests of 20.101 and compliance of **cutting heads** is checked by the tests of 20.102.*

K.20.3.1 *Unless otherwise specified, for machines with **detachable battery packs**, the heaviest **detachable battery pack** in accordance with K.8.14.2 e) 2) shall be installed on the machine for the following tests.*

*Machines, except for **walk-behind trimmers**, are dropped three times in total on a concrete surface from a height of 1 m.*

*The machine is configured for use according to 8.14.2 a), fitted with the **cutting head** or **cutting accessory** and placed on the concrete surface in a stable resting position.*

For the first drop, the machine is lifted vertically by 1 m and allowed to drop onto the concrete surface.

For the second drop:

– *the machine is placed on the concrete surface as in the first test;*
– *the machine is lifted vertically by 1 m; then*
– *the machine is rotated about its longitudinal axis approximately 90° in the most unfavourable direction prior to dropping onto the concrete surface.*

For the third drop:

– *the machine is placed on the concrete surface as in the first test;*
– *the machine is lifted vertically by 1 m; then*
– *the machine is rotated about its longitudinal axis approximately 180° prior to dropping onto the concrete surface.*

Secondary impacts shall be avoided.

NOTE A method for avoiding secondary impacts is tethering.

*For **battery** machines with **detachable battery packs**, the test is repeated three more times without the **detachable battery pack** attached to the machine. New samples may be used for each series of three drops.*

For machines with handles having a storage configuration in accordance with 8.14.2 b) 109), the six drops are repeated on a separate sample with the handle adjusted to the storage configuration.

*In addition, for **detachable battery packs** or **separable battery packs**, the test is repeated three more times on the **battery** packs separately.*

~~*In addition, **grass trimmers**, **brush cutters** and **brush saws** are subjected to three impacts that result from the machine being tipped over to strike a concrete surface, from the vertical standing position with the **cutting head** or the **cutting accessory** downwards. The sample is rotated to its three most unfavourable positions prior to being released. For machines with **detachable battery packs**, the test is repeated without the **detachable battery pack** attached to the machine. New samples may be used for each series of three impacts.*~~

~~*Each drop shall be conducted on a separate machine. At the manufacturer's request, each drop may be conducted on the same machine.*~~

Each drop shall be conducted on a separate sample, unless a single sample can be subjected to multiple drops without failure. If a sample has been subjected to multiple drops and fails, then the drop in the orientation that resulted in the failure is repeated using a new sample. If the new sample passes the test for the drop in that orientation, then the requirements for the drop in that orientation are considered to be fulfilled. The test is continued in this manner until all drops in each of the three orientations are completed.

K.20.101.3 *Addition:*

The weight of the machine excludes any **detachable battery pack** or **separable battery pack** in accordance with K.8.14.2 e) 2).

K.21.18 *Addition:*

NOTE 301 In Europe (EN 62841-4-4), the following additional subclause applies:

K.21.18.Z101 Isolation device

Hand-held trimmers and **walk-behind trimmers** with an **integral battery** shall be equipped with an isolation device to prevent the risk of injury from mechanical hazards during servicing or **user maintenance**.

An isolation device shall

– provide disconnection of all poles of the **battery** from the serviceable region of the machine;

– be equipped with an unambiguous indication of the state of the disconnection device which corresponds to each position of its manual control (actuator);

– be provided with protection against accidental reconnection.

NOTE 1 Examples of methods to achieve this disconnection include removable jumpers, **integral batteries** that can be disconnected for servicing or **user maintenance**, or an electromechanical **power switch** with a direct mechanical link between the actuator and the contact.

NOTE 2 The risk of accidental reconnection for a **power switch** is addressed by the requirement of 21.18.1.2. The other examples in NOTE 1 achieve this by the necessary actions for reconnection.

Compliance is checked by inspection and by manual test.

K.21.107 Balance

K.21.107.1 Machines intended to be used with a harness in accordance with 8.14.2 b) 110), except for machines as specified in K.21.107.2, shall be provided with at least one suspension point for attaching the harness. The suspension point(s) shall be designed such that the machine is balanced when it is suspended.

Compliance is checked by inspection, by measurement and by the following test, with the most unfavourable machine configuration in accordance with 8.14.2 in combination with

– *the heaviest **battery** in accordance with K.8.14.2 e) 2); and*

– *the lightest **battery** in accordance with K.8.14.2 e) 2).*

If the machine is provided with more than one suspension point or if the suspension point is adjustable, the most favourable suspension point or position is selected for each test.

~~*If the machine is supplied by means of a **separable battery pack**, the cord shall be removed at its point of exit from the machine or, if supplied with a cord guard or adapter, at its point of exit from the cord guard or adapter.*~~

*If the machine is supplied by means of a **separable battery pack**, the **separable battery pack** shall be positioned as it would on an operator with a height of (1 750 ± 100) mm, in accordance with K.8.14.2 b) 301).*

The suspension point is positioned at a vertical distance of (775 ± 25) mm above the ground, the machine is suspended from this point and the following dimensional requirements shall be fulfilled:

– *for **hand-held trimmers** and **grass trimmers**: a distance from the ground to the nearest point of the **cutting means** or **cutting accessory** shall be (150 ± 150) mm;*

– *for **brush cutters** and **brush saws**: a distance from the ground to the nearest point of the **cutting accessory** shall be (200 ± 100) mm.*

K.21.107.2 Grass trimmers, **brush cutters** and **brush saws** intended to be used with a harness in accordance with 8.14.2 b) 110), and designed to be supported by the ground shall be provided with at least one suspension point to which the harness is attached, so the ground contact force is not greater than 20 N.

Compliance is checked by inspection, by measurement and by the following test with the most unfavourable machine configuration in accordance with 8.14.2 in combination with

– *the heaviest **battery** in accordance with K.8.14.2 e) 2); and*

– *the lightest **battery** in accordance with K.8.14.2 e) 2).*

~~*If the machine is supplied by means of a **separable battery pack**, the cord shall be removed at its point of exit from the machine or, if supplied with a cord guard or adapter, at its point of exit from the cord guard or adapter.*~~

*If the machine is supplied by means of a **separable battery pack**, the **separable battery pack** shall be positioned as it would on an operator with a height of (1 750 ± 100) mm, in accordance with K.8.14.2 b) 301).*

If the machine is provided with more than one suspension point or if the suspension point is adjustable, the most favourable suspension point or position is selected for each test.

The force applied to the ground by the machine is measured.

K.21.301 Separable battery packs that are intended to be supported on the body of an operator in accordance with K.8.14.2 b) 301) shall be provided with a means of support or attachment.

This requirement may be fulfilled by providing a shoulder harness, belt harness or other means of support or attachment.

Any shoulder or belt harness shall be adjustable to the size of the operator and its operation shall be in accordance with K.8.14.2 b) 301).

Shoulder or belt harnesses shall be:

– designed in a way for easy removal; or

– equipped with a quick release mechanism

that ensures that the **separable battery pack**(**s**) can be removed or released quickly from the operator.

The quick release mechanism shall be positioned either at the connection between the **separable battery pack**(**s**) and harness or between the harness and operator. The quick release mechanism shall only allow separation by deliberate action of the operator. The quick release mechanism shall be designed to open while under the weight of the **separable battery pack**(**s**). It shall require the use of only one hand and have no more than two release points.

NOTE An example of a release point is a buckle that requires squeezing between a thumb and finger before releasing, e.g. side release buckles.

A double shoulder harness is considered to be designed in a way for easy removal, if the left and right shoulder straps are not connected to each other in front of the operator's body. If straps to connect between the left and right shoulder straps are provided, it is also considered to be designed in a way for easy removal when the straps connecting between the left and right shoulder straps can be released under the load of the **separable battery pack**(**s**) by using one hand and have no more than two release points.

*Compliance is checked by inspection and by functional test using the heaviest **separable battery pack**(**s**) identified in K.8.14.2 e) 2).*

K.21.302 Machines with integral batteries

~~**K.21.302.1** For machines with **integral batteries**, there shall be a means of disconnecting the **cutting means** or **cutting accessory** motor circuit which is separate from the **power**~~

~~**switch**. The actuation of this means shall be easily accessible with the machine in its normal operating position.~~

~~This requirement may be fulfilled by a single device that also fulfils the requirements of a **disabling device** as specified in K.21.302.2.~~

~~NOTE In Europe (EN 62841-4-4), the following additional text applies:~~

~~In addition, this requirement may be fulfilled by a single device that also fulfils the requirements of an isolation device as specified in K.21.18.Z101.~~

~~*Compliance is checked by inspection.*~~

K.21.302.2 Disabling device

K.21.302.2.1 General

~~For machines with **integral batteries**, a **disabling device** shall be provided which shall prevent operation of the **cutting means** or **cutting accessory** when it is removed or operated. The **disabling device** shall not be easily overridden.~~

For **grass trimmers**, **brush cutters** and **brush saws** with **integral batteries**, a **disabling device** shall be provided which shall prevent operation of the **cutting means** or **cutting accessory** when it is removed or operated. The **disabling device** shall not be easily overridden.

The **disabling device** shall be according to either K.21.302.2.2 or K.21.302.2.3.

K.21.302.2.2 Removable disabling device

When the **disabling device** is removed, it shall not be possible for the **cutting means** or **cutting accessory** to operate.

The **removable disabling device** shall not be permanently attached to the machine.

Compliance is checked by inspection and by manual test.

K.21.302.2.3 Code protected disabling device

When the machine is disabled by operating the **code protected disabling device**, it shall not be possible for the **cutting means** or **cutting accessory** to be operated until a specific "key sequence" (e.g. an alpha and/or numerical code of at least 4 characters) has been entered into the key pad.

The machine is not considered to be operating when displaying, communicating, transmitting or storing data (e.g. error codes) whilst the machine is disabled by the **code protected disabling device**.

It shall only be possible to de-activate the **code protected disabling device** from the machine.

It shall not be possible to de-activate the **code protected disabling device** from any remote device without an acknowledgement function being completed on the machine before the unlock is complete.

Compliance is checked by inspection and by manual test.

K.23.1.10.1 This subclause of Part 4-4 is not applicable.

K.23.1.10.2 This subclause of Part 4-4 is not applicable.

K.23.1.201 *Modification to Part 1:*

***Power switches** are subjected to*

– *10 000 cycles of operation for **lawn trimmers** and **lawn edge trimmers**; or*
– *50 000 cycles of operation for **grass trimmers**, **brush cutters** and **brush saws**.*

K.24 Supply connection and external flexible cords

This clause of Part 4-4 is not applicable, except as follows:

K.24.301 External flexible cables or cords connecting machines to **separable battery packs** and **interconnection cords** shall have a cord anchorage to prevent strain on the conductors, including twisting, at the terminals and protect the insulation of the conductors from abrasion.

It shall not be possible to push the cord into any enclosure to such an extent that the cord or internal parts could be damaged.

Compliance is checked by inspection, by manual test, and by the following test.

A mark is made on the cord while it is subjected to the pull force specified in ~~Table 301~~ Table 9 of Part 1, at a distance of approximately 20 mm from the cord anchorage or other suitable point.

The cord is then pulled, without jerking, for 1 s in the most unfavourable direction with a force as specified in ~~Table 301~~ Table 9 of Part 1. The test is carried out 25 times.

The cord, unless on an automatic cord reel, is then subjected to a torque as specified in ~~Table 301~~ Table 9 of Part 1 that is applied as close as possible to the enclosure for 1 min.

After the tests, the cord shall not

– *demonstrate tearing of the sheath, covering or sleeving; or*
– *demonstrate breakage of more than 10 % of the strands of any conductor; or*
– *show appreciable strain at the terminals; or*
– *be longitudinally displaced by more than 2 mm.*

~~**Table 301 – Pull and torque value**~~

~~**Cord type**~~	~~**Pull**~~ ~~N~~	~~**Torque**~~ ~~Nm~~
~~External flexible cables or cords connecting machines to **separable battery packs**~~	~~100~~	~~0,35~~
~~**Interconnection cords**~~	~~100~~	~~Not applicable~~

K.24.302 If a machine is supplied with a **separable battery pack**, it shall be possible for the operator to disconnect the **separable battery pack** from the machine without the aid of a tool during **normal use**.

Compliance is checked by inspection.

K.24.303 External flexible cables or cords used on machines with **separable battery packs** and **interconnection cords** shall comply with 24.4 or

– have an insulation of the conductor that is adequate for its **working voltage** and temperature; and

– have a covering or sleeving.

Compliance is checked by inspection.

K.28 Creepage distances, clearances and distances through insulation

Replacement:

K.28.1 **Creepage distances** and **clearances** shall not be less than the values in millimetres shown in Table K.1. The **clearances** specified do not apply to the air gap between the contacts of thermal controls, **protective devices**, switches of micro-gap construction, and the like, or to the air gap between the current-carrying members of such devices where the **clearances** vary with the movement of the contacts. **Creepage distances** and **clearances** also do not apply to the construction of **battery cells** or the interconnections between **cells** in a **battery** pack. The values specified in Table K.1 do not apply to cross-over points of motor windings.

The values in Table K1 are equal to or larger than the values required by IEC 60664-1, when all the following

– an overvoltage category I;

– a material group III;

– a pollution degree 1 for parts protected against deposition of dirt and for lacquered or enamelled windings;

– a pollution degree 3 for other parts;

– inhomogeneous electric field

are applied.

Protection against deposition of dirt may be achieved through the use of

– encapsulation with a minimum thickness of 0,5 mm; or

– protective coatings that prevent the combined deposition of fine particles and moisture on surfaces between conductors. Requirements for these types of protective coatings are described in IEC 60664-3; or

– enclosures that prevent the ingress of dust by means of filters or seals, provided that no dust is generated within the enclosure itself.

NOTE 1 An example of encapsulation is potting.

Table K.1 – Minimum creepage distances and clearances between parts of different potential

Dimensions in millimetres

Conditions	Working voltage ≤ 15 V		Working voltage > 15 V and ≤ 32 V		Working voltage > 32 V and ≤ 130 V		Working voltage > 130 V and ≤ 280 V		Working voltage > 280 V and ≤ 480 V	
	Creepage distance	Clearance	Creepage distance	Clearance	Creepage distance	Clearance	Creepage distance	Clearance	Creepage distance	Clearance
Switched circuit										
– protected against deposition of dirt	0,8	0,8	1,0	1,0	1,0	1,0	2,0	2,0	2,0	2,0
– not protected against deposition of dirt	0,8 [a]	0,8	1,5	1,5	2,0 [a]	1,5	3,0 [a]	2,5	8,0	3,0
Non-switched circuit										
– protected against deposition of dirt	0,8	0,8	1,5	1,5	1,5	1,5	2,0	2,0	2,0	2,0
– not protected against deposition of dirt	1,1	0,8	1,5	1,5	2,5	1,5	4,0	2,5	8,0	3,0

[a] These **creepage distances** are slightly lower than suggested by IEC 60664-1. **Creepage distances** between parts of different potential (functional insulation) are only associated to fire hazard in the machine, not to electric shock hazard. As products in the scope of IEC 62841 are products supervised during **normal use**, lower distances are justified.

For parts of different potential in **switched circuits** only, including conductive patterns on printed circuit boards, **creepage distances** and **clearances** smaller than the minimum values specified

– in Table K.1; or

– for conductive patterns on printed circuit boards as specified below

are allowed, provided shorting of the two parts does not result in the machine starting or in a risk of fire in the machine as specified in K.18.1.

For conductive patterns on printed circuit boards, except at their edges, the minimum **creepage distances** and **clearances** in Table K.1 between parts of different potential may be reduced, as long as the peak value of the voltage stress does not exceed:

– 150 V per mm with a minimum value of 0,2 mm, if protected against the deposition of dirt;

– 100 V per mm with a minimum value of 0,5 mm, if not protected against the deposition of dirt.

When the limits mentioned above lead to higher values than those of Table K.1, the values of Table K.1 apply.

NOTE 2 The above values are equal to or larger than the values required by IEC 60664-3.

For parts having a **hazardous voltage** between them, the sum total of the measured distances between each of these parts and their nearest accessible surface shall not be less than the values shown in Table K.2.

NOTE 3 Figure K.1 provides clarification on the measurement method.

Table K.2 – Minimum total sum of creepage distances and clearances to accessible surfaces

Dimensions in millimetres

Hazardous voltage with a working voltage of					
≤ 130 V		> 130 V and ≤ 280 V		> 280 V and ≤ 480 V	
Creepage distance	Clearance	Creepage distance	Clearance	Creepage distance	Clearance
5,0	1,5	8,0	3,0	16,0	4,0

Creepage distances and **clearances** for **working voltages** greater than those shown in this subclause shall be determined from the application of IEC 60664-1.

Compliance is checked by measurement.

*The way in which **creepage distances** and **clearances** are measured is indicated in Annex A.*

Distances through slots or openings in external parts of insulating material are measured to the metal foil in contact with the accessible surface; the foil is pushed into corners and the like by means of the standard test probe B of IEC 61032:1997, but is not pressed into openings.

*The sum total of distances measured between parts operating at **working voltage** that is a **hazardous voltage** and accessible surfaces is determined by measuring the distance from each part to the accessible surface. The distances are to be added together to determine the sum total. See Figure K.1.*

*In addition, one of the **creepage distances** or **clearances** to the nearest accessible surface shall be at least 1 mm.*

*If necessary, a force is applied to any point on bare conductors and to the outside of metal enclosures, in an endeavour to reduce the **creepage distances** and **clearances** while taking the measurements.*

The force is applied by means of the test probe B of IEC 61032:1997 and has a value of:

– 2 N for bare conductors;

– 30 N for enclosures.

Means provided for fixing the tool to a support are considered to be accessible.

K.28.2 This subclause of Part 4-4 is not applicable.

Annex L
(normative)

Battery tools and battery packs provided with mains connection or non-isolated sources

All clauses of the main body of this Part 4-4 apply unless otherwise specified in this annex. If a clause is stated in this annex, its requirements replace the requirements of the main body of this Part 4-4 unless otherwise specified. Subclauses, notes, tables and figures which are additional to those in the main body of this Part 4-4 are numbered starting from 301.

L.1 Scope

Addition:

NOTE 301 In Europe (EN 62841-4-4), this document does not apply to **grass trimmers**, **brush cutters** and **brush saws** equipped with **integral batteries**.

L.5.17 *Addition:*

*The mass of the machine includes the heaviest **detachable battery pack(s)**, but does not include any **separable battery pack(s)**, in accordance with L.8.14.2 e) 2).*

L.5.207 *Addition to Part 1:*

*For tests that are conducted at **maximum speed**:*

*For machines capable of being operated by the mains, the test shall be conducted at **rated voltage**.*

For machines that are not capable of being operated by the mains,

– *the **battery** shall be replaced with a **fully charged battery** as needed in order to maintain the speed of the **cutting means** or **cutting accessory** to be not less than 90 % of **maximum speed**; or*
– *the machine may be powered by an external power source maintained at the nominal voltage of the **battery**.*

L.8.14.1.102 Grass trimmer, brush cutter and brush saw safety warnings

Item x) is not applicable.

Addition:

bb) **When clearing jammed material or servicing the machine, make sure the switch is off, the power cord is disconnected and the battery pack is removed.** *Unexpected starting of the machine while clearing jammed material or servicing may result in serious personal injury.*

NOTE 301 The above warning is omitted for machines with **integral batteries**.

cc) **When clearing jammed material or servicing the machine, make sure the switch is off, the power cord is disconnected and the lock-off is in the locked position.** *Unexpected starting of the machine while clearing jammed material or servicing may result in serious personal injury.*

NOTE 302 The above warning is omitted for machines with **detachable battery packs** and **separable battery packs**.

NOTE 303 In Europe (EN 62841-4-4) the above warning is omitted for **grass trimmers**, **brush cutters** and **brush saws**.

L.8.14.2 b) *Addition:*

301) Instructions for the use and adjustment of any means of support for **separable battery packs** in accordance with L.21.301 and instructions for release or removal.

L.8.14.2 c) *Addition:*

301) For machines with **integral batteries**, instructions on how to disable the machine during maintenance or servicing.

L.18.8 *Addition to Table 4:*

Table 4 – Required performance levels

Type and purpose of SCF	Minimum Performance Level (PL)
Any **disabling device** as in L.21.302.2	Not an **SCF**

L.20.3.1 *Unless otherwise specified, for machines with **detachable battery packs**, the heaviest **detachable battery pack** in accordance with L.8.14.2 e) 2) shall be installed on the machine for the following tests.*

*Machines, except for **walk-behind trimmers**, are dropped three times in total on a concrete surface from a height of 1 m.*

*The machine is configured for use according to 8.14.2 a), fitted with the **cutting head** or **cutting accessory** and placed on the concrete surface in a stable resting position.*

For the first drop, the machine is lifted vertically by 1 m and allowed to drop onto the concrete surface.

For the second drop:

- *the machine is placed on the concrete surface as in the first test;*
- *the machine is lifted vertically by 1 m; then*
- *the machine is rotated about its longitudinal axis approximately 90° in the most unfavourable direction prior to dropping onto the concrete surface.*

For the third drop:

- *the machine is placed on the concrete surface as in the first test;*
- *the machine is lifted vertically by 1 m; then*
- *the machine is rotated about its longitudinal axis approximately 180° prior to dropping onto the concrete surface.*

Secondary impacts shall be avoided.

NOTE A method for avoiding secondary impacts is tethering.

*For **battery** machines with **detachable battery packs**, the test is repeated three more times without the **detachable battery pack** attached to the machine. New samples may be used for each series of three drops.*

For machines with handles having a storage configuration in accordance with 8.14.2 b) 109), the six drops are repeated on a separate sample with the handle adjusted to the storage configuration.

*In addition, for **detachable battery packs** or **separable battery packs**, the test is repeated three more times on the **battery** packs separately.*

*In addition, **grass trimmers**, **brush cutters** and **brush saws** are subjected to three impacts that result from the machine being tipped over to strike a concrete surface, from the vertical standing position with the **cutting head** or the **cutting accessory** downwards. The sample is rotated to its three most unfavourable positions prior to being released. For machines with **detachable battery packs**, the test is repeated without the **detachable battery pack** attached to the machine. New samples may be used for each series of three impacts.*

Each drop shall be conducted on a separate machine. At the manufacturer's request, each drop may be conducted on the same machine.

L.20.101.3 *Addition:*

The weight of the machine excludes any **detachable battery pack** or **separable battery pack** in accordance with L.8.14.2 e) 2).

L.21.18 *Addition:*

NOTE 301 In Europe (EN 62841-4-4), the following additional subclause applies:

L.21.18.Z101 Isolation device

Hand-held trimmers and **walk-behind trimmers** with an **integral battery** shall be equipped with an isolation device to prevent the risk of injury from mechanical hazards during servicing or **user maintenance**.

An isolation device shall

– provide disconnection of all poles of the **battery** from the serviceable region of the machine;

– be equipped with an unambiguous indication of the state of the disconnection device which corresponds to each position of its manual control (actuator);

– be provided with protection against accidental reconnection.

NOTE 1 Examples of methods to achieve this disconnection include removable jumpers, **integral batteries** that can be disconnected for servicing or **user maintenance**, or an electromechanical **power switch** with a direct mechanical link between the actuator and the contact.

NOTE 2 The risk of accidental reconnection for a **power switch** is addressed by the requirement of 21.18.1.2. The other examples in NOTE 1 achieve this by the necessary actions for reconnection.

Compliance is checked by inspection and by manual test.

L.21.107.2 Grass trimmers, **brush cutters** and **brush saws** intended to be used with a harness in accordance with 8.14.2 b) 110), and designed to be supported by the ground shall be provided with at least one suspension point to which the harness is attached, so the ground contact force is not greater than 20 N.

Compliance is checked by inspection, by measurement and by the following test with the most unfavourable machine configuration in accordance with 8.14.2 in combination with

– *the heaviest **battery** in accordance with L.8.14.2 e) 2); and*

– *the lightest **battery** in accordance with L.8.14.2 e) 2).*

*The effect of any **supply cord** shall be negated either by positioning it so it does not influence the test or by cutting it off at the point it exits the machine.*

*If the machine is supplied by means of a **separable battery pack**, the cord shall be removed at its point of exit from the machine or, if supplied with a cord guard or adapter, at its point of exit from the cord guard or adapter.*

If the machine is provided with more than one suspension point or if the suspension point is adjustable, the most favourable suspension point or position is selected for each test.

The force applied to the ground by the machine is measured.

L.21.301 Separable battery packs that are intended to be supported on the body of an operator in accordance with L.8.14.2 b) 301) shall be provided with a means of support or attachment.

This requirement may be fulfilled by providing a shoulder harness, belt harness or other means of support or attachment.

Any shoulder or belt harness shall be adjustable to the size of the operator and its operation shall be in accordance with L.8.14.2 b) 301).

Shoulder or belt harnesses shall be:

– designed in a way for easy removal; or

– equipped with a quick release mechanism

that ensures that the **separable battery pack**(**s**) can be removed or released quickly from the operator.

The quick release mechanism shall be positioned either at the connection between the **separable battery pack**(**s**) and harness or between the harness and operator. The quick release mechanism shall only allow separation by deliberate action of the operator. The quick release mechanism shall be designed to open while under the weight of the **separable battery pack**(**s**). It shall require the use of only one hand and have no more than two release points.

NOTE An example of a release point is a buckle that requires squeezing between a thumb and finger before releasing, e.g. side release buckles.

A double shoulder harness is considered to be designed in a way for easy removal, if the left and right shoulder straps are not connected to each other in front of the operator's body. If straps to connect between the left and right shoulder straps are provided, it is also considered to be designed in a way for easy removal when the straps connecting between the left and right shoulder straps can be released under the load of the **separable battery pack**(**s**) by using one hand and have no more than two release points.

*Compliance is checked by inspection and by functional test using the heaviest **separable battery pack**(**s**) identified in L.8.14.2 e) 2).*

L.21.302 Machines with integral batteries

L.21.302.1 For machines with **integral batteries**, there shall be a means of disconnecting the **cutting means** or **cutting accessory** motor circuit which is separate from the **power switch**. The actuation of this means shall be easily accessible with the machine in its normal operating position.

This requirement may be fulfilled by a single device that also fulfils the requirements of a **disabling device** as specified in L.21.302.2.

NOTE In Europe (EN 62841-4-4), the following additional text applies:

In addition, this requirement may be fulfilled by a single device that also fulfils the requirements of an isolation device as specified in L.21.18.Z101.

Compliance is checked by inspection.

L.21.302.2 Disabling device

L.21.302.2.1 General

For machines with **integral batteries**, a **disabling device** shall be provided which shall prevent operation of the **cutting means** or **cutting accessory** when it is removed or operated. The **disabling device** shall not be easily overridden.

The **disabling device** shall be according to either L.21.302.2.2 or L.21.302.2.3.

L.21.302.2.2 Removable disabling device

When the **disabling device** is removed, it shall not be possible for the **cutting means** or **cutting accessory** to operate.

The **removable disabling device** shall not be permanently attached to the machine.

Compliance is checked by inspection and by manual test.

L.21.302.2.3 Code protected disabling device

When the machine is disabled by operating the **code protected disabling device**, it shall not be possible for the **cutting means** or **cutting accessory** to be operated until a specific "key sequence" (e.g. an alpha and/or numerical code of at least 4 characters) has been entered into the key pad.

The machine is not considered to be operating when displaying, communicating, transmitting or storing data (e.g. error codes) whilst the machine is disabled by the **code protected disabling device**.

It shall only be possible to de-activate the **code protected disabling device** from the machine.

It shall not be possible to de-activate the **code protected disabling device** from any remote device without an acknowledgement function being completed on the machine before the unlock is complete.

Compliance is checked by inspection and by manual test.

L.24.1 *Addition:*

This subclause also applies to a flexible cord between a **non-isolated source** and the machine.

L.24.4 *Addition:*

This subclause applies, except a flexible cord provided between a **non-isolated source** and the tool shall not be provided with a plug that can be connected directly to the mains.

L.24.301 If a machine is supplied with a **separable battery pack**, it shall be possible for the operator to disconnect the **separable battery pack** from the machine without the aid of a tool during **normal use**.

Compliance is checked by inspection.

Annex AA
(normative)

Safety signs which may be used on machines

Figure AA.1 to Figure AA.19 provide safety signs for safety instructions and warnings.

Figure AA.1 – Optional safety sign illustrating – "Wear eye and ear protection"

Figure AA.2 – Optional safety sign illustrating – "Wear eye and head protection"

a) Safety sign illustrating – "Wear eye, ear and head protection"

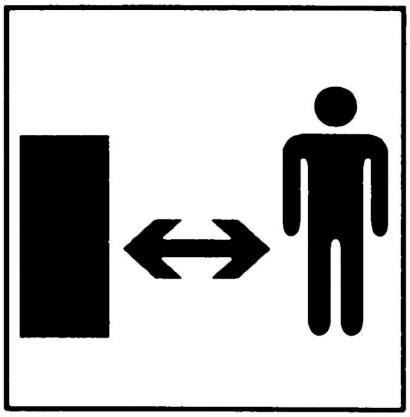
b) Alternate safety sign illustrating – "Wear eye, ear and head protection"

Figure AA.3 – Optional safety sign illustrating – "Wear eye, ear and head protection"

Figure AA.4 – Safety signs illustrating – "Wear eye protection"

Figure AA.5 – Safety sign illustrating – "Wear ear protection"

Figure AA.6 – Safety sign illustrating – "Do not expose to rain"



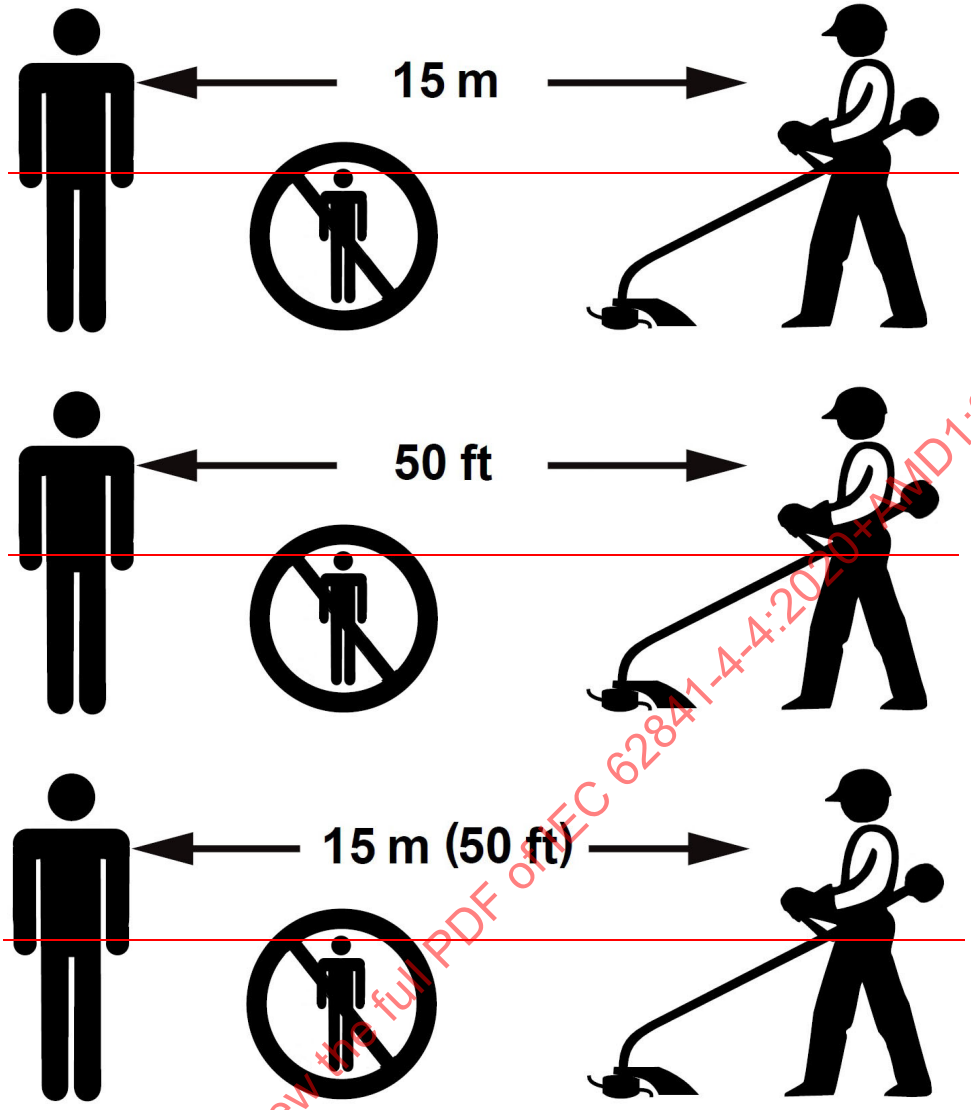
a) Safety sign illustrating – "WARNING – Keep bystanders away"

b) Alternate safety sign illustrating – "WARNING – Keep bystanders away"

c) Alternate safety sign illustrating – "WARNING – Keep bystanders away"

A distance between the machine and the bystander may optionally be added to the safety signs above.

Figure AA.7 – Safety signs illustrating – "WARNING – Keep bystanders away"



~~Figure AA.8 – Safety signs illustrating – "WARNING – The distance between the machine and bystanders shall be at least 15 m (50 ft)"~~

Figure AA.9 – Safety sign illustrating – "WARNING – Beware of thrown objects"

Figure AA.10 – Safety sign illustrating – "Wear head protection where there is a risk of falling objects "

Figure AA.11 – Safety sign illustrating – "Wear hand protection"

Figure AA.12 – Safety sign illustrating – "Wear slip-resistant footwear"

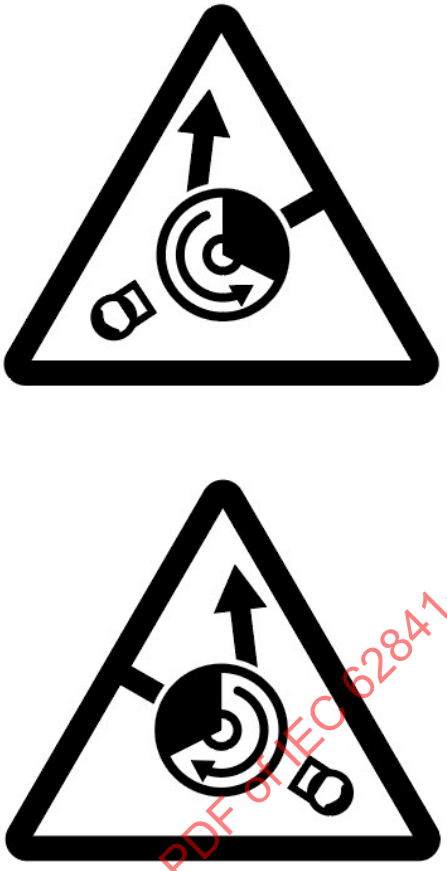


Figure AA.13 – Safety signs illustrating – "WARNING – Beware of blade thrust"

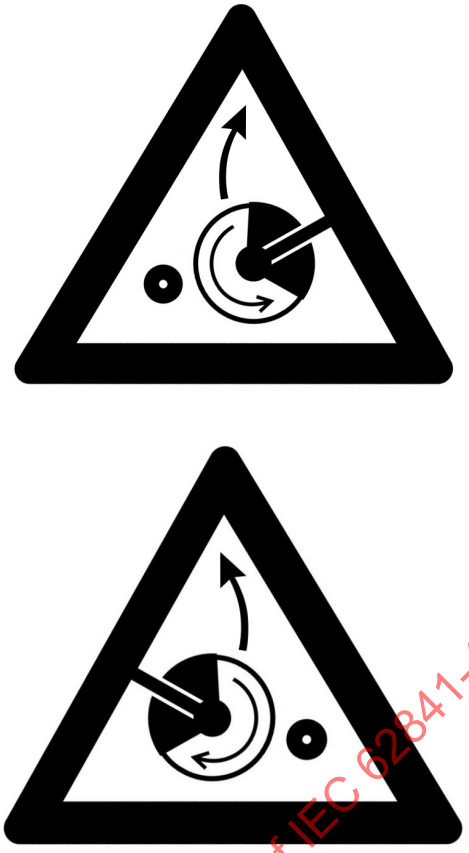


Figure AA.14 – Alternative safety signs illustrating – "WARNING – Beware of blade thrust"

Figure AA.15 – Safety sign illustrating – "Do not use metal blades"

Figure AA.16 – Safety sign illustrating – "WARNING – Remove plug from the mains immediately if the power cord or cable is damaged or cut"

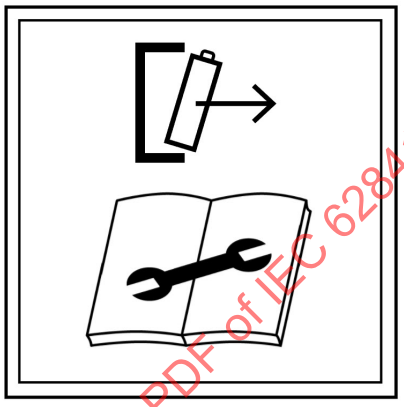


Figure AA.17 – Safety sign illustrating – "WARNING – Disconnect battery before maintenance"

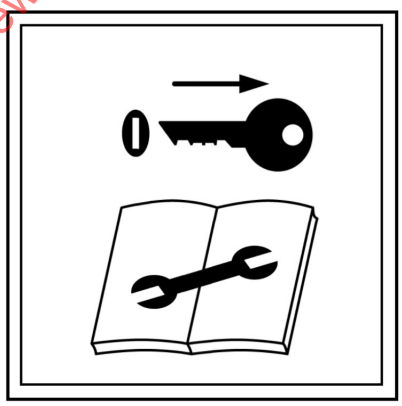


Figure AA.18 – Safety sign illustrating – "WARNING – Remove the disabling device before maintenance"

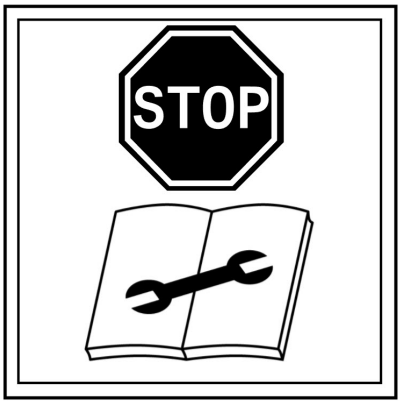


Figure AA.19 – Safety sign illustrating – "WARNING – Operate the disabling device before maintenance"

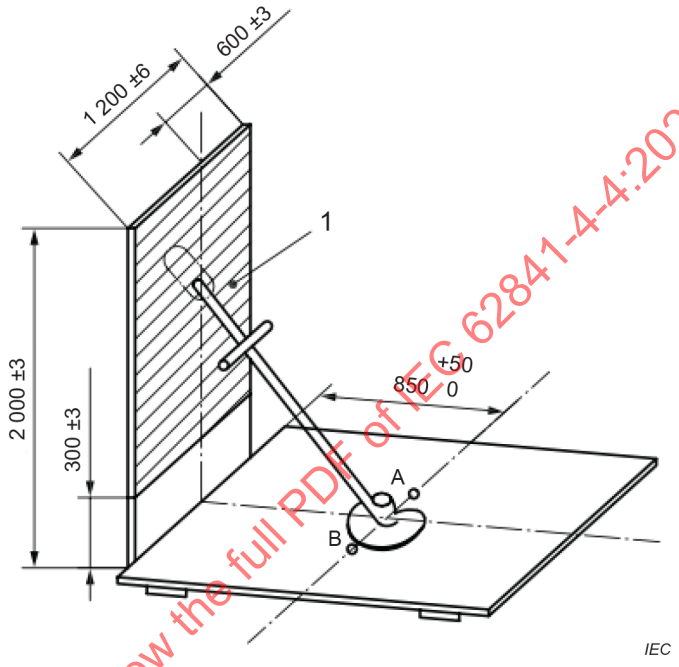
Annex BB
(normative)

Thrown objects test for grass trimmers, brush cutters and brush saws

BB.1 Test stand

BB.1.1 *The test shall be conducted on a test stand as shown in Figure BB.1 and Figure BB.2.*

Dimensions in millimetres



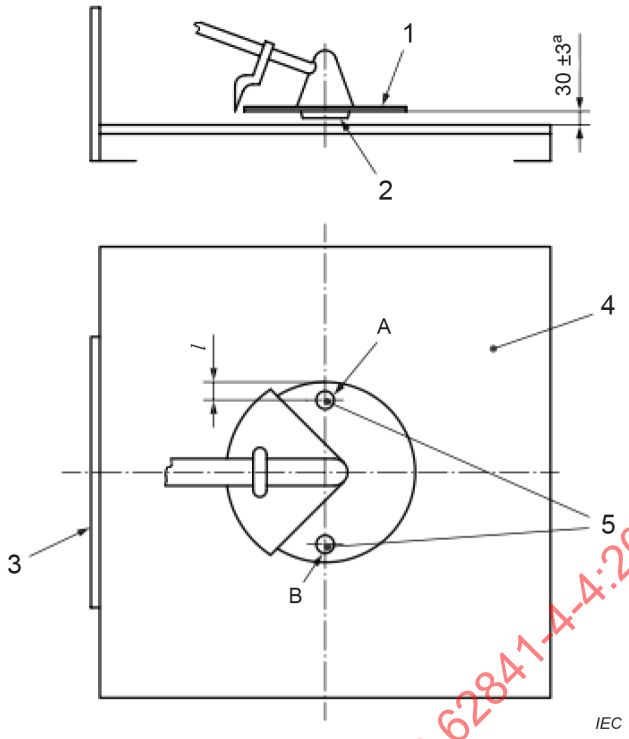
Key

1 target zone

NOTE For insertion positions of the test pieces, see Figure BB.2

Figure BB.1 – Machine position on test stand

Dimensions in millimetres



Key

1 **cutting means** or **cutting accessory**

2 **cutting head** or **cutting accessory** retention

3 target zone

4 artificial grass mat

5 insertion positions for test probes (A and B)

[a] See BB.2.3

Figure BB.2 – Insertion positions of the test pieces

BB.1.2 *The base shall be a flat board.*

BB.1.3 *The base shall be covered with an artificial grass mat with a maximum height of 15 mm and a fibre length of 6 mm to 8 mm.*

BB.1.4 *The fibre shall not have any specific orientation.*

NOTE For the insertion position of the test piece injection tube, see Figure BB.2.

BB.2 Test conditions

BB.2.1 *The machine shall be mounted rigidly above the base, and oriented in such a way that the device which inserts the test pieces is at a distance (l) (see Figure BB.2) which is*

– *half the depth of the cutting teeth for **brush saws**; or*

– *13 mm inside the outer path line of the **cutting means** or **cutting accessory** for **grass trimmers** and **brush cutters**.*

*The flexible lines of a **grass trimmer** shall be adjusted to their maximum length.*

BB.2.2 *The insertion of the test pieces shall be made in a vertical direction from below, at one of the two positions shown in Figure BB.2, as follows:*

– *if the **cutting means** or **cutting accessory** rotates counter-clockwise, position A shall be used; and*

– *if the **cutting means** or **cutting accessory** rotates clockwise, position B shall be used.*

BB.2.3 *The lower surface of the **cutting means** or **cutting accessory** shall be parallel to and (30 ± 3) mm above the top of the artificial grass mat (see Figure BB.2). ~~In cases where the **cutting head** or **cutting accessory** retention system (see Figure BB.2) extends more than 30 mm below the **cutting means** or **cutting accessory**, a clearance of 1 mm to 5 mm between the **cutting head** or **cutting accessory** retention system and the artificial grass mat shall be maintained.~~ In cases where it is not possible to achieve the (30 ± 3) mm distance due to the design of the machine, a clearance of 1 mm to 5 mm between the lowest part of the machine and the artificial grass mat shall be maintained.*

BB.2.4 *Adjust the velocity with which the test piece is inserted, so that the test piece rises a minimum of 20 mm and a maximum of 30 mm above the **cutting means** or **cutting accessory**.*

BB.3 Penetration wall

BB.3.1 *At the operator's position, a penetration wall with a minimum height of 2 000 mm above the top of the base shall be established.*

BB.3.2 *The penetration wall shall be made of kraft paper (mass per unit area 80 g/m^2).*

BB.3.3 *The paper shall be flatly attached without folds on a framework whose minimum inside dimensions are shown in Figure BB.1.*

BB.3.4 *The target zone (see Figure BB.1) is the portion of the penetration wall that extends from a height of (300 ± 3) mm to (2 000 ± 3) mm above the top of the base and having a width of (1 200 ± 6) mm.*

BB.4 Test pieces

The test pieces shall be ceramic prisms with triangular sides and a prism height of (6,5 ± 0,8) mm (see Figure BB.3). The mass of one prism shall be ~~0,42 $^{+0,03}_{-0,04}$ g~~ 0,4 $^{+0,2}_{-0,1}$ g.

NOTE The test pieces are commonly used in mass surface finishing processes.

Dimensions in millimetres

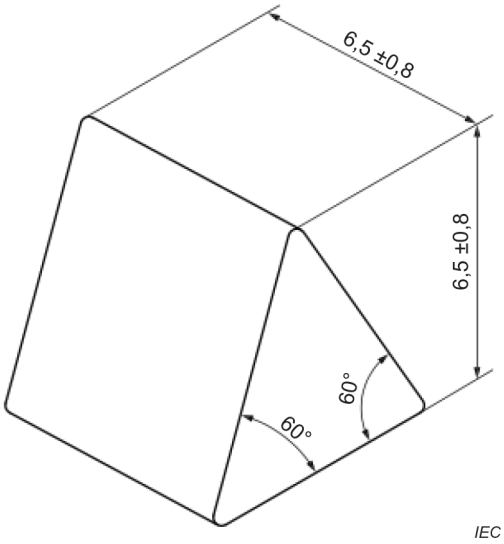


Figure BB.3 – Test piece

BB.5 Procedure

BB.5.1 *At the selected test-piece insertion position (A or B), 25 test pieces shall be inserted vertically and individually from below, into the circular path of the rotating **cutting means** or **cutting accessory**.*

BB.5.2 *The machine shall be run at no load, at **maximum speed**.*

BB.5.3 *The artificial grass mat of the test stand shall be cleaned after the insertion of every five test pieces.*

BB.6 Inspection of the cutting means or cutting accessory

BB.6.1 *If the **cutting means** or **cutting accessory** is damaged during the test such that it would influence the test result, it shall be replaced with a new **cutting means** or **cutting accessory**.*

BB.6.2 *For **grass trimmers** with a damaged **cutting element** which is a filament line on a spool, extend the filament line to obtain a fresh piece and operate the machine so that the filament line is cut to the correct length.*

*For **grass trimmers** with a damaged **cutting element** which is a filament line not on a spool, replace the filament line. If applicable, operate the machine so that the filament line is cut to the correct length.*

BB.7 Result

After the test, the penetration wall shall be examined to determine if there has been any penetration in the target zone.

Penetration is confirmed if a ball of 5 mm diameter can be pressed through the tear with a maximum force of 3 N.

*Damage to the **cutting means** or **cutting accessory** is ignored.*

NOTE The strength of the **cutting means** or **cutting accessory** is evaluated in Clause 20.

Annex CC
(normative)

Impact test for brush cutter and brush saw cutting accessories and grass trimmer cutting means

CC.1 *The machine shall be suspended freely in an operating position (see Figure CC.1).*

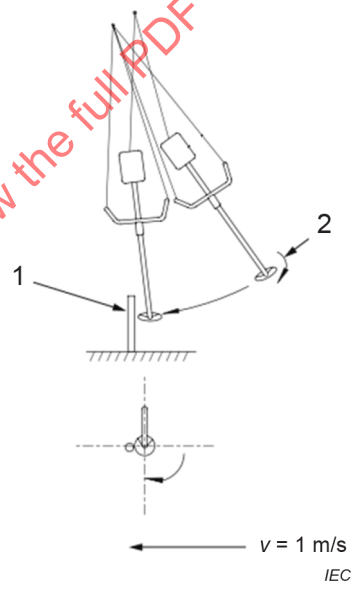
CC.2 *The test shall be conducted with one swing against a (25 ± 1) mm diameter steel rod of designation 9S20 in accordance with Table 2 of ISO 683-4:2016. The steel rod shall be impacted by the* ***cutting accessory*** *or non-metallic pivoting cutter, such that the plane of the* ***cutting accessory*** *or non-metallic pivoting cutter is approximately perpendicular to the longitudinal axis of the steel rod, at an approach speed v of (1 ± 0,1) ms^{-1}, as shown in Figure CC.1, and with the* ***cutting accessory*** *or non-metallic pivoting cutter rotating at* ***maximum speed*** *of the machine.*

For machines with ***separable battery packs****, the* ***separable battery pack*** *is supported in a fixed position during the test. The external flexible cable or cord connecting the* ***separable battery pack*** *to the machine shall be positioned such that it does not influence the test result.*

Proper precautions should be taken to ensure operator safety during this test.

CC.3 *The machine shall be switched off immediately after the impact. Secondary impacts to the machine shall be avoided.*

NOTE A method for avoiding secondary impacts to the machine is tethering.



Key

1 steel rod

2 direction of rotation[a]

[a] If the **cutting means** or **cutting accessory** rotates in the opposite direction, the **cutting means** or **cutting accessory** shall impact the steel rod from the other side.

Figure CC.1 – Impact test

Annex DD
(informative)

Example of a material and construction fulfilling the requirements for an artificial surface

DD.1 Material

Mineral fibre, 20 mm thick, having an airflow resistance of 11 kN.s/m^4 and a density of 25 kg/m^3.

DD.2 Construction

As is shown in Figure DD.1, the artificial flooring of the measurement site is sub-divided into nine joint planes, each of approximately 1,20 m × 1,20 m. The backing layer (a) of the construction as shown in Figure DD.1 consists of chipboard, 19 mm thick, coated with a plastics material on both sides. Such boards are used, for example, for the construction of kitchen furniture. The cut edges of the chipboards should be protected against moisture by applying a coat of plastic paint. The outsides of the flooring are bordered by a two-legged aluminium section (d), its leg height being 20 mm. Sections of this profile material are also screwed to the edges of the joint planes where they serve as spacers and attachment points.

On the middle joint plane on which the machine is placed during measurement as well as any other place on which the operator can get to stand on, aluminium T-sections (c) with a leg length of 20 mm are mounted as spacers. These sections also provide exact markings which facilitate the alignment of the machine in the middle of the measurement site. The prepared boards are then covered with the insulating felt material (b) cut to size.

The felt flooring of the joint planes which are neither stood on nor driven over (type A surface in Figure DD.1) are covered with a simple wire mesh fastened to the edge strips and to the attachment points; for this purpose, the sections should be provided with holes. Thus, the material is adequately attached, but it remains possible to replace the felt material should it become soiled. As a wire mesh, a so-called aviary wire (e) with a mesh width of 10 mm and a wire diameter of 0,8 mm has proved to be suitable. This wire appears to protect the surface adequately without affecting the acoustic conditions.

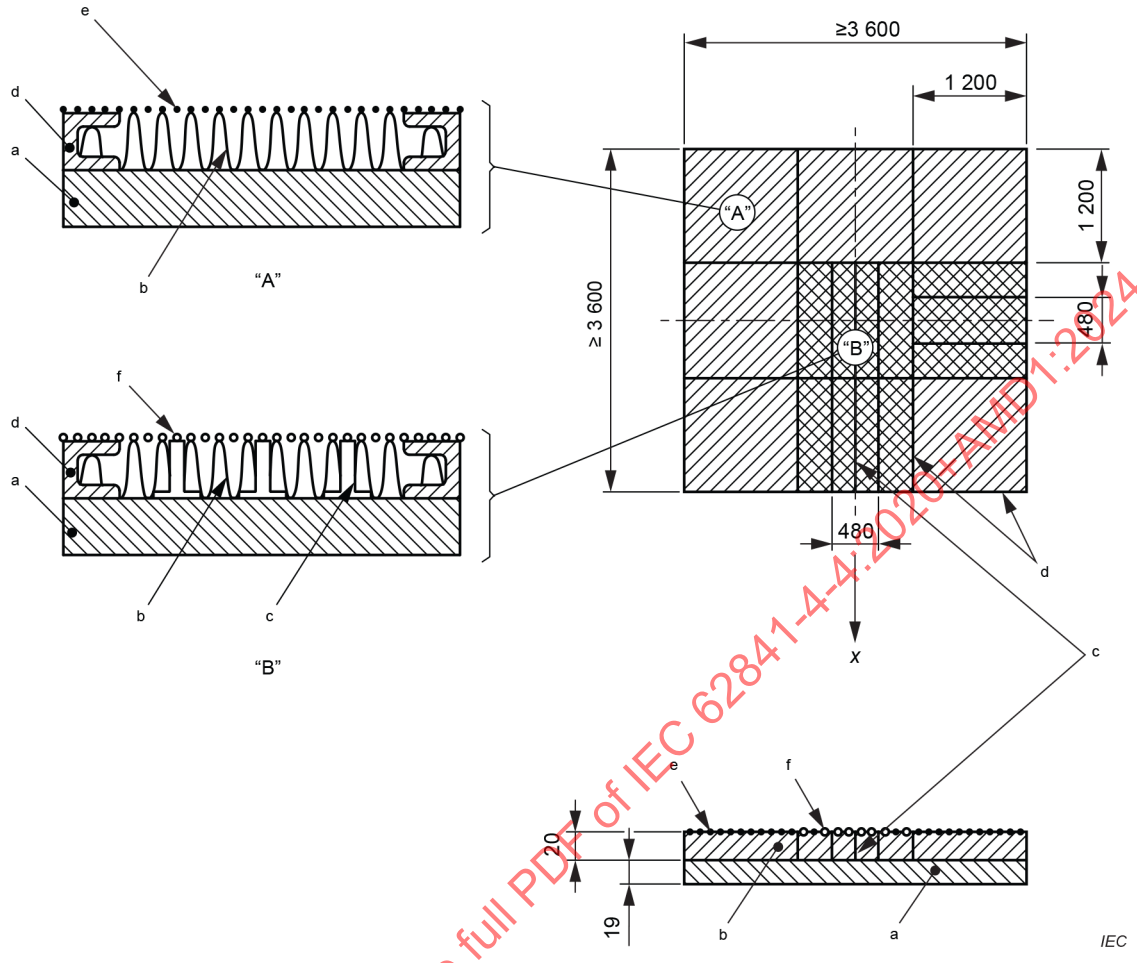
Protection by simple wire mesh is not, however, sufficient in the area subjected to traffic (type B surface in Figure DD.1). For these surfaces, the use of wire grating of corrugated steel wire (f) with a diameter of 3,1 mm and a mesh width of 30 mm has proved to be suitable.

The construction of the measurement site as described above offers two advantages: it can be prepared without much time and effort, and all the materials are easily obtainable.

The fact that the microphone positions are not situated directly above the flooring of the measurement site allows the microphones to be easily mounted on stands, assuming that the ground is even and hard as, for example, an asphalt or concrete site.

When arranging the microphones, account has to be taken of the fact that the height of the microphones has to be determined in relation to the surface of the flooring of the measurement site. It shall, therefore, be 40 mm higher when measuring from the ground under the microphone.

Dimensions in millimetres
(unless otherwise stated all dimensions are approximate)



Key

A This surface is not suitable to carry weight. Do not stand on or drive over.

B This surface is suitable to carry weight. May be stood on or driven over.

a backing layer of plastics coated chipboard (nominally 19 mm thick)

b mineral wool fibre layer (nominally 20 mm thick)

c aluminium T-sections (nominally 3 mm thick × 20 mm high)

d aluminium U-sections (nominally 3 mm thick × 20 mm high)

e wire mesh (nominally 10 mm × 10 mm mesh made of 0,8 mm diameter steel wire)

f wire grating (nominally 30 mm × 30 mm mesh made of 3,1 mm diameter steel wire)

x axis *x* according to Annex I (see Figure I.101)

Figure DD.1 – Sketch of the measurement surface covered with an artificial surface (not to scale)

Annex EE
(informative)

Summary of characteristics for lawn trimmers, lawn edge trimmers, grass trimmers, brush cutters and brush saws

Table EE.1 provides an informative summary of characteristics for **lawn trimmers**, **lawn edge trimmers**, **grass trimmers**, **brush cutters** and **brush saws**. For correct application of this document, the normative text takes precedence over the guidance given in this annex and reliance should not be placed on Table EE.1.

Table EE.1 – Machine categories

Characteristic (subclause reference)	**Lawn trimmer according to 19.101.1.4**	**Lawn trimmer (except for 19.101.1.4)**	**Walk-behind lawn trimmer**	**Lawn edge trimmer**	**Grass trimmer**	**Brush cutter**	**Brush saw**
Intended use	Cutting grass or similar soft vegetation	Cutting grass or similar soft vegetation	Cutting grass or similar soft vegetation	Cutting lawn edges of grass or similar soft vegetation	Cutting small weeds, grass or similar soft vegetation	Cutting weeds, scrub, brush, and similar vegetation	Cutting small trees and saplings
Cutting means or **cutting accessory**	Non-metallic filament line(s) or freely pivoting non-metallic cutter(s)	Non-metallic filament line(s) or freely pivoting non-metallic cutter(s)	Non-metallic filament line(s) or freely pivoting non-metallic cutter(s)	Non-metallic filament line(s) or freely pivoting non-metallic cutter(s)	Non-metallic filament line(s) or freely pivoting non-metallic cutter(s)	Rigid metal or rigid plastic	Metallic with multiple peripheral teeth
Maximum kinetic energy of **cutting element** (J) (21.101)	5	10	10	10	Not applicable	Not applicable	Not applicable
Plane of **cutting means** or **cutting accessory**	Horizontal	Horizontal	Horizontal	Vertical	Horizontal	Horizontal	Horizontal
Minimum total **guard** coverage (19.101)	90°	135°	135°/360°	Design dependent	152 mm	90°	90°
Minimum **guard** coverage below cutting plane (mm) (19.101)	10	10	10/3	10	0	3	3
Thrown objects test (19.104)	Not applicable	Not applicable	Not applicable	Not applicable	Required	Required	Required
Minimum number of handles (19.102)	1 (2 if over 3,5 kg)	1 (2 if over 3,5 kg)	1	1 (2 if over 3,5 kg)	2	2	2
Minimum distance between handles (19.102)	250 mm (if over 3,5 kg)	250 mm (if over 3,5 kg)	Not applicable	250 mm (if over 3,5 kg)	250 mm	250 mm	500 mm
Barrier on operator side (19.103)	Not required	Not required	Not required	Not required	Not required	Required	Required

Characteristic (subclause reference)	**Lawn trimmer according to 19.101.1.4**	**Lawn trimmer (except for 19.101.1.4)**	**Walk-behind lawn trimmer**	**Lawn edge trimmer**	**Grass trimmer**	**Brush cutter**	**Brush saw**
Minimum distance of **guard** to **power switch** (mm)	1 250[a] (19.101.1.4)	600 (21.102)	600 (21.102)	600 (21.102)	750 (21.102)	Not applicable	Not applicable
Minimum distance front handle to **cutting means** (mm) (19.101.1.4)	830	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Minimum distance of **cutting accessory** to **barrier** (mm) (19.103)	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	830	830
Telescopic **shaft** prevents operation when not extended (19.105.2)	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Required	Required
Lock-off device on **power switch** (21.18.101)	Not required	Not required	Not required	Not required	Required	Required	Required
Single shoulder harness (21.106)	If > 7 kg and ≤ 8,5 kg	If > 7 kg and ≤ 8,5 kg	Not required	If > 7 kg and ≤ 8,5 kg	If > 7 kg and ≤ 8,5 kg	If ≤ 8,5 kg	Not applicable
Double shoulder harness and hip pad (21.106)	If > 8,5 kg	If > 8,5 kg	Not required	If > 8,5 kg	If > 8,5 kg	If > 8,5 kg	Required

[a] requirement is not applicable if the distance from the front handle to the nearest unguarded point of the cutting means is at least 830 mm.

Bibliography

The bibliography of Part 1 is applicable except as follows:

Addition:

CR 1030-1:1995, *Hand-arm vibration – Guidelines for vibration hazards reduction – Part 1: Engineering methods by design of machinery*

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ELECTRIC MOTOR-OPERATED HAND-HELD TOOLS, TRANSPORTABLE TOOLS AND LAWN AND GARDEN MACHINERY – SAFETY –

Part 4-4: Particular requirements for lawn trimmers, lawn edge trimmers, grass trimmers, brush cutters and brush saws

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This consolidated version of the official IEC Standard and its amendment has been prepared for user convenience.

IEC 62841-4-4 edition 1.1 contains the first edition (2020-11) [documents 116/468/FDIS and 116/479/RVD] and its amendment 1 (2024-10) [documents 116/806/FDIS and 116/829/RVD].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough

red text. A separate Final version with all changes accepted is available in this publication.

International Standard IEC 62841-4-4 has been prepared by IEC technical committee 116: Safety of motor-operated electric tools.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

This Part 4-4 is to be used in conjunction with the first edition of IEC 62841-1:2014.

This Part 4-4 supplements or modifies the corresponding clauses in IEC 62841-1, so as to convert it into the IEC Standard: Particular requirements for lawn trimmers, lawn edge trimmers, grass trimmers, brush cutters and brush saws.

Where a particular subclause of Part 1 is not mentioned in this Part 4-4, that subclause applies as far as reasonable. Where this standard states "addition", "modification" or "replacement", the relevant text in Part 1 is to be adapted accordingly.

The following print types are used:

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

The terms defined in Clause 3 are printed in **bold typeface**.

Subclauses, notes, tables and figures which are additional to those in Part 1 as well as Annexes of Part 1, except as described for Annex K and Annex L below, are numbered starting from 101.

Subclauses, notes, tables and figures in Annex K and Annex L which are additional to those in the main body of this Part 4-4 are numbered starting from 301.

A list of all parts of the IEC 62841 series, under the general title: *Electric motor-operated hand-held tools, transportable tools and lawn and garden machinery – Safety*, can be found on the IEC website.

The committee has decided that the contents of this document and its amendment will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

NOTE The attention of National Committees is drawn to the fact that equipment manufacturers and testing organizations may need a transitional period following publication of a new, amended or revised IEC publication in which to make products in accordance with the new requirements and to equip themselves for conducting new or revised tests.

It is the recommendation of the committee that the content of this publication be adopted for implementation nationally not earlier than 36 months from the date of publication.

INTRODUCTION

The International Electrotechnical Commission (IEC) draws attention to the fact that it is claimed that compliance with this document may involve the use of patents concerning prevention of inadvertent starting given in Subclause 21.18.101.

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ELECTRIC MOTOR-OPERATED HAND-HELD TOOLS, TRANSPORTABLE TOOLS AND LAWN AND GARDEN MACHINERY – SAFETY –

Part 4-4: Particular requirements for lawn trimmers, lawn edge trimmers, grass trimmers, brush cutters and brush saws

1 Scope

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

Addition:

This document applies to hand-held and **walk-behind lawn trimmers** and **lawn edge trimmers**, used by a standing operator for cutting grass, weeds or similar soft vegetation, and **grass trimmers**, **brush cutters** and **brush saws** used by a standing operator for cutting grass, weeds, brush, bushes, saplings and similar vegetation.

This document does not apply to

– hand-held machines having a mass of 18 kg or greater;
– self-propelled **lawn trimmers** or **lawn edge trimmers**;
– scissors type **lawn trimmers** and **lawn edge trimmers**;
– machines equipped with metallic **cutting accessories** consisting of more than one piece, e.g. pivoting chains or flail blades;
– edgers with rigid and/or metallic cutting devices.

NOTE 101 Freely pivoting non-metallic **cutting elements** are considered not to be rigid cutting devices.

NOTE 102 Edgers with rigid or metal cutting devices will be covered by a future part of IEC 62841-4.

NOTE 103 Annex EE provides an informative summary of characteristics for **lawn trimmers**, **lawn edge trimmers**, **grass trimmers**, **brush cutters** and **brush saws**.

Brush cutters and **brush saws** covered by this document are designed only to be operated with the machine to the right of the operator.

2 Normative references

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

Replacement of undated normative reference for ISO 3744:

ISO 3744:2010, *Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Engineering methods for an essentially free field over a reflecting plane*

Addition:

IEC 60664-3, *Insulation coordination for equipment within low-voltage systems – Part 3: Use of coating, potting or moulding for protection against pollution*

IEC 60664-4, *Insulation coordination for equipment within low-voltage systems – Part 4: Consideration of high-frequency voltage stress*

ISO 354:2003, *Acoustics – Measurement of sound absorption in a reverberation room*

ISO 683-4:2016, *Heat-treatable steels, alloy steels and free-cutting steels – Part 4: Free-cutting steels*

ISO 7918:1995, *Forestry machinery – Portable brush-cutters and grass-trimmers – Cutting attachment guard dimensions*

ISO 11201:2010, *Acoustics – Noise emitted by machinery and equipment – Determination of emission sound pressure levels at a work station and at other specified positions in an essentially free field over a reflecting plane with negligible environmental corrections*

ISO 22867:2021, *Forestry and gardening machinery – Vibration test code for portable hand-held machines with internal combustion engine – Vibration at the handles*

ISO 22868:2021, *Forestry and gardening machinery – Noise test code for portable hand-held machines with internal combustion engine – Engineering method (Grade 2 accuracy)*

3 Terms and definitions

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

3.16 *Addition:*

Note 101 to entry: Interchangeable **attachments** such as a lower shaft assembly or an interchangeable **guard** are considered not to be **detachable parts**.

Addition:

3.101
barrier
device attached to the machine, designed to maintain a minimum distance between the operator and the **cutting accessory** when the machine is being operated

3.102
blade thrust
sudden sideways, forward or backward motion of the machine, which may occur when the **cutting accessory** jams or catches on an object such as a sapling or a tree stump

3.103
brush cutter
machine with a rotating **cutting accessory** intended to cut weeds, scrub, brush, and similar vegetation

Note 101 to entry: See Figure 101.

3.104
brush saw
machine with a rotating circular metal **cutting accessory** having peripheral cutting teeth, designed to cut wood, such as small trees and saplings, by continuously removing material

Note 101 to entry: See Figure 102.

3.105
cutting accessory
rigid cutting device made of metal or plastic, used on **brush cutters** and **brush saws**

3.106
cutting element
single non-metallic filament line or freely pivoting non-metallic cutter

3.107
cutting head
support and retention system for the **cutting means**

Note 101 to entry: **Cutting heads** are used on **lawn trimmers**, **lawn edge trimmers** and **grass trimmers**.

3.108
cutting means
assembly of non-metallic filament line(s) or freely pivoting non-metallic cutter(s) that rotates about an axis perpendicular to the cutting plane, used to provide the cutting action by one or more **cutting elements**

Note 101 to entry: **Cutting means** are used on **lawn trimmers**, **lawn edge trimmers** and **grass trimmers**.

3.109
grass trimmer
machine with a **cutting means**, intended to cut small weeds, grass or similar soft vegetation, where the **cutting means** operates in a plane approximately parallel to the ground

Note 101 to entry: See Figure 103.

3.110
hand-held trimmer
lawn trimmer or **lawn edge trimmer** which is supported by hand, possibly assisted by wheel(s), skids or harness, etc. and constructed such that it cannot maintain its operating position without being held by an operator

3.111
lawn edge trimmer
machine with a **cutting means** for cutting grass or similar soft vegetation where the **cutting means** operates in a plane approximately perpendicular to the ground

Note 101 to entry: See Figure 104.

Note 102 to entry: The maximum kinetic energy for **cutting elements** on **lawn edge trimmers** is specified in 21.101.

3.112
lawn trimmer
machine with a **cutting means** for cutting grass or similar soft vegetation where the **cutting means** operates in a plane approximately parallel to the ground

Note 101 to entry: See Figure 105.

Note 102 to entry: The maximum kinetic energy for **cutting elements** on **lawn trimmers** is specified in 21.101.

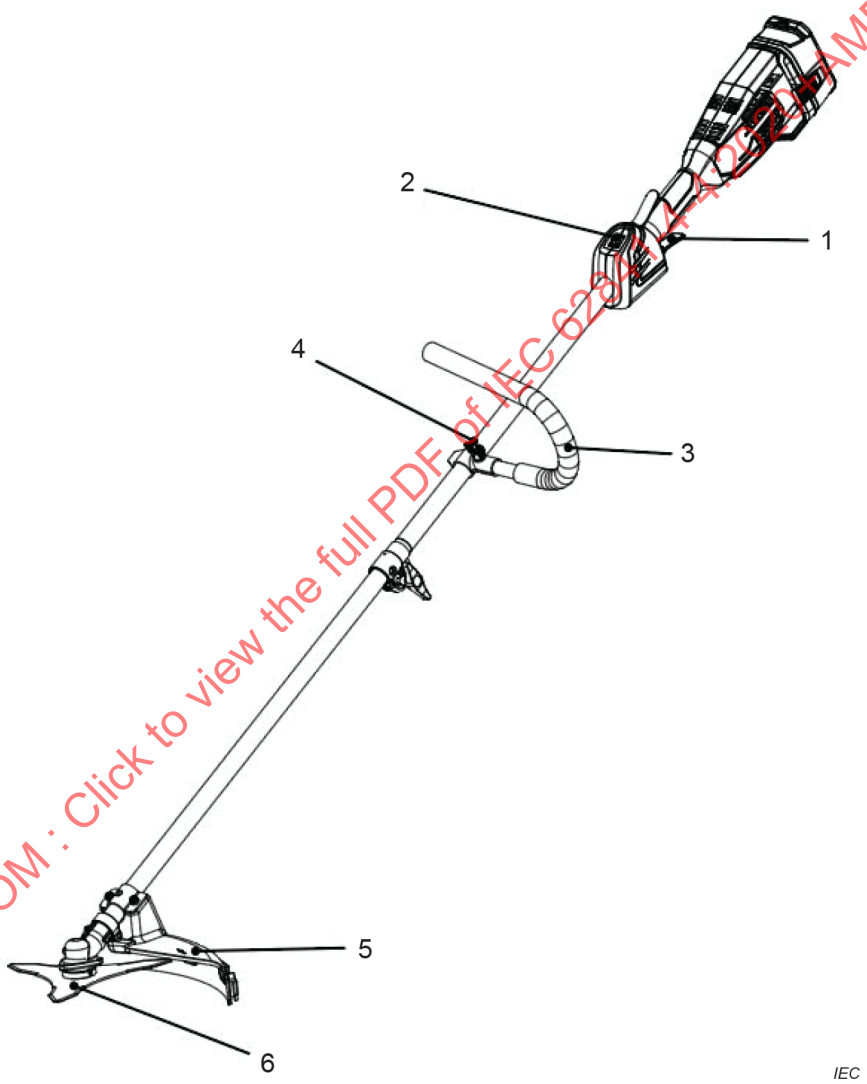
3.113
maximum speed
highest output speed attainable under all conditions of **normal use**, including no load

3.114
operator presence sensor
device to detect the presence of an operator's hand

3.115
shaft
element of the machine that distances the **cutting accessory** or **cutting means** from the handles

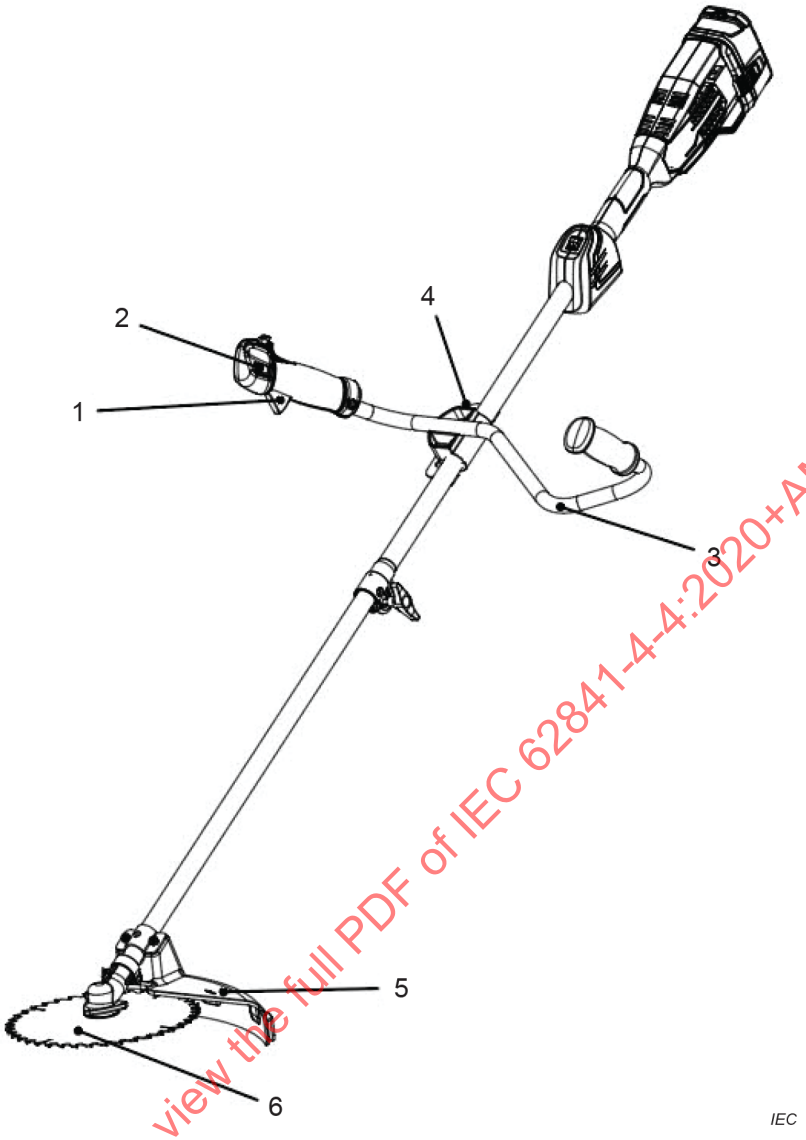
3.116
walk-behind trimmer
lawn trimmer or **lawn edge trimmer** which is ground supported, controlled by an operator walking behind and constructed such that it maintains its operating position without being held by an operator

Note 101 to entry: See Figure 106.



Key
1 **power switch**
2 lock-off device
3 **barrier**
4 suspension point
5 **cutting accessory guard**
6 **cutting accessory**

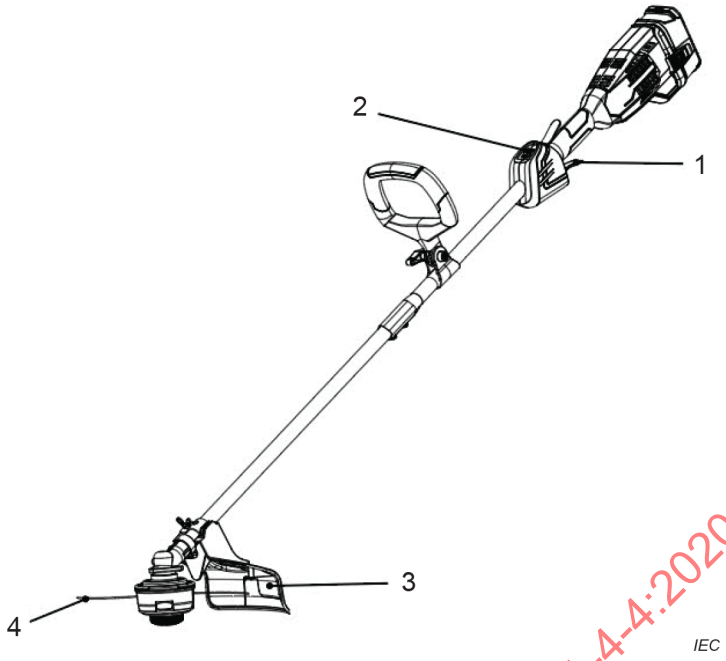
Figure 101 – Example of a brush cutter



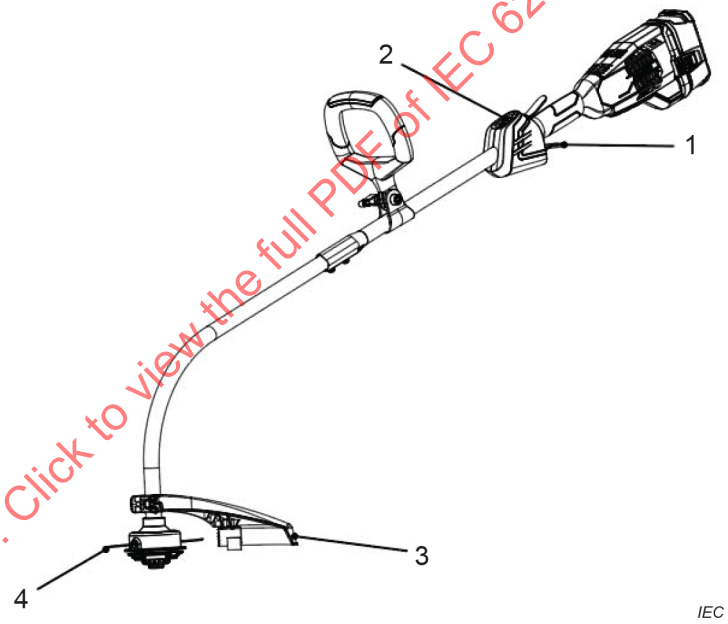
Key

1 **power switch**
2 lock-off device
3 **barrier**
4 suspension point
5 **cutting accessory guard**
6 **cutting accessory**

Figure 102 – Example of a brush saw



a) Grass trimmer with straight shaft

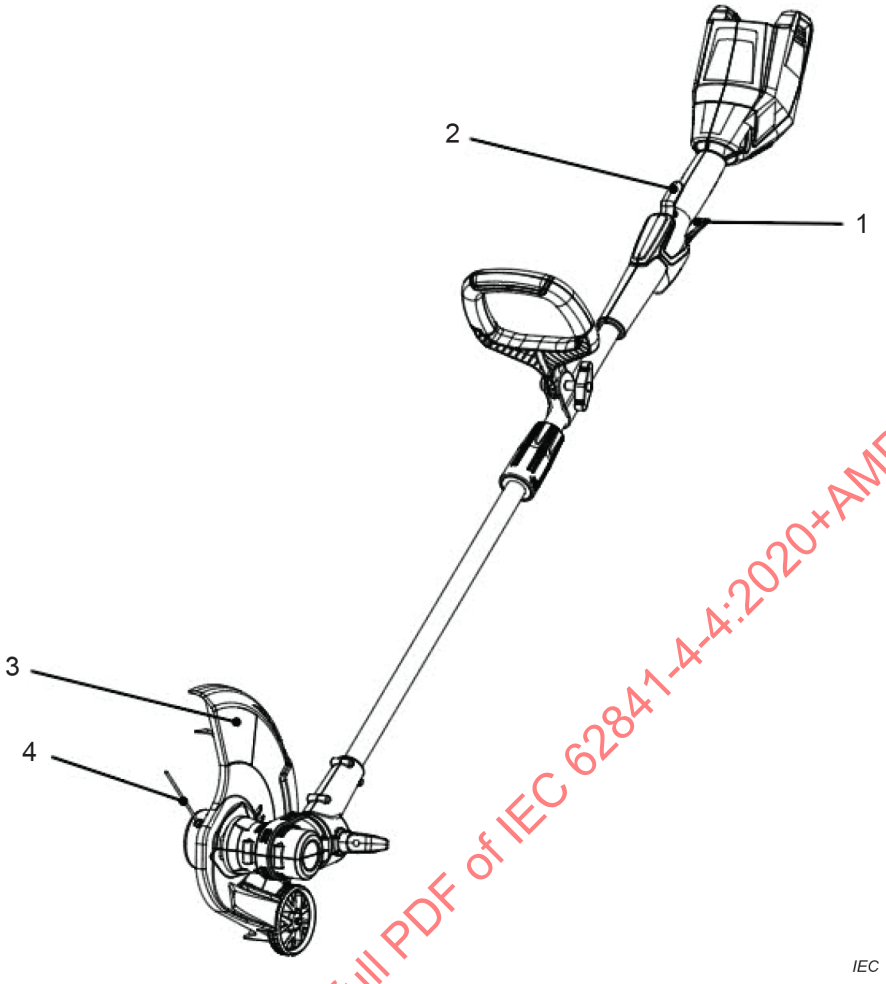


b) Grass trimmer with curved shaft

Key

1 **power switch**
2 lock-off device
3 **cutting means guard**
4 **cutting means**

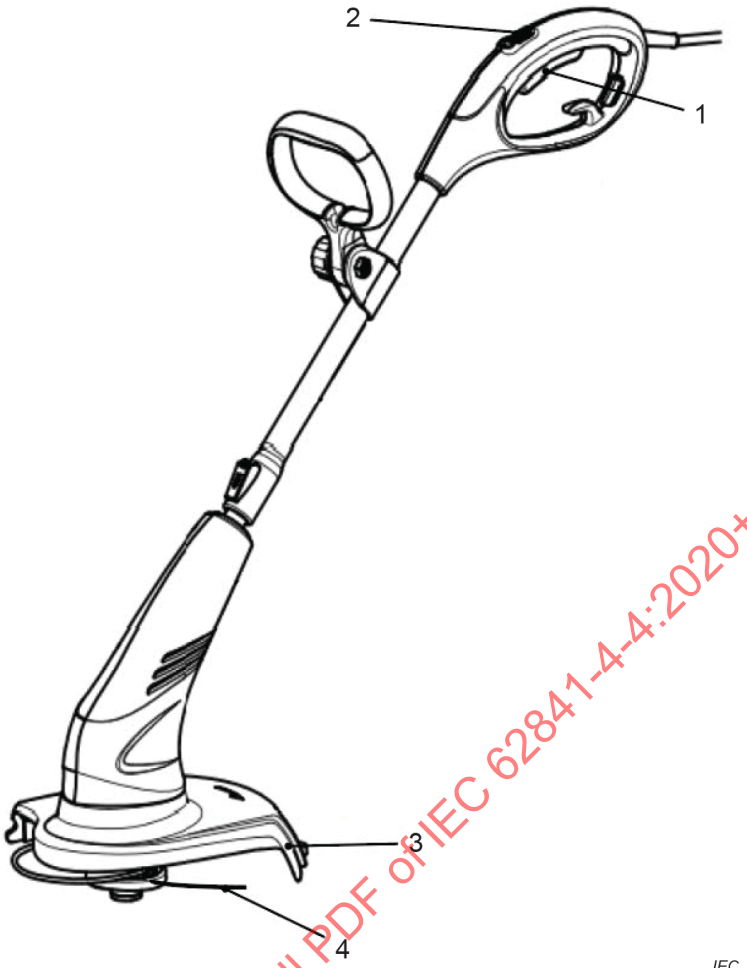
Figure 103 – Examples of grass trimmers



Key

1 **power switch**
2 lock-off device (if any)
3 **cutting means guard**
4 **cutting means**

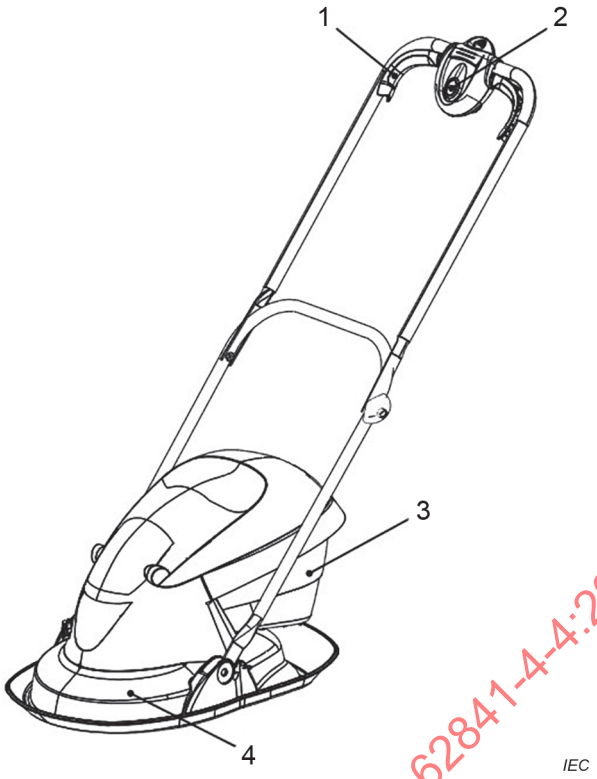
Figure 104 – Example of a lawn edge trimmer



Key

1 **power switch**
2 lock-off device (if any)
3 **cutting means guard**
4 **cutting means**

Figure 105 – Example of a lawn trimmer



Key

1 **power switch**
2 lock-off device (if any)
3 grass catcher (if any)
4 **cutting means guard**

Figure 106 – Example of a walk-behind trimmer

4 General requirements

This clause of Part 1 is applicable.

5 General conditions for the tests

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

5.4 *Addition:*

Handle positions that are used for storage or transportation purposes are not included in this requirement.

5.17 *Addition:*

*For **brush cutters** and **brush saws**, the mass of the machine includes the heaviest **cutting accessory** in accordance with 8.14.2 a) 101) and 8.14.2 a) 104), but excludes the **cutting accessory** cover, harness and hip pad, if any.*

*For **lawn trimmers**, **lawn edge trimmers** and **grass trimmers**, the mass of the machine includes the **cutting head***

- *with freely pivoting non-metallic cutters, if any; and*
- *with a spool for non-metallic filament line, if any;*
- *without the non-metallic filament line, if any;*

*and for **hand-held trimmers**, wheels or skids, if any.*

5.101 *The tests are carried out on the machine as supplied. However, a machine constructed as a single machine but supplied in an unassembled state is tested after assembly in accordance with 8.14.2.*

5.102 *Unless otherwise specified, for Clause 19 and Clause 21, machines are tested in each operating configuration as described in 8.14.2.*

5.103 *For tests that are performed at **maximum speed** and no load, the manufacturer may need to provide special hardware and/or software.*

6 Radiation, toxicity and similar hazards

This clause of Part 1 is applicable.

7 Classification

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

7.1 *Replacement:*

Machines shall be of one of the following classes with respect to protection against electric shock:

class II tool (machine), **class III tool** (machine)

Compliance is checked by inspection and by the relevant tests.

7.2 *Addition:*

Walk-behind trimmers that are a **class II tool** (machine) shall be classified at least as IPX4.

8 Marking and instructions

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

8.1 *Addition:*

Grass trimmers, **brush cutters** and **brush saws** shall be marked with the **maximum speed** of the spindle assigned by the manufacturer.

The **cutting head** for **grass trimmers** and the **cutting accessories** for **brush cutters** and **brush saws** shall be marked with their maximum permitted rotational speed.

8.2.101 Additional safety markings

8.2.101.1 General

Machines shall be marked with cautionary statements or instructions as specified in 8.2.101.2 to 8.2.101.8. A combination of ISO safety signs, such as eye, ear and head protection, is allowed. In addition, a combination of safety signs as specified in Figure AA.1, Figure AA.2 and Figure AA.3 is allowed.

Compliance is checked by inspection.

8.2.101.2 For all machines, unless otherwise specified:

– "Wear eye protection" or a relevant safety sign of ISO 7010 or one of the safety signs specified in Figure AA.4. This marking may be omitted for **walk-behind trimmers** with 360 degree guarding of the **cutting means**;

– "Wear ear protection" or a relevant safety sign of ISO 7010 or the safety sign specified in Figure AA.5. This marking may be omitted if the measured A-weighted emission sound pressure level at the operator position in accordance with Annex I does not exceed 85 dB(A);

– the primary direction of rotation of the spindle, by a legible and durable mark that is visible when operating the machine. This marking may be on the **guard**. This marking may be omitted for **walk-behind trimmers**, machines with no primary direction (i.e. dual direction) of rotation of the spindle, or machines with 360 degree guarding of the **cutting means**.

– "⚠WARNING – Keep bystanders away" or one of the safety signs specified in Figure AA.7;

– safety sign W017 of ISO 7010 (2011-05) in accordance with Table 2, if applicable.

8.2.101.3 For all hand-held machines with a degree of protection of less than IPX4:

– "Do not expose to rain" or the safety sign specified in Figure AA.6.

8.2.101.5 For **grass trimmers**, **brush cutters** and **brush saws**:

– "⚠WARNING – Beware of thrown objects", or the safety sign specified in Figure AA.9.

8.2.101.6 For **brush cutters** and **brush saws**:

– "Wear head protection where there is a risk of falling objects" or a relevant safety sign of ISO 7010 or the safety sign specified in Figure AA.10;

– "Wear hand protection" or a relevant safety sign of ISO 7010 or the safety sign specified in Figure AA.11;

– "Wear slip-resistant footwear" or the safety sign specified in Figure AA.12;

– "⚠WARNING – Beware of blade thrust", or one of the safety signs specified in either Figure AA.13 or Figure AA.14.

8.2.101.7 For **grass trimmers** that cannot be converted to a **brush cutter** or **brush saw** in accordance with 8.14.2 a) 104):

– "Do not use metal blades", or the safety sign specified in Figure AA.15.

8.2.101.8 For mains supplied machines:

– "⚠WARNING – Remove plug from the mains immediately if the cable is damaged or cut" or the safety sign specified in Figure AA.16.

8.3.101 For **grass trimmers**, **brush cutters** and **brush saws**, the **cutting head** or **cutting accessory** shall be marked with the following information:

– intended direction of rotation, if any;

– name or trade mark of the manufacturer.

8.3.102 For **grass trimmers**, **brush cutters** and **brush saws**, where the minimum handle distance is not prevented by design, the machine shall be marked with an indication on the machine as to the placement of the handle to meet the minimum handle distance requirement of 19.102.1.2.

8.6 *Modification of the following unit:*

n_0 **maximum speed** assigned by the manufacturer in accordance with 8.1

8.12 *Replacement of the first paragraph:*

Markings required by the standard shall be legible and durable. Signs shall be in contrast such as colour, texture, or relief, to their background such that the information or instructions provided by the signs are clearly legible when viewed with normal vision from a distance of (500 ± 50) mm. Signs need not be in accordance with the colour requirements of ISO 3864-2. If markings are embossed, stamped, etched, engraved or moulded, contrasting colours are not required.

8.14.1 *Addition:*

The additional safety instructions as specified in 8.14.1.101 to 8.14.1.103 shall be given. This part may be printed separately from the "General Machine Safety Warnings".

NOTE 101 "General Machine Safety Warnings" are referred to as "General Power Tool Safety Warnings" in Part 1.

8.14.1.1 *Addition for item 2) c):*

For machines classified at least IPX4, the warning may be replaced as specified below.

c) **Do not operate the machine in rain or wet conditions.** *Water entering the machine may increase the risk of electric shock or malfunction that could result in personal injury.*

8.14.1.101 Lawn trimmer and lawn edge trimmer safety warnings

a) **Do not use the machine in bad weather conditions, especially when there is a risk of lightning.** *This decreases the risk of being struck by lightning.*

b) **Thoroughly inspect the area for wildlife where the machine is to be used.** *Wildlife may be injured by the machine during operation.*

c) **Thoroughly inspect the area where the machine is to be used and remove all stones, sticks, wires, bones, and other foreign objects.** *Thrown objects can cause personal injury.*

d) **Before using the machine, always visually inspect to see that the cutter and the cutter assembly are not damaged.** *Damaged parts increase the risk of injury.*

e) **Before use, check the supply cord and any extension cord for signs of damage or aging. Do not use the machine if the cord is damaged or worn. If the cord is damaged or worn during use, switch off the machine and do not touch the cord before disconnecting it from the supply.** *A damaged supply cord or extension cord may result in electric shock, fire and/or serious injury.*

f) **Check the grass collector frequently for wear or deterioration.** *A worn or damaged grass collector may increase the risk of personal injury.*

NOTE 101 The warning in item f) above is omitted if the machine does not have a provision for fitting a grass collector.

NOTE 102 The term "collector" can be replaced by the term "catcher" or "bag".

g) **Keep guards in place. Guards must be in working order and be properly mounted.** *A guard that is loose, damaged, or is not functioning correctly may result in personal injury.*

h) **Keep all cooling air inlets clear of debris.** *Blocked air inlets and debris may result in overheating or risk of fire.*

i) **Wear eye protection and ear protection.** *Adequate protective equipment will reduce personal injury.*

NOTE 103 The ear protection portion of the warning can be omitted if the measured A-weighted emission sound pressure level at the operator's ear in accordance with Annex I does not exceed 85 dB(A).

NOTE 104 The eye protection portion of the warning can be omitted for **walk-behind trimmers** with 360 degree guarding of the **cutting means**.

NOTE 105 The warning in item i) is omitted for **walk-behind trimmers** with 360 degree guarding of the **cutting means** and where the measured A-weighted emission sound pressure level at the operator's ear in accordance with Annex I does not exceed 85 dB(A).

j) **While operating the machine, always wear non-slip and protective footwear. Do not operate the machine when barefoot or wearing open sandals.** *This reduces the chance of injury to the feet from contact with the moving cutter.*

k) **Always wear clothing such as trousers that covers the operator's legs while operating the machine.** *Contact with the moving cutter or line may cause injury.*

l) **Keep bystanders away while operating the machine.** *Thrown debris can result in serious personal injury.*

m) **Do not operate the machine above waist height.** *This helps prevent unintended cutter contact and enables better control of the machine in unexpected situations.*

n) **Exercise caution when operating the machine in wet grass. Walk, never run.** *This reduces the risk of slipping and falling which may result in personal injury.*

o)

p) **When working on slopes, always be sure of your footing, always work across the face of slopes, never up or down and exercise extreme caution when changing direction.** *This reduces the risk of loss of control, slipping and falling which may result in personal injury.*

q) **Keep all power cords and cables away from cutting area.** *Power cords or cables may be hidden in hedges or bushes and can be accidentally cut or damaged by the line or cutter.*

r) **Keep all parts of the body away from the moving trimmer cutter or line. Do not clear material from the machine until it has been disconnected from the power source.** *The moving trimmer cutter or line may result in serious personal injury.*

s) **Carry the machine with the machine switched off and away from your body.** *Proper handling of the machine will reduce the likelihood of accidental contact with a moving trimmer cutter or line.*

t) **Only use replacement cutting heads and trimmer cutters or lines specified by the manufacturer. Do not replace the trimmer cutters or lines with metal wires or blades.** *Incorrect replacement parts may cause loss of control, breakage and injury.*

8.14.1.102 Grass trimmer, brush cutter and brush saw safety warnings

a) **Do not use the machine in bad weather conditions, especially when there is a risk of lightning.** *This decreases the risk of being struck by lightning.*

b) **Thoroughly inspect the area for wildlife where the machine is to be used.** *Wildlife may be injured by the machine during operation.*

c) **Thoroughly inspect the area where the machine is to be used and remove all stones, sticks, wires, bones, and other foreign objects.** *Thrown objects can cause personal injury.*

d) **Before using the machine, always visually inspect to see that the cutter or blade and the cutter or blade assembly are not damaged.** *Damaged parts increase the risk of injury.*

e) **Before use, check the supply cord and any extension cord for signs of damage or aging. Do not use the machine if the cord is damaged or worn. If the cord is damaged or worn during use, switch off the machine and do not touch the cord before disconnecting it from the supply.** *A damaged supply cord or extension cord may result in electric shock, fire and/or serious injury.*

f) **Follow instructions for changing accessories.** *Improperly tightened blade securing nuts or bolts may either damage the blade or result in it becoming detached.*

g) **The rated rotational speed of the blade must be at least equal to the maximum rotational speed marked on the machine.** *Blades running faster than their rated rotational speed can break and fly apart.*

NOTE 101 This warning is omitted for **grass trimmers** that cannot be converted to a **brush cutter** or a **brush saw** in accordance with 8.14.2 a) 104).

NOTE 102 It is possible to replace the term "blade" with the term "cutter".

h)

NOTE 103 The ear protection portion of the warning can be omitted if the measured A-weighted emission sound pressure level at the operator's ear in accordance with Annex I does not exceed 85 dB(A).

i) **While operating the machine, always wear non-slip and protective footwear. Do not operate the machine when barefoot or wearing open sandals.** *This reduces the chance of injury to the feet from contact with the moving cutter line or blade.*

j)

k) **While operating the machine, always wear long trousers.** *Exposed skin increases the likelihood of injury from thrown objects.*

l) **Keep bystanders away while operating the machine.** *Thrown debris can result in serious personal injury.*

m) **Always use two hands when operating the machine.** *Holding the machine with both hands will avoid loss of control.*

n) **Hold the machine by insulated gripping surfaces only, because the cutting line or blade may contact hidden wiring or its own cord.** *Cutting line or blades contacting a "live" wire may make exposed metal parts of the machine "live" and could give the operator an electric shock.*

o) **Always keep proper footing and operate the machine only when standing on the ground.** *Slippery or unstable surfaces may cause a loss of balance or control of the machine.*

p) **Do not operate the machine on excessively steep slopes.** *This reduces the risk of loss of control, slipping and falling which may result in personal injury.*

q) **When working on slopes, always be sure of your footing, always work across the face of slopes, never up or down and exercise extreme caution when changing direction.** *This reduces the risk of loss of control, slipping and falling which may result in personal injury.*

r) **Keep the supply cord away from the cutter, line or blade.** *A damaged supply cord may result in electric shock, fire and/or serious injury.*

NOTE 106 It is possible to replace the term "blade" with the term "cutter".

s) **Keep all parts of the body away from the cutter, line or blade when the machine is operating. Before you start the machine, make sure the cutter, line or blade is not contacting anything.** *A moment of inattention while operating the machine may result in injury to yourself or others.*

t) **Do not operate the machine above waist height.** *This helps prevent unintended cutter or blade contact and enables better control of the machine in unexpected situations.*

u) **When cutting brush or saplings that are under tension, be alert for spring back**. *When the tension in the wood fibres is released, the brush or sapling may strike the operator and/or throw the machine out of control.*

v) **Use extreme caution when cutting brush and saplings**. *The slender material may catch the blade and be whipped toward you or pull you off balance.*

w) **Maintain control of the machine and do not touch cutters, lines or blades and other hazardous moving parts while they are still in motion.** *This reduces the risk of injury from moving parts.*

x) **When clearing jammed material or servicing the machine, make sure all power switches are off and the power cord is disconnected.** *Unexpected starting of the machine while clearing jammed material or servicing may result in serious personal injury.*

y) **Carry the machine with the machine switched off and away from your body.** *Proper handling of the machine will reduce the likelihood of accidental contact with a moving cutter, line or blade.*

z) **When transporting or storing the machine, always fit the cover on metal blades.** *Proper handling of the machine will reduce the likelihood of accidental contact with the blade.*

NOTE 107 This warning is omitted for **grass trimmers** that cannot be converted to a **brush cutter** or **brush saw** in accordance with 8.14.2 a) 104).

aa) **Only use replacement cutters, lines, cutting heads and blades specified by the manufacturer.** *Incorrect replacement parts may increase the risk of breakage and injury.*

8.14.1.103 Blade thrust causes and related warnings

NOTE 101 The verbatim text of this subclause is omitted for **lawn trimmers**, **lawn edge trimmers** and **grass trimmers** that cannot be converted to a **brush cutter** or a **brush saw** in accordance with 8.14.2 a) 104).

Blade thrust is a sudden sideways, forward or backward motion of the machine, which may occur when the blade jams or catches on an object such as a sapling or a tree stump. It can be violent enough to cause the machine and/or operator to be propelled in any direction, and possibly lose control of the machine.

Blade thrust and its related hazards can be avoided by taking proper precautions as given below.

a) **Maintain a firm grip with both hands on the machine and position your arms to resist blade thrust. Position your body to the left side of the machine.** *Blade thrust can increase the risk of injury due to the machine moving unexpectedly. Blade thrust can be controlled by the operator if proper precautions are taken.*

b) **If the blade binds, or when interrupting a cut for any reason, switch the machine off and hold the machine motionless in the material until the blade comes to a complete**

stop. While the blade is binding, never attempt to remove the machine from the material or pull the machine backward while the blade is in motion, otherwise blade thrust may occur. *Investigate and take corrective actions to eliminate the cause of blade binding.*

c) **Do not use blunt or damaged blades.** *Blunt or damaged blades increase the risk of jamming or catching on an object, resulting in blade thrust.*

d) **Always maintain good visibility of the material being cut.** *Blade thrust is more likely to occur in areas where it is difficult to see the material being cut.*

e) **If you are approached by another person while operating the machine, switch the machine off.** *There is an increased risk of injury to other persons being struck by the moving blade in the event of blade thrust.*

8.14.2 a) *Addition:*

For **lawn trimmers** and **lawn edge trimmers**:

101) Instructions for configuring the machine for each intended use including handles, **guards**, grass catcher (if any) or **cutting means** adjustment;

102) Instructions on which types of **accessories** and **guards** to be used for the intended applications of the machine;

For **grass trimmers**, **brush cutters** and **brush saws**, according to the type of supplied **cutting accessory**:

103) Explanation of the safety devices that the **grass trimmer**, **brush cutter** or **brush saw** incorporates as part of the original equipment;

104) Instructions for configuring the machine for each intended use, as applicable, including any handle(s), **guard**, **barrier**, **cutting means** or **cutting accessory** adjustment, as applicable, and the method to reconfigure the machine, if applicable;

105) Instruction that the **cutting accessory guard** and handle adjustments should be made with the motor stopped and disconnected from the mains supply or **battery** removed;

106) Instructions on which combinations of **cutting means**, **cutting accessories** and **guards** to be used for the intended applications of the machine.

8.14.2 b) *Addition:*

101) Advice to inspect machine for damage upon striking a hard object or if there appears to be excessive vibration;

102) Recommendation for the use of a **residual current device** with a tripping current of 30 mA or less;

103) Instruction to keep hands away from any sharp device intended to limit the length of the filament line, if any;

104) Instruction on how to extend and/or replace **cutting element**(**s**), **cutting means** or **cutting accessory**, as applicable;

105) Instruction to secure the locking device(s) of any adjustable elements (e.g. extendable **shafts** and/or pivoting elements), if any;

106) Instruction on the normal position of use of the machine;

107) Instructions on starting and stopping techniques, with particular reference to safety;

108) Instructions on cutting techniques, including the materials that can be cut;

109) Instructions for the use and adjustment of handles;

110) Instructions for the use and adjustment of any provided shoulder harness in accordance with 21.106 and instructions for release or removal; if any;

111) Instructions not to simultaneously wear multiple belt harnesses or multiple shoulder harnesses;

112) Instructions, that when wearing a harness, no other wearable interferes with the release and removal of the harness;

113) Instructions on how to avoid situations which may be encountered while performing typical tasks, such as blockage of the **cutting accessory** or **cutting head**;

114) Instructions on how to clear blockages of the **cutting accessory** or **cutting head**;

115) Instruction to position the **supply cord** so that it will not be cut or caught on objects during operation;

116) Information on the **maximum speed** of the spindle assigned by the manufacturer, if required to be marked in accordance with 8.1;

8.14.2 c) *Addition:*

101) Advice to keep any ventilation openings clear of debris;

102) Recommendations for cleaning and maintenance before storage;

103) Instructions on the selection of replacement **cutting elements**, **cutting means**, **cutting heads** or **cutting accessories**, as applicable;

Additionally, for **brush cutters** and **brush saws**:

104) Instructions on sharpening and maintenance of the **cutting accessory** and/or a recommendation to have sharpening and maintenance of the **cutting accessory** performed by authorised service centres, with particular emphasis on the effects of **blade thrust** behaviour that may result if specifications are not followed. Or as an alternative, **cutting accessory** sharpening techniques, including the use of gloves;

105) Instruction on how to use the **cutting accessory** cover.

Replacement of NOTE:

NOTE In Europe (EN 62841-4-4), the following additional requirements apply:

Emissions

1) The noise emission, measured in accordance with Clause I.2, as follows:
   - A-weighted emission sound pressure level L_{pA} and its uncertainty K_{pA}, where L_{pA} exceeds 70 dB(A). Where L_{pA} does not exceed 70 dB(A), this fact shall be indicated;
   - for **lawn trimmers** and **lawn edge trimmers**, the A-weighted measured and guaranteed sound power levels L_{WA};
   - for **grass trimmers, brush cutters** and **brush saws**, the A-weighted sound power level L_{WA} and its uncertainty K_{WA}, where the A-weighted sound pressure level L_{pA} exceeds 80 dB(A);
   - C-weighted peak emission sound pressure value L_{pCpeak}, where this exceeds 63 Pa (130 dB in relation to 20 µPa).
2) Recommendation for the operator to wear hearing protection.
3) The vibration total value and its uncertainty measured in accordance with Clause I.3.

   When the vibration total value does not exceed 2,5 m/s^2, this shall be stated.

   When the vibration total value exceeds 2,5 m/s^2, its value shall be given in the instructions.
4) The following information:
   - that the declared vibration total value(s) has been measured in accordance with a standard test method and may be used for comparing one machine with another;
   - that the declared vibration total value(s) may also be used and the declared noise emission value(s) may also be used in a preliminary assessment of exposure.
5) A warning:
   - that the vibration emission during actual use of the machine can differ from the declared total value depending on the ways in which the machine is used; and
   - of the need to identify safety measures to protect the operator that are based on an estimation of exposure in the actual conditions of use (taking account of all parts of the operating cycle such as the times when the machine is switched off and when it is running idle in addition to the trigger time).

8.14.3 *Replacement:*

If information about the mass or weight of the machine is provided, it shall be

– for **lawn trimmers**, **lawn edge trimmers** and **grass trimmers**, the mass specified in 5.17; and
– for **brush cutters** and **brush saws**, the mass without the **cutting accessory**, **cutting accessory** cover, harness and hip pad, if any.

Compliance is checked by inspection.

9 Protection against access to live parts

This clause of Part 1 is applicable.

10 Starting

This clause of Part 1 is applicable.

11 Input and current

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

Addition:

*For **lawn trimmers**, **lawn edge trimmers** and **grass trimmers**, the **cutting head** is fitted for this test, but **cutting elements** are removed.*

*For **brush cutters** and **brush saws**, the **cutting accessory** is removed for this test.*

12 Heating

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

12.2 *Replacement:*

*For machines with one or more **rated voltages**, the machine is operated at each **rated voltage** under the load conditions specified in 12.2.1. Without any further alteration of the applied torque, the voltage is then adjusted to 0,94 times the **rated voltage** and 1,06 times the **rated voltage**.*

The temperatures are measured at the most unfavourable of the two voltage settings. The temperatures that are measured by means of thermocouples are taken while the machine is operating.

*For machines with a **rated voltage range**, the machine is operated*

– *at the lower limit of the **rated voltage range**, under the load conditions specified in 12.2.1, and without any further alteration of the applied torque, the voltage is then adjusted to 0,94 times the lower limit of the **rated voltage range**;*

and

– *at the upper limit of the **rated voltage range**, under the load conditions specified in 12.2.1, and without any further alteration of the applied torque, the voltage is then adjusted to 1,06 times the upper limit of the **rated voltage range**.*

The temperatures are measured at the most unfavourable of the two voltage settings. The temperatures that are measured by means of thermocouples are taken while the machine is operating.

12.2.1 *Replacement:*

The load conditions for the heating test of 12.2 are as follows:

The machine is loaded by the application of a torque until thermal equilibrium is reached.

*For **lawn trimmers**, **lawn edge trimmers** and **grass trimmers** that cannot be converted to a **brush cutter** or **brush saw** in accordance with 8.14.2 a) 104), at the manufacturer's discretion, the torque may be applied by either*

– *an external load; or*
– *extending or modifying the **cutting elements***

*such that when supplied at **rated voltage** the machine operates at **rated input** or **rated current**.*

*For **brush cutters**, **brush saws** and **grass trimmers** that can be converted to a **brush cutter** or **brush saw** in accordance with 8.14.2 a) 104), the torque is applied by means of an external load such that when supplied at **rated voltage** the machine operates at **rated input** or **rated current**.*

Replacement of Table 2:

Table 2 – Maximum outside surface temperature rises

Parts	Temperature rise[a] K
External enclosure, except handles held in **normal use**	60
Handles, knobs, grips, and the like which, in **normal use**, are continuously held:	
– of metal	30
– of porcelain or vitreous material	40
– of moulded material, rubber or wood	50
Handles, knobs, grips, and the like which, in **normal use**, are held for short periods only (e.g. switches):	
– of metal	35
– of porcelain or vitreous material	45
– of moulded material, rubber or wood	60
[a] Temperature rise limits are not applicable to the **cutting means** or **cutting accessory** drive enclosure, if it is marked with the safety sign W017 of ISO 7010 (2011-05).	

13 Resistance to heat and fire

This clause of Part 1 is applicable.

14 Moisture resistance

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

14.2 *Replacement of the first paragraph:*

The enclosure of the machine shall provide the degree of protection against moisture in accordance with the marking (other than IPX0) of the machine.

14.2.1 *Replacement:*

The machine is not connected to the supply. Machines fitted with an appliance inlet or cable coupler shall be tested without the mating connector in place.

*For a **walk-behind trimmer**, the machine is placed on a non-perforated turntable. The front to rear centreline of the machine is aligned with the pivot axis of the oscillating tube at the start of test.*

*For a **hand-held tool** (machine), the machine is placed in its normal rest position on a perforated turntable.*

The turntable is turned continuously at (1 ± 0,1) r/min.

***Detachable parts** are removed and subjected, if necessary, to the relevant treatment with the main part. Movable covers that are non-**detachable parts** and are not self-restoring are placed in the most unfavourable position.*

NOTE Examples of self-restoring covers include those that are spring loaded or close by gravity.

Air filters are not removed.

14.2.2 *Replacement of the last paragraph:*

*Immediately after the appropriate treatment, the machine shall withstand the electric strength test of Annex D between **live parts** and **accessible parts**, the test voltage being 2 500 V. Then the machine is connected to the supply. It shall not start with the **power switch** in the "off" position.*

*Afterwards, inspection shall show that there is no trace of water on insulation which could result in a reduction of **creepage distances** between bare conductors of different potential below the values specified in 28.1. For all instances where **creepage distances** could be reduced below the values specified in 28.1, a short circuit is introduced between adjacent conductors simultaneously. The machine is then evaluated for*

– *the risk of fire in accordance with item a) of 18.6.1; and*
– *the loss of any **SCF**, unless the machine is rendered into a safe state.*

15 Resistance to rusting

This clause of Part 1 is applicable.

16 Overload protection of transformers and associated circuits

This clause of Part 1 is applicable.

17 Endurance

This clause of Part 1 is applicable except as follows:

17.2 *Replacement:*

***Lawn trimmers**, **lawn edge trimmers** and **grass trimmers** are operated at **maximum speed**, with the **cutting means** adjusted to the maximum cutting length, if applicable.*

***Hand-held trimmers** are operated for 15 h at a voltage equal to 1,1 times the highest **rated voltage** or 1,1 times the upper limit of the **rated voltage range**, and then for 15 h at a supply voltage equal to 0,9 times the lowest **rated voltage** or 0,9 times the lower limit of the **rated voltage range**. The machine may be operated for a number of periods in order to achieve the 15 h operating time. For machines that can be operated in various positions in accordance with 8.14.2, the test may be conducted in any single orientation or distributed in various orientations for each 15 h test duration.*

***Walk-behind trimmers** are operated for 15 h at a voltage equal to 1,1 times the highest **rated voltage** or 1,1 times the upper limit of the **rated voltage range**, and then for 15 h at a supply voltage equal to 0,9 times the lowest **rated voltage** or 0,9 times the lower limit of the **rated voltage range**. The machine may be operated for a number of periods in order to achieve the 15 h operating time. During the test, the machine is placed in its normal operating position according to 8.14.2.*

***Grass trimmers**, **brush cutters** and **brush saws** are fitted with the **cutting means** or **cutting accessory**, as applicable, that results in the highest power input. The machine is then operated at **maximum speed** for 24 h at a voltage equal to 1,1 times the highest **rated voltage** or 1,1 times the upper limit of the **rated voltage range**, and then for 24 h at a supply voltage equal to 0,9 times the lowest **rated voltage** or 0,9 times the lower limit of the **rated voltage range**. The machine may be operated for a number of periods in order to achieve the 24 h operating time.*

During this test, replacement of the carbon brushes is allowed, and the machine is oiled and greased in accordance with 8.14.2 c) 1). If mechanical failure occurs and does not impair compliance with this standard, the part that failed may be replaced.

If the temperature rise of any part of the machine exceeds the temperature rise determined during the test of 12.1, forced cooling or rest periods may be applied, the rest periods being excluded from the specified operating time. If forced cooling is applied, it shall not alter the air flow of the machine or redistribute carbon deposits.

During these tests, overload protection devices incorporated in the machine shall not activate.

18 Abnormal operation

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

18.3 *Replacement:*

***Lawn trimmers**, **lawn edge trimmers** and **grass trimmers** incorporating a series motor are operated at a voltage equal to 1,3 times **rated voltage** for 1 min at no-load with the spool empty of any filament line and with any freely pivoting **cutting means** removed.*

***Brush cutters** and **brush saws** incorporating a series motor are operated at a voltage equal to 1,3 times **rated voltage** for 1 min at no-load with the **cutting accessory** removed.*

During the test, parts shall not be ejected from the machine. After this test, the machine need not be capable of further use.

An additional device incorporated in the machine to limit the speed may operate during the test.

18.5 *Replacement:*

Protection against electric shock shall not be impaired when a **class II tool** is subjected to running overload conditions.

*For **lawn trimmers**, **lawn edge trimmers** and **grass trimmers** that cannot be converted to a **brush cutter** or **brush saw** in accordance with 8.14.2 a) 104), with*

– *motors having electronically commutated stator windings, compliance is checked by the test of 18.5.4;*
– *series motors, compliance is checked by the test of 18.5.1;*
– *other motors, compliance is checked by the test of 18.5.3.*

*For **brush cutters**, **brush saws** and **grass trimmers** that can be converted to a **brush cutter** or **brush saw** in accordance with 8.14.2 a) 104), with*

– *motors having electronically commutated stator windings, compliance is checked by the test of 18.5.4;*
– *other motors, compliance is checked by the test of 18.5.3.*

18.5.1 *Addition:*

*The method described in 12.2.1 may be used to achieve the load of 160 % of **rated current**.*

18.5.2 This subclause of Part 1 is not applicable.

18.8 *Replacement of Table 4 by the following:*

Table 4 – Required performance levels

Type and purpose of SCF		Minimum performance level (PL)
Power switch – prevent unwanted switch-on		
	– **lawn trimmers**; – **lawn edge trimmers**; and – **grass trimmers** that cannot be converted to a **brush cutter** or a **brush saw**	a
	– **brush cutters**; – **brush saws**; and – **grass trimmers** that can be converted to a **brush cutter** or a **brush saw**	c
Power switch – provide desired switch-off		
	– **lawn trimmers**; – **lawn edge trimmers**; and – **grass trimmers** that cannot be converted to a **brush cutter** or a **brush saw**	a
	– **brush cutters**; – **brush saws**; and – **grass trimmers** that can be converted to a **brush cutter** or a **brush saw**	b
Starting current limitation as in 10.2		Not an **SCF**
Prevent exceeding thermal limits as in Clause 18		a
Overspeed prevention		
	For machines covered by 19.6 to prevent output speed above 130 % of **maximum speed** assigned by the manufacturer	a
	For machines other than those covered by 19.6 or with output speed increases that do not exceed 130 % of **maximum speed**: Any speed limiting device	Not an **SCF**
	If such overspeed would result in exceeding the 5 J kinetic energy limit as specified in 19.101.1.4 by more than 1,5 J	a
	For machines provided with a reverse rotation selector as specified in 21.18.103: Prevent reverse rotational speed exceeding 30 % of the **maximum speed**	b
	For machines if such overspeed would result in exceeding the 10 J kinetic energy limit as specified in 21.101 by more than 2 J	a
Provide desired direction of rotation		
	For machines covered by 19.101.1.3	a
	For machines covered by 19.101.1.4	a
	For machines covered by 19.101.2	a
	For machines covered by 21.104 that will not loosen due to a change in the direction of rotation	Not an **SCF**
	For machines covered by 21.104 that will loosen due to a change in the direction of rotation	b
Prevent drive to the **cutting accessory** as required in 19.105.3		a
De-energizing means, if any, as specified in 19.106		a
Lock-off function as required in 21.18.101		a
Visual or audible indicator as referenced in 21.18.101		Not an **SCF**
Operator presence sensor as in 21.18.102		a

19 Mechanical hazards

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

19.1 *Addition:*

The requirements of this subclause do not apply to those moving parts and **guards** which are separately covered by 19.101.

The requirements of this subclause apply to all operating configurations as described in 8.14.2.

Machines that are intended to be configured as a **lawn trimmer** and a **lawn edge trimmer** in accordance with 8.14.2 a) 101) shall comply with the guarding requirements of 19.101.1 and 19.101.2 respectively.

19.3 This subclause of Part 1 is not applicable.

19.4 This subclause of Part 1 is not applicable.

Addition:

NOTE 101 Requirements for handles are given in 19.102.

19.5

Addition:

This subclause of Part 1 is not applicable for **walk-behind trimmers** with 360 degree guarding of the **cutting means**.

19.6 *Replacement:*

For **grass trimmers**, **brush cutters** and **brush saws**, the **maximum speed** of the spindle at **rated voltage** shall not exceed 110 % of the **maximum speed** marked as specified in 8.1.

*Compliance is checked by measuring the speed of the spindle with the most unfavourable **cutting means** or **cutting accessory** fitted, as applicable, in accordance with 8.14.2 a) 106).*

19.7 This subclause of Part 1 is not applicable.

19.8 This subclause of Part 1 is not applicable.

19.101 Guarding of cutting means and cutting accessories

19.101.1 Lawn trimmers

19.101.1.1 General

Lawn trimmers shall be guarded such as to minimise the likelihood of debris being ejected outward towards the operator during use as specified in

– 19.101.1.2; and

– either 19.101.1.3 or 19.101.1.4, depending on the energy of the **cutting element** calculated as in 21.101.

19.101.1.2 Within the required coverage area, the **guard** shall extend below the plane of the **cutting means** by at least

– 3 mm for **walk-behind trimmers** where the **guard** has 360° of coverage; and
– 10 mm for other **lawn trimmers**.

See dimension "*a*" in Figure 107 b).

Compliance is checked by inspection and by measurement.

19.101.1.3 The angular coverage of the **guard**, as measured from the projection of the axis of the **shaft** onto the plane of the rotating **cutting means** shall be

– at least 45° on the side where the direction of rotation is away from the operator; and
– at least 75° on the side where the direction of rotation is towards the operator; and
– at least 135° of total coverage.

The vertices of these angles lie on the axis of the **cutting head** spindle. The **guard** shall cover, from above and to the operator side, the area beyond 80 % of the largest radius of the **cutting means**. See Figure 107 a).

Compliance is checked by inspection and by measurement.

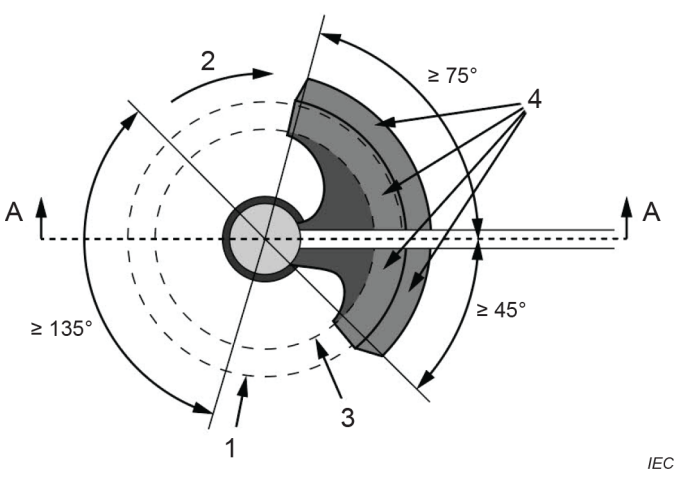
19.101.1.4 For machines where the energy of the **cutting element** calculated as in 21.101 is less than 5 J, the angular coverage of the **guard**, as measured from the projection of the axis of the **shaft** onto the plane of the rotating **cutting means** shall be at least 45° on either side provided that:

– the **lawn trimmer** possesses a front handle where the minimum chain distance from the front handle to the nearest unguarded point of the **cutting means** is at least 830 mm as shown in Figure 107 c), with the front handle adjusted to the nearest position to the **cutting means** in accordance with 8.14.2 b); or
– the distance from the **guard** to the nearest point of the **power switch** as measured in 21.102 is at least 1 250 mm.

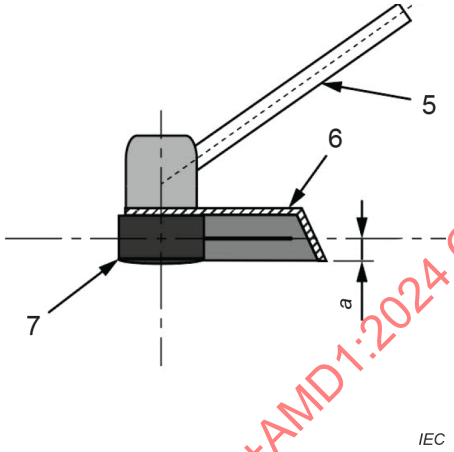
The vertices of these angles lie on the axis of the **cutting head** spindle. See Figure 107 c).

Compliance is checked by inspection and by measurement.

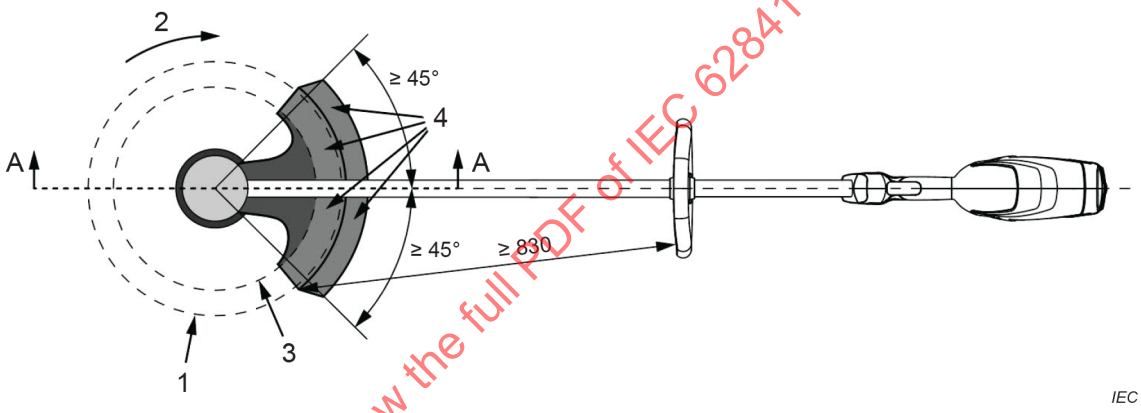
Linear dimensions in millimetres



a) Plan view for lawn trimmers having cutting element energy ≤ 10 J



b) View A-A



c) Plan view for lawn trimmers having cutting element energy < 5 J

Key

1 outer radius of **cutting means**
2 direction of rotation
3 80 % of the radius of the **cutting means**
4 area of the **guard** beyond 80 % of the largest radius of the **cutting means**
5 **shaft**
6 **guard**
7 **cutting head**
a distance of **guard** extension from the plane of **cutting means**

NOTE 101 For reasons of clarity, any skids or wheels are not shown in the figure. The figure is not intended to govern design except as regards the dimensions and specific requirements shown.

NOTE 102 Figures are not to scale.

Figure 107 – Minimum guard coverage, lawn trimmer (see 19.101.1)

19.101.2 Lawn edge trimmers

Lawn edge trimmers shall be guarded, as a minimum, to the extent shown in Figure 108. The outer edge of the **guard** shall extend beyond the plane of the **cutting means** by at least 10 mm. If, with the **lawn edge trimmer** in its normal position of use in accordance with 8.14.2 b) 106), the angle of the axis of the **shaft**, θ, is less than 45° to the plane of the **cutting means** (see Figure 109), then the **guard** shall cover the **cutting means** as follows:

For the case where the direction of rotation is 1 (see Figure 110), then $\beta \geq 45°$ and either:

– $h \geq 0{,}78 \times r$; or

– $\alpha \geq 135° - \beta$, provided that $\alpha \geq 75°$.

For the case where the direction of rotation is 2 (see Figure 110);

– $\alpha \geq 0°$, and

– $\beta \geq 75°$

where r, h, α and β are as follows:

– r is the radius of the circle formed by the **cutting means**;

– h is the distance measured from the ground to the centre of the **cutting means** when the front of the **power switch** is positioned (775 ± 15) mm above the ground and the rear of the **guard** is in contact with the ground, as shown in Figure 110. If the **lawn edge trimmer** has wheels or other components that are not part of the guarding that prevent this arrangement, those components are removed for the measurement;

– α is the angle of the end of the **guard** on the side of the operator measured from the axis of the **shaft** (see Figure 110); and

– β is the angle of the end of the **guard** away from the operator measured from the axis of the **shaft** (see Figure 110).

If, with the **lawn edge trimmer** in its normal position of use in accordance with 8.14.2 b) 106), the angle of the axis of the **shaft**, θ, is greater or equal to 45° to the plane of the **cutting means** (see Figure 109 a) and Figure 109 b)), then the **guard** shall cover the **cutting means** by at least the angles α and β as follows:

– $\alpha \geq 45°$, and

– $\beta \geq 45°$ (see Figure 111)

where

– α is the angle of the end of the **guard** on the side of the operator measured from the axis of the **shaft** (see Figure 111); and

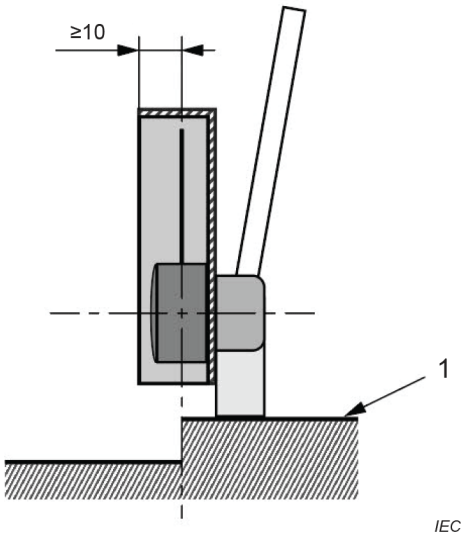
– β is the angle of the end of the **guard** away from the operator measured from the axis of the **shaft** (see Figure 111).

For **lawn edge trimmers**, irrespective of the angle of the axis of the **shaft**, θ, where the axis of the **shaft** is not straight or does not intersect the axis of rotation for the **cutting means**, the angles α, β, and θ shall be measured using an axis created from the centre of rotation of the **cutting means** to the nearest point of the **power switch**.

The guarding requirements above may be fulfilled by a combination of elements such as support wheels, debris deflectors and the like.

Compliance is checked by inspection and by measurement in all normal positions of use in accordance with 8.14.2 b) 106).

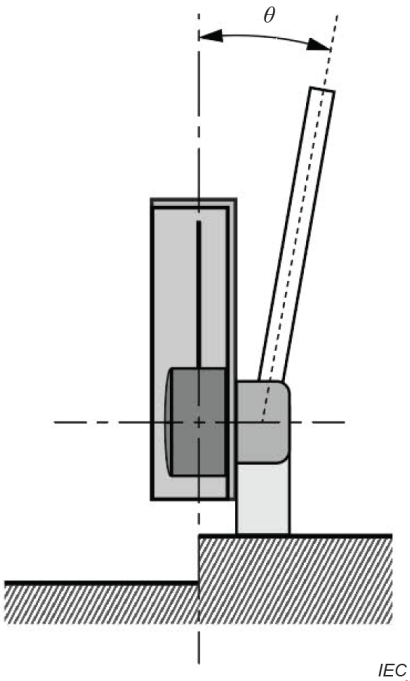
Dimensions in millimetres



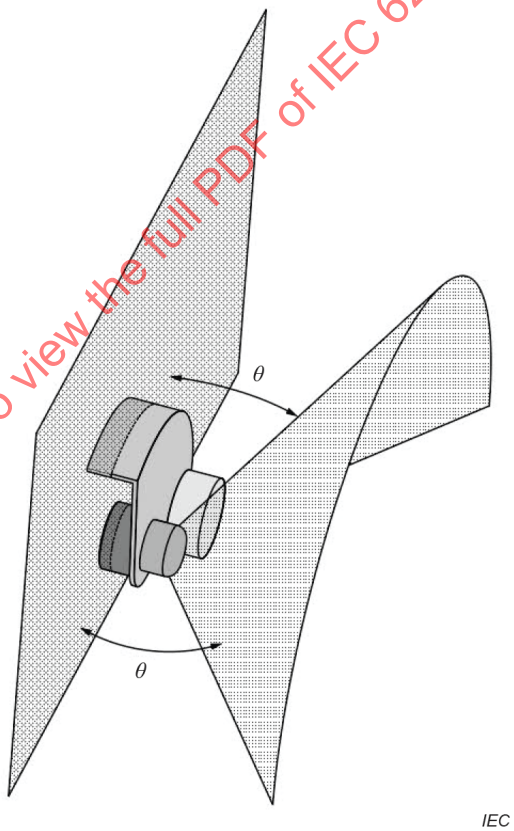
Key

1 representation of the ground in **normal use**

Figure 108 – Cross-sectional view of lawn edge trimmer cutting means guard



a) Front view



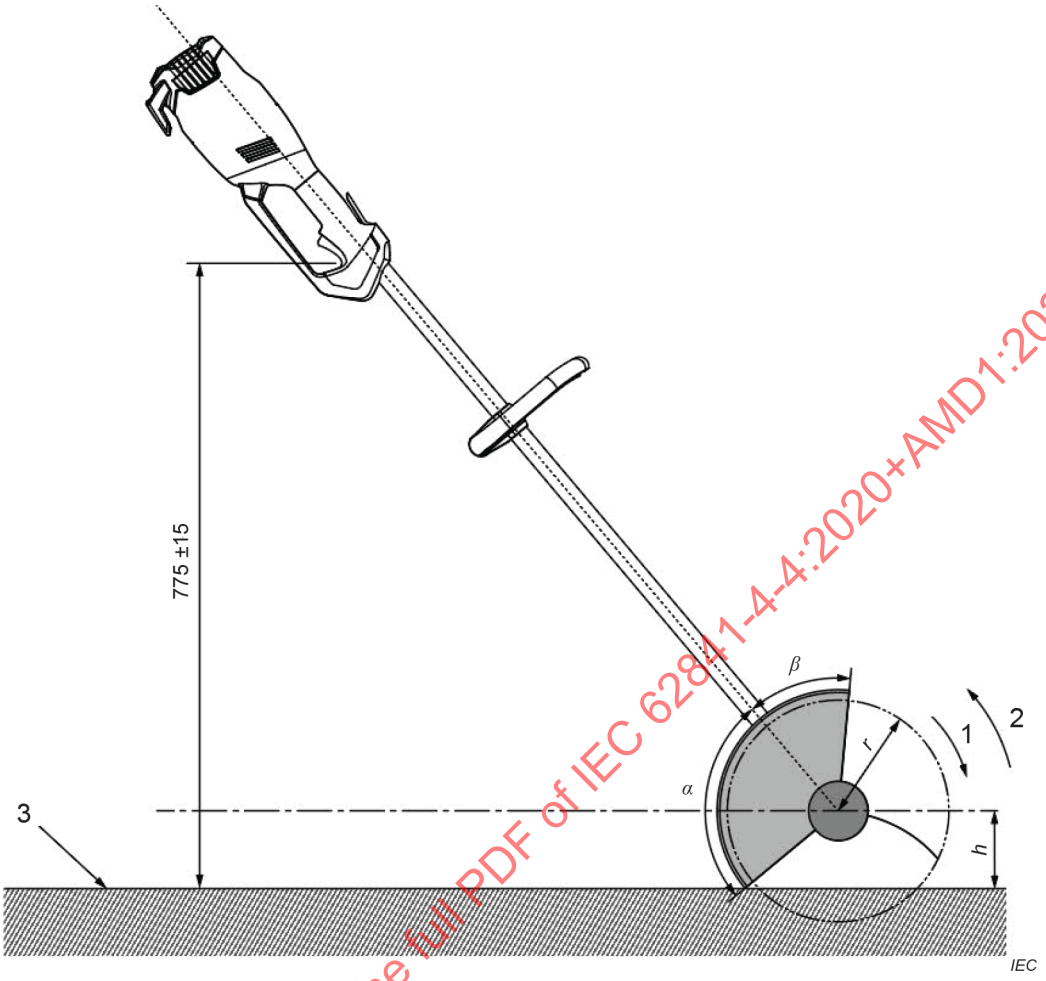
b) Isometric view

Key

θ angle of the axis of the **shaft** to the plane of the **cutting means**

Figure 109 – Shaft angle measurement

Dimensions in millimetres



Key

1 direction of rotation of **cutting means**

2 direction of rotation of **cutting means**

3 representation of the ground in **normal use**

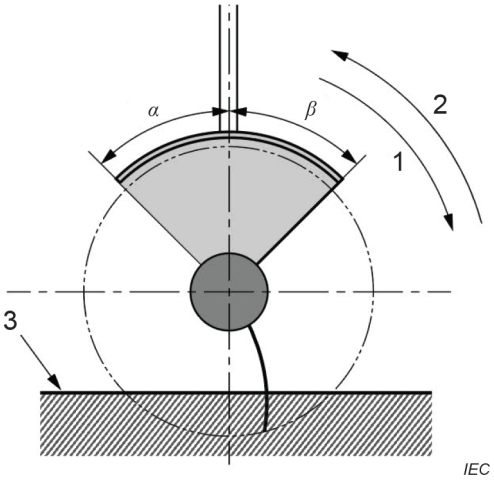
α angle of the end of the **guard** on the side of the operator measured from the axis of the **shaft**

β angle of the end of the **guard** away from the operator measured from the axis of the **shaft**

h distance measured from the ground to the centre of the **cutting means**

r radius of the circle formed by the **cutting means**

Figure 110 – Lawn edge trimmer guarding when *θ* < 45°



Key

1 direction of rotation of **cutting means**

2 direction of rotation of **cutting means**

3 representation of the ground in **normal use**

α angle of the end of the **guard** on the side of the operator measured from the axis of the **shaft**

β angle of the end of the **guard** away from the operator measured from the axis of the **shaft**

Figure 111 – Lawn edge trimmer guarding when $\theta \geq 45°$

19.101.3 Grass trimmers, brush cutters and brush saws

Grass trimmers, **brush cutters** and **brush saws** shall be provided with a **guard**, to protect the user against unintentional contact with the **cutting means** or **cutting accessory**, as applicable, and from thrown objects.

The **guard** shall comply with ISO 7918:1995.

Compliance is checked by inspection and by measurement.

19.101.4 Guard requirements

The **guards** specified in 19.101.1 and 19.101.2 shall be

– imperforate in the area of the **guard** beyond 80 % of the radius of the largest **cutting means** that can be used with the **guard** in accordance with 8.14.2 a); and

– permanently attached or secured to prevent removal without the aid of a tool, by means such as screws, nuts or snap fits.

The **guard** specified in 19.101.3 shall be permanently attached or secured to prevent removal without the aid of a tool, by means such as screws, nuts or snap fits.

Compliance is checked by inspection and by measurement.

19.102 Handles

19.102.1 General

The handle(s) specified in 19.102.1.1 and 19.102.1.2 shall be designed in such a way that each one can be grasped with one hand and while wearing gloves. Handles shall be suitably shaped to be grasped securely and have a perimeter *P* between 65 mm and 170 mm as illustrated in Figure 112 a), Figure 112 b) and Figure 112 c). The perimeter is determined by a

chain measurement with the **power switch**, if any, fully depressed. The gripping length *L* of the handle shall be at least 100 mm.

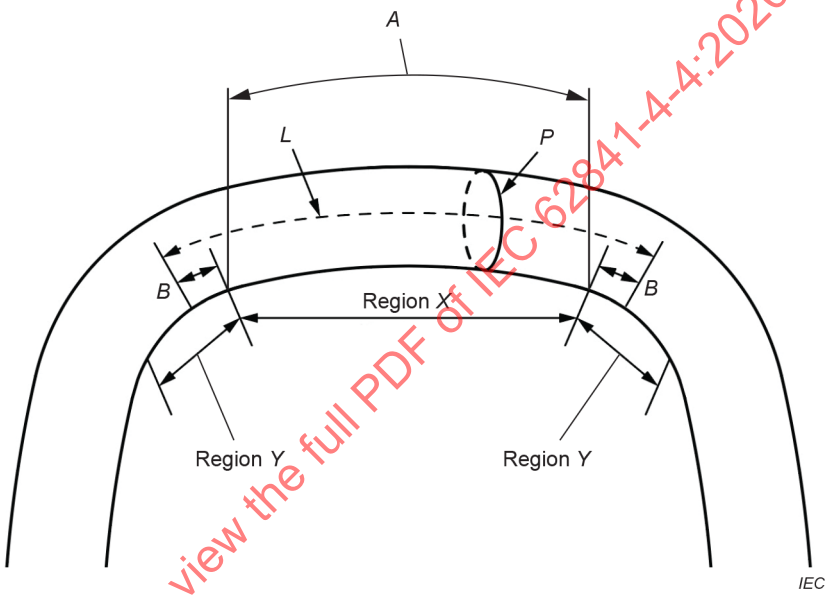
A **shaft** or a part containing the motor may be considered a handle, provided it

– complies with the dimensions for a handle specified in 19.102.1.1 and 19.102.1.2; and
– is identified as a handle in accordance with 8.14.2 b) 6) of Part 1.

If applicable, the part of the handle containing the **power switch** shall be counted as part of the handle gripping length.

If there are finger grips or similar superimposed profiles, the handle gripping length shall not be measured along the surface, but only the arc or straight line distance of the gripping surface, as applicable, shall be taken into account.

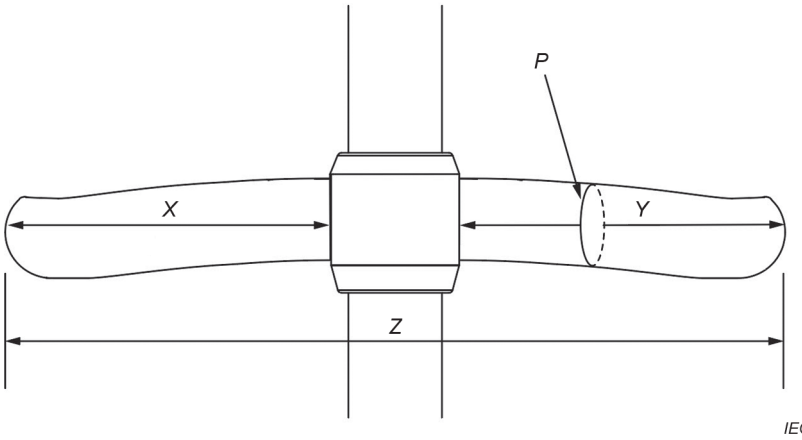
Compliance is checked by inspection and by measurement.



Key

A gripping length in region *X*
B transition radius length in region *Y*
L gripping length
P perimeter

a) Gripping length of a bail or closed handle



Key

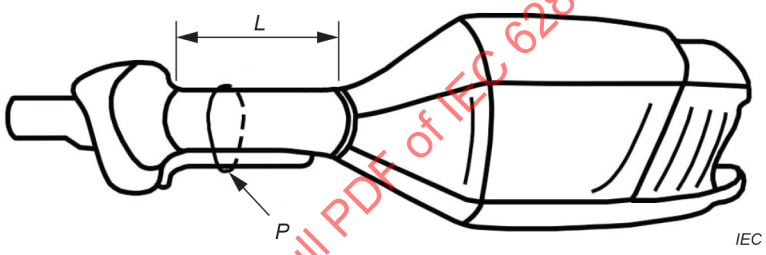
P perimeter of handle (not including the support)

X part of gripping length

Y part of gripping length

Z complete length

b) Gripping length of a handle supported centrally (i.e. T-type)



Key

L maximum gripping length

P perimeter

c) Determination of gripping length and perimeter dimension of a handle formed by the shaft

Figure 112 – Measurement of handle gripping length

19.102.1.1 Lawn trimmers and lawn edge trimmers

Hand-held trimmers and **walk-behind trimmers** shall have at least one handle.

All **hand-held 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 with the handles positioned in accordance with 8.14.2 b) 109).

This measurement of 250 mm does not apply to two handled **hand-held trimmers** with a mass of 3,5 kg or less.

Compliance is checked by inspection and by measurement.

19.102.1.2 Grass trimmers, brush cutters and brush saws

Grass trimmers, **brush cutters** and **brush saws** shall be provided with at least two handles to provide safe control.

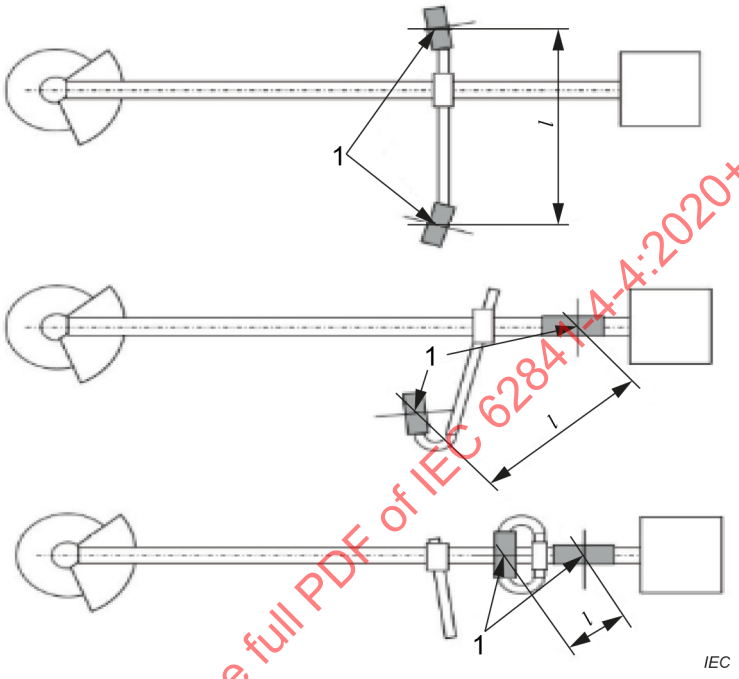
The distance *l* between the centre of the handles (see Figure 113) shall be at least

– 250 mm for **grass trimmers** and **brush cutters**; and

– 500 mm for **brush saws**.

The handles of **grass trimmers**, **brush cutters** and **brush saws** shall be adjustable so that a suitable ergonomic working position can be achieved. An adjustment below the minimum distance *l* shall be prevented by design or the machine shall be marked in accordance with 8.3.102.

Compliance is checked by inspection, by measurement and by test.



Key

1 centre of the handle

l distance between handles

Figure 113 – Measurement of distance between handles for grass trimmers, brush cutters and brush saws

19.102.2 Dimensions of bail or closed handles

On bail or closed handles, the gripping length is related to the inner width of the gripping surface. There shall be a minimum radial clearance of 25 mm around the gripping length.

If a bail or closed handle is used, the gripping length *L* in Figure 112 a) shall be measured using lengths *A* and *B* as follows:

– the length *A* is measured within region *X* where the radius is at least 100 mm;

– the length(s) *B* are measured within region(s) *Y* where the transition radius is less than 100 mm, but each length *B* cannot exceed 10 mm in each region Y of the gripping surface.

NOTE 101 Bail or closed handles are also known as U-shaped handles.

Compliance is checked by inspection and by measurement.

19.102.3 Dimensions of handles supported centrally (T–type)

If a handle is supported centrally (i.e. T-type), there shall be a minimum radial clearance of 25 mm around the gripping length. The gripping length shall be calculated as follows (see Figure 112 b)):

– for handles with a perimeter *P* (not including the support) of less than 80 mm, the gripping length is the sum of the two parts of the gripping length *X* + *Y* on either side of the support;

– for handles with a perimeter *P* (not including the support) of 80 mm or more, the gripping length is the complete length *Z* from end to end.

Compliance is checked by inspection and by measurement.

19.103 Barrier and distance to cutting accessory

Brush cutters and **brush saws** shall be equipped with a **barrier**, located on the same side as the operator position (i.e. on the left side of the machine), to prevent an unintentional contact with the **cutting accessory** during operation. This function can also be performed by the handle assembly. See Figure 114.

The straight line distance

– from a point on the rear of the **barrier** 200 mm perpendicular to the centreline of the **shaft** (2)

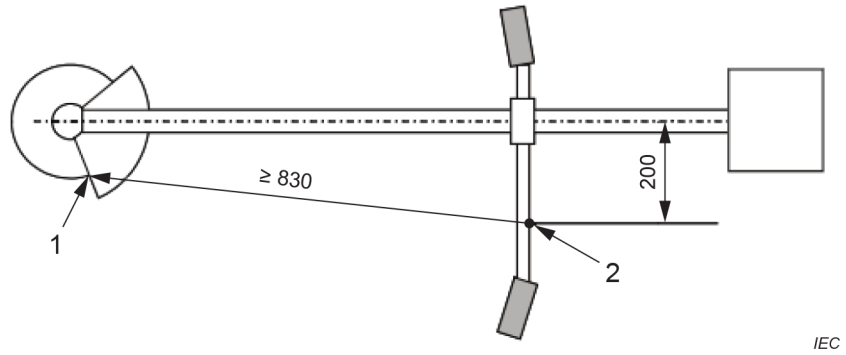
– to the nearest unguarded point of the **cutting accessory** (1)

shall be at least 830 mm. The point (1) on the **cutting accessory** may or may not be located on the edge of the **cutting accessory**, depending on the geometry of the **cutting accessory guard**. See Figure 114.

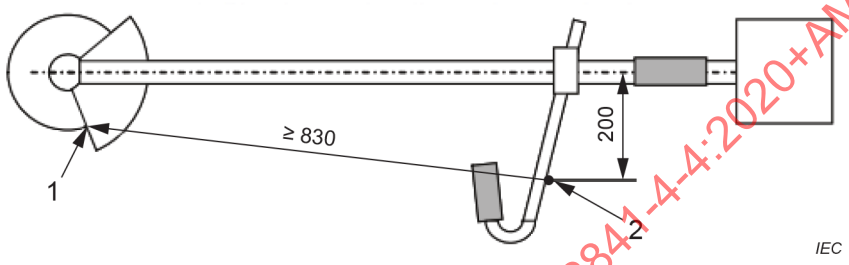
Barriers that are independent of the handle assembly and are removable, in accordance with 8.14.2, shall be fixed by systems that can be opened or removed only with the aid of a tool. The fastenings for **barriers** which are independent of the handle assembly shall remain attached to the **barrier** and/or the machine when the **barrier** is removed.

Compliance is checked by inspection and by measurement.

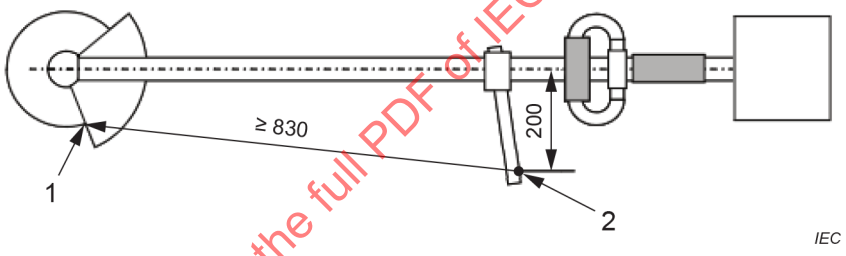
Dimensions in millimetres



a) Bicycle-type handle serving as a barrier



b) Front and rear handles with front handle serving as a barrier



c) Front and rear handle with separate barrier

Key

1 unguarded point of the **cutting accessory**

2 rear of the handle bar/**barrier**

Figure 114 – Examples of brush cutters and brush saws with different handle and barrier configurations: Measurement of distance to cutting accessory

19.104 Thrown objects test

For **grass trimmers**, **brush cutters** and **brush saws**, the **cutting means guard** and the **cutting accessory guard** shall be designed and constructed in such a way as to minimize the risk of injury from thrown objects in **normal use**.

Compliance is checked by the test of Annex BB.

No more than three penetrations in the target zone are allowed. If more than three penetrations occur, the test has to be repeated five times with no more than three penetrations in each of these tests.

*No cracks or breakages of the **guard** are allowed.*

19.105 Telescopic shafts

19.105.1 All machines equipped with telescopic **shafts** shall be provided with end stops that prevent the telescopic **shafts** from becoming separated or damaged.

Compliance is checked by the following test.

*The **shaft** is adjusted to its maximum possible length whilst overriding any locking mechanism or detent, if possible. One end of the **shaft** is fixed and a tensile force of (210 ± 10) N is applied to the other end for 1 min.*

After the test, parts of the machine shall not have separated or be permanently deformed and the machine shall comply with the acceptance criteria of 20.1.

*The **shaft** is then adjusted to its shortest possible length whilst overriding any locking mechanism or detent, if possible. A compressive force of (210 ± 10) N is applied instead of the tensile force for 1 min.*

After the test, the machine shall comply with the acceptance criteria of 20.1 and shall not have separated or permanently deformed to a degree that the mechanical safety of the machine as required by this standard is impaired as a result of the applied force.

19.105.2 **Brush cutters** and **brush saws** equipped with telescopic **shafts** shall be provided with locking detents that, when engaged, prevent

– relative movement or rotation of the **shaft** elements; and
– **shaft** elements and other parts from becoming separated or damaged.

Compliance is checked by the following test.

*The **shaft** length is adjusted to its maximum locking detent length in accordance with 8.14.2 b). One end of the **shaft** is fixed, while the other end is subjected, in turn, to the following:*

– *a tensile force of (210 ± 10) N for 1 min;*
– *a compressive force of (210 ± 10) N for 1 min; and*
– *a torque of (6 ± 1) Nm in both directions.*

During the test, there shall be no

– *relative linear movement of **shaft** elements exceeding 10 mm;*
– *relative rotation of **shaft** elements exceeding 5°.*

*The test is then repeated for all other **shaft** locking detent lengths in accordance with 8.14.2 b).*

19.105.3 **Brush cutters** and **brush saws** equipped with telescopic **shafts** shall be so designed that the drive to the **cutting accessory** is possible only when the **shaft** is adjusted to a configuration that fulfils the dimensional requirements of 19.103.

Compliance is checked by inspection, by measurement and by functional test.

19.106 Grass catcher and guards

If a **lawn trimmer** or **lawn edge trimmer** is fitted with a grass catcher in accordance with 8.14.2, it shall be designed so that either

– the requirements of 19.101 are fulfilled after removal of the grass catcher; or

– the machine is provided with a means that de-energizes the **cutting means** after removal of the grass catcher.

NOTE 101 An example of a **lawn trimmer** with a grass catcher is shown in Figure 106.

Compliance is checked by inspection.

20 Mechanical strength

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

20.1 *Replacement:*

Machines shall have adequate mechanical strength, and shall be so constructed that they withstand rough handling that may be expected.

Compliance is checked by the tests specified in 20.2, 20.3 and 20.4.

*Immediately after the tests, the machine shall withstand the electric strength test as specified in Annex D between **live parts** and **accessible parts**, and **live parts** shall not have become accessible, as specified in Clause 9.*

*Damage to the finish, small dents and cracks which do not reduce **creepage distances** or **clearances** below the values specified in 28.1, or small chips which do not adversely affect protection against shock or moisture are neglected. Damage to the **cutting means**, **cutting means guard**, **cutting head**, **cutting accessory** or **cutting accessory guard**, as applicable, during the test of 20.3.1 are ignored.*

NOTE The strength and rigidity of the **cutting means guard** and the **cutting head** are covered in 20.101. The strength and rigidity of the **cutting accessory guard** and the **cutting accessories** are covered in 20.102.

The mechanical safety of the machine as required by this standard shall not be impaired.

If a decorative cover is backed by an inner cover, a fracture of the decorative cover is neglected when the inner cover withstands the test after removal of the decorative cover.

20.3 *Replacement:*

*For **hand-held trimmers**, **grass trimmers**, **brush cutters** and **brush saws**, 20.3.1 applies.*

*For **walk-behind trimmers**, 20.3.2 applies.*

*Compliance of **cutting means guards** is checked by the tests of 20.101 and the compliance of **cutting heads** is checked by the tests of 20.102.*

20.3.1 *Replacement:*

*Machines, except for **walk-behind trimmers**, are dropped three times in total on a concrete surface from a height of 1 m.*

*The machine is configured for use according to 8.14.2 a), fitted with the **cutting head** or **cutting accessory** and placed on the concrete surface in a stable resting position.*

For the first drop, the machine is lifted vertically by 1 m and allowed to drop onto the concrete surface.

For the second drop:

– *the machine is placed on the concrete surface as in the first test;*
– *the machine is lifted vertically by 1 m; then*
– *the machine is rotated about its longitudinal axis approximately 90° in the most unfavourable direction prior to dropping onto the concrete surface.*

For the third drop:

– *the machine is placed on the concrete surface as in the first test;*
– *the machine is lifted vertically by 1 m; then*
– *the machine is rotated about its longitudinal axis approximately 180° prior to dropping onto the concrete surface.*

Secondary impacts shall be avoided.

NOTE A method for avoiding secondary impacts is tethering.

For machines with handles having a storage configuration in accordance with 8.14.2 b) 109), the three drops are repeated on a separate sample with the handle adjusted to the storage configuration.

Each drop shall be conducted on a separate sample, unless a single sample can be subjected to multiple drops without failure. If a sample has been subjected to multiple drops and fails, then the drop in the orientation that resulted in the failure is repeated using a new sample. If the new sample passes the test for the drop in that orientation, then the requirements for the drop in that orientation are considered to be fulfilled. The test is continued in this manner until all drops in each of the three orientations are completed.

20.5 *Addition:*

This subclause of Part 1 is not applicable for **lawn trimmers**, **lawn edge trimmers** and **grass trimmers** that cannot be converted to a **brush cutter** or **brush saw** in accordance with 8.14.2 a) 104).

This subclause of Part 1 is applicable for **grass trimmers** that can be converted to a **brush cutter** or **brush saw** in accordance with 8.14.2 a) 104), **brush cutters** and **brush saws**, except as follows:

NOTE 101 Requirements for handle insulation on **grass trimmers** that can be converted to a **brush cutter** or **brush saw** in accordance with 8.14.2 a) 104), **brush cutters** and **brush saws** are covered in 21.30.

For **grass trimmers**, **brush cutters** and **brush saws**, if a pliable insulation material is used

– to cover a tubular shaped metal handle, and
– is relied upon to fulfil the requirements of this subclause,

it shall be suitable for temperatures foreseen in **normal use** and shall have adequate mechanical strength in order to provide insulation between the grasping area and the **cutting device**. This requirement is not applicable for metal handles that are isolated by insulating barrier(s) from accessible metal parts that can become live by the **cutting device** in accordance with 21.30.

NOTE 102 Examples of pliable insulation material include foam, heat shrink and elastomeric tubing.

NOTE 103 Examples of a tubular shaped metal handle include those with a round, oval or square cross section.

Compliance is checked by the following test:

A separate sample of the covered part shall be conditioned for 168 h at a temperature of

– *(25 ± 2) K higher than the maximum temperature measured during the test of Clause 12; or*

– *(70 ± 2) °C*;

whichever is higher.

After conditioning, the sample shall be allowed to attain approximately ambient temperature.

The insulating covering shall not

– *have peeled off;*

– *be able to move longitudinally; or*

– *have shrunk to such an extent that the required insulation is not given.*

After this, the sample shall be maintained for 4 h at a temperature of (−10 ± 2) °C and then immediately subjected to an impact applied by means of an apparatus (see Figure 115) with a weight "A" having a mass of 300 g and falling from a height of 350 mm on to a chisel "B" of hardened steel, the edge of which is placed on the sample. One impact shall be applied to each place where the covering is likely to be weak or damaged. The distance between the impact points shall be at least 10 mm.

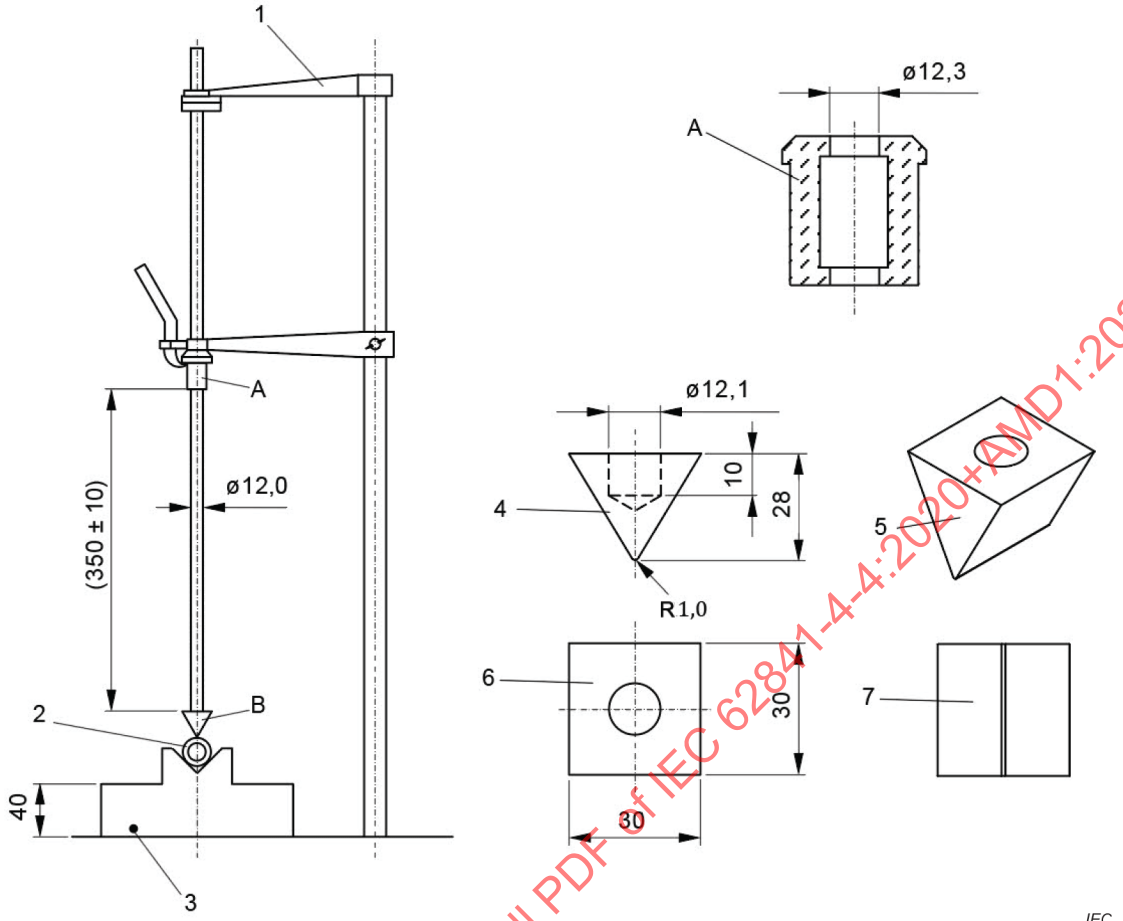
After this, an electric strength test is carried out according to Clause D.2 using 1 250 V a.c. between

– *the handles and grasping surfaces in contact with foil; and*

– *the spindle of the machine and any surface within 300 mm of the spindle of the machine.*

During this test, no flashover or breakdown shall occur.

Dimensions in millimetres



Key

A weight with mass of (300 ± 5) g
B chisel made of hardened steel
1 fixing arm
2 sample
3 base having a mass of at least 10 kg
4 chisel detail
5 chisel isometric view
6 chisel plan view
7 chisel bottom view

Figure 115 – Impact test apparatus for handle insulation

20.101 Strength of lawn trimmers, lawn edge trimmers and grass trimmers

20.101.1 General

The mechanical strength of **lawn trimmers**, **lawn edge trimmers** and **grass trimmers** shall be adequate for **normal use**.

Compliance is checked by the tests given in 20.101.2 to 20.101.6.

20.101.2 Cutting means guard drop test

*The strength of the **cutting means guards** of **hand-held trimmers** and **grass trimmers** are tested by means of the following drop test.*

*One sample of the complete machine without the **supply cord** is dropped three times so that the **guard** falls through a vertical distance of (900 ± 10) mm onto a smooth horizontal concrete surface. A string may be used to suspend the machine so that the desired orientation of the machine is achieved. Cutting the string will allow the machine to fall in the correct orientation to test the **guard** of the **cutting head** (see Figure 116).*

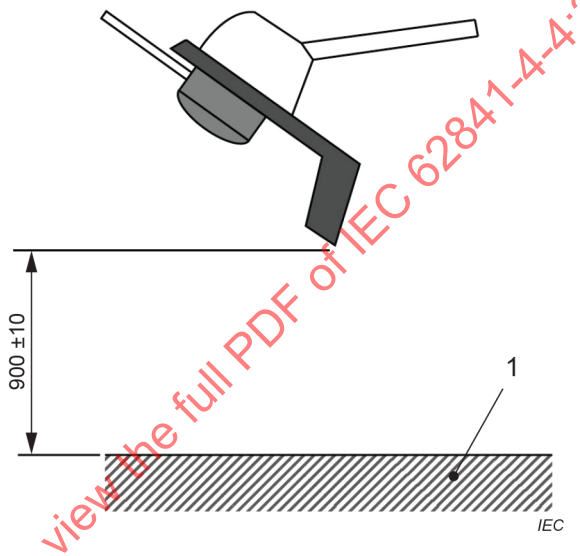
Secondary impacts shall be avoided.

NOTE A method for avoiding secondary impacts is tethering.

If the machine has a provision for fitting a grass catcher, the test is performed with the grass catcher fitted and then repeated with the grass catcher removed. Damage to the grass catcher is considered not to be a failure of this test.

*After the tests, the **guard** shall not have become detached nor shall it show any visible cracks. Screws and retaining clips shall still be secure.*

Dimensions in millimetres



Key

1 concrete surface

Figure 116 – Cutting means guard drop test

20.101.3 Cutting means guard rigidity

*For **hand-held trimmers** and **grass trimmers**, the rigidity of the **cutting means guard** is checked by applying a force, at any point, equivalent to the weight of the machine in the most unfavourable direction for 30 s.*

*During the test, the **guard** shall not have become detached, nor shall it show any visible cracks. After the test, the **guard** shall not have distorted permanently to the extent that the **guard** does not comply with this document.*

20.101.4 Strength of the cutting head

The mechanical strength of the **cutting head** on **hand-held trimmers**, **walk-behind trimmers** and **grass trimmers** shall be adequate for **normal use**.

Compliance is checked by the test given below.

*One sample of the complete machine 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 A (see Figure 117) is*

– *(900 ± 10) mm for **hand-held trimmers** and **grass trimmers**; and*

– *(250 ± 10) mm for **walk-behind trimmers**.*

*A string may be used to suspend the machine so that the desired orientation of the machine is achieved. Cutting the string will allow the machine to fall in the correct orientation to test the **cutting head** (see Figure 117).*

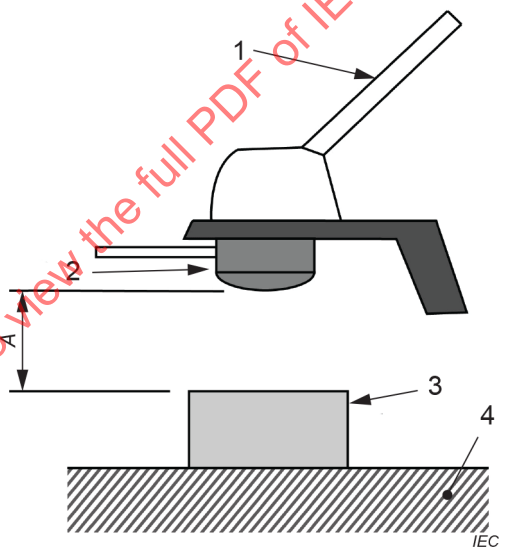
Damage to other parts during this test shall be ignored.

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

*If the machine is operable, then immediately following the test, the machine shall be run at its highest attainable speed for 30 s both with and without **cutting means**.*

*If the machine 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 machine. This new machine is then run at its **maximum speed** for 30 s both with and without **cutting means**.*

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



Key

1 **shaft**
2 **cutting head**
3 steel block
4 rigid support for steel block
A distance from **cutting head** to steel block

Figure 117 – Cutting head strength test

20.101.5 Mechanical strength of grass catchers

Grass catchers, if any, shall have adequate mechanical strength.

Compliance is checked by the test of 20.3.2.

20.101.6 Mechanical strength of non-metallic pivoting cutters

Pivoting cutters, employed as **cutting means** for **grass trimmers**, shall have adequate mechanical strength.

Compliance is checked by the following test.

NOTE 101 It is important to take proper precautions to ensure operator safety during this test.

The tests are done at an ambient temperature of (25 ± 10) °C.

*The cutters shall not break apart when the **cutting head** is impacted once against a steel rod of diameter (25 ± 1) mm according to Annex CC.*

*The same pivoting cutters shall then not break or crack when operated at **maximum speed** for 30 s.*

No part shall have broken off a pivoting cutter, reducing its total length by more than 1 mm.

20.102 Strength of brush cutters and brush saws

20.102.1 General

The mechanical strength of **brush cutters** and **brush saws** shall be adequate for **normal use**.

Compliance is checked by the tests given in 20.102.2 to 20.102.4.

20.102.2 Cutting accessory guard strength

20.102.2.1 The strength of the **cutting accessory guards** specified in accordance with 8.14.2 shall be adequate.

*Compliance is checked by the tests specified in 20.102.2.2, 20.102.2.3 and 20.102.2.4. During the test, the **cutting accessory guard** shall not break or show cracking visible with normal vision. After the test, the **cutting accessory guard** dimensions shall comply with ISO 7918:1995.*

20.102.2.2 *The **cutting accessory** is removed prior to the test. The sample is conditioned for a minimum of 4 h at a **guard** temperature of*

- *(40 ± 2) °C; and*
- *(0 ± 3) °C.*

It is not required to heat up or cool down the entire machine.

*The machine is mounted on a swivel bracket at the end of the machine furthest away from the **cutting accessory**, with the **cutting accessory guard** in its lowest suspended position (see Figure 118).*

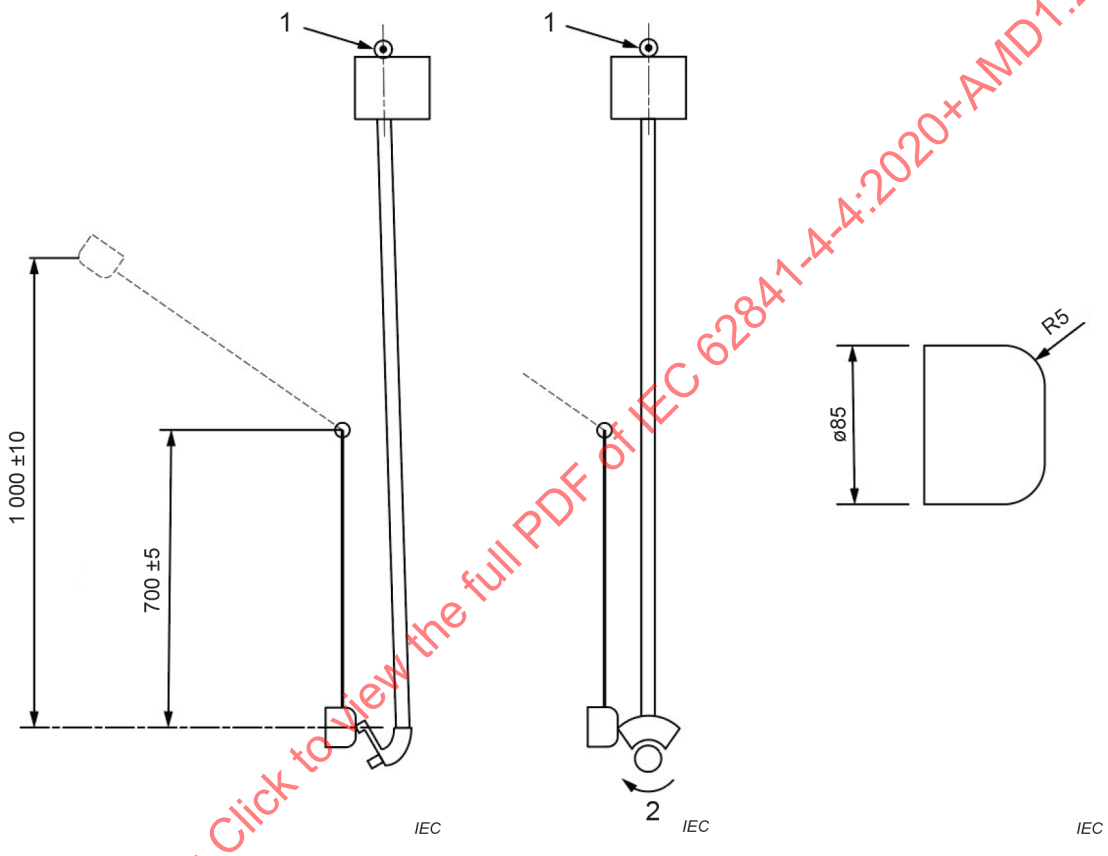
*The **cutting accessory guard** is subjected to a total of 50 blows at each temperature from a steel hammer suspended on a pendulum length of (700 ± 5) mm. The pendulum arm shall be as light as possible. The weight of the hammer shall correspond to a potential energy of the total pendulum system of (25 ± 0,5) J with the hammer raised to a height of 1 000 mm.*

20.102.2.3 *The hammer is raised to a height of (1 000 ± 10) mm above the point of impact with the **cutting accessory guard** and allowed to fall so that it strikes the **cutting accessory guard** rear edge (see Figure 118 a)). The test is conducted so that the rear edge of the*

cutting accessory guard *is subjected to a total of 25 blows conducted in succession as quickly as possible after the temperature conditioning for each temperature specified in 20.102.2.2.*

20.102.2.4 *The hammer is raised to a height of (1 000 ± 10) mm above the point of impact with the* ***cutting accessory guard*** *and allowed to fall so that it strikes the* ***cutting accessory guard*** *from the side where the* ***cutting accessory*** *rotates towards the* ***guard*** *(see Figure 118 b)). The test is conducted so that the side of the* ***cutting accessory guard*** *is subjected to a total of 25 blows conducted in succession as quickly as possible after the temperature conditioning for each temperature specified in 20.102.2.2.*

Dimensions in millimetres



a) Rear edge impact **b) Side impact** **c) Hammer**

Key

1 swivel bracket

2 direction of rotation

Figure 118 – Cutting accessory guard test

20.102.3 Cutting accessory guard rigidity

The rigidity of the ***cutting accessory guard*** *is checked by applying a force, at any point, equivalent to the weight of the machine in the most unfavourable direction for 30 s.*

During the test, the ***guard*** *shall not have become detached, nor shall it show any visible cracks. After the test, the* ***guard*** *shall not have distorted permanently and the screws and retaining clips shall still be secure.*

20.102.4 Strength of cutting accessory

The mechanical strength of the **cutting accessory** shall be adequate for **normal use**.

Compliance is checked by the following test.

NOTE 101 It is important to take proper precautions to ensure operator safety during this test.

The tests are done at an ambient temperature of (25 ± 10) °C.

*The **cutting accessory** shall not break or crack when impacted once against a steel rod of diameter (25 ± 1) mm according to Annex CC.*

*The same **cutting accessory** shall then, without any adjustments, not break or crack when operated at **maximum speed** for 5 min.*

*If the machine is not operable, this may be accomplished by assembling the **cutting accessory** to a new machine sample or to an external driving device.*

The final verification for cracks shall be done by visual inspection using normal vision.

*These requirements are applicable to all **cutting accessories** specified in accordance with 8.14.2.*

21 Construction

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

21.17.1 *Addition:*

This subclause of Part 1 is also applicable for an **operator presence sensor** whose motion is mechanically obstructed and either

– functions as a lock-off device; or
– is locked off by the lock-off device.

21.17.1.3 *Replacement of Table 7:*

Table 7 – Switch trigger force

Trigger type	Force N
Single finger trigger (trigger length < 30 mm)	100
Multi finger trigger (trigger length ≥ 30 mm)	150
Operator presence sensor	100

21.18 *Replacement:*

Requirements for **power switches** for all machines are specified in 21.18.1.

Additional requirements for **power switches** for **lawn trimmers** and **lawn edge trimmers** are specified in 21.18.1.2 or 21.18.101.

Additional requirements for **power switches** for **grass trimmers**, **brush cutters** and **brush saws** are specified in 21.18.101.

21.18.1 *Replacement:*

The **power switch** required by 21.17 shall be a **momentary power switch** without a lock-on device, which can be switched on and off by the user without the need to release any of the handle(s) identified in accordance with 8.14.2 b) 6) of Part 1.

The **cutting means** or **cutting accessory** shall operate within 1 s after actuation of the **power switch**, provided the lock-off device, if applicable, has been first actuated.

NOTE The up to 1 s delay provides an allowance for a self-checking function of electronic controls.

Compliance is checked by inspection, by measurement and by manual test.

21.18.1.1 This subclause of Part 1 is not applicable.

21.18.1.2 *Replacement:*

For **lawn trimmers** and **lawn edge trimmers**, **power switch** triggers shall be so located, designed or guarded that inadvertent operation is unlikely to occur.

It shall not be possible to start the machine when a rigid sphere with a diameter of (100 ± 1) mm is applied to the **power switch** in any direction with a single linear motion. Alternatively, the requirements of 21.18.101 shall be fulfilled.

Compliance is checked by inspection and by manual test.

21.18.2 This subclause of Part 1 is not applicable.

21.18.2.1 to **21.18.2.4** These subclauses of Part 1 are not applicable.

21.18.101 Inadvertent starting prevention

Grass trimmers, **brush cutters** and **brush saws** shall be provided with a **power switch** having a lock-off device such that at least two separate and dissimilar actions are required before drive to the **cutting means** or **cutting accessory** is possible. It shall not be possible to achieve these actions with a single grasping motion or a straight line motion within any grasping surface identified in accordance with 8.14.2 a).

Drive to the **cutting means** or **cutting accessory** shall only be enabled when the lock-off device is operated prior to the **power switch**.

It shall not be necessary to sustain the actuation of the lock-off device until the **power switch** is activated, provided:

– the **power switch** or an **operator presence sensor** (if any) is activated within 5 s of the release of the lock-off device; and
– there is a visual or audible indication as soon as the lock-off actuator is released and continues at least until the **power switch** or **operator presence sensor** (if any) is activated;

or

– an **operator presence sensor** (if any) is activated prior to the release of the actuator of the lock-off device.

NOTE 101 The visual or audible indication is intended to only indicate the state of the machine.

After the **power switch** is released, the machine shall return to the original locked state (i.e. at least two separate and dissimilar actions are required before drive to the **cutting means** or **cutting accessory** is possible)

– within 5 s; or
– no later than when the **cutting means** or **cutting accessory** has come to a complete stop,

whichever is longer, unless

– an **operator presence sensor** is provided; and
– the hand is not released from the **operator presence sensor**.

Compliance is checked by inspection, by measurement and by manual test.

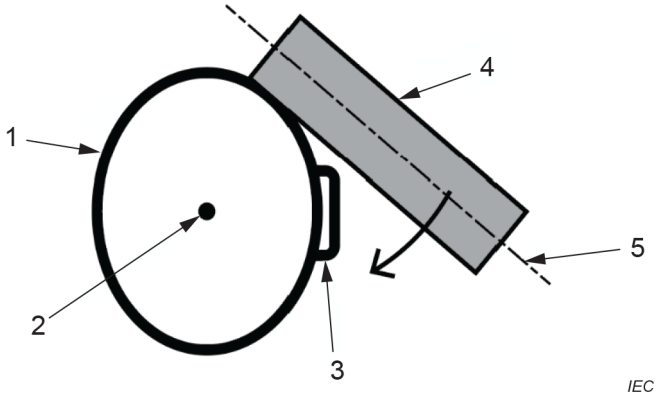
*Additionally, for lock-off devices that are actuated in a direction generally perpendicular to the surrounding surface of the machine, (see Figure 119), and that are located within any gripping surface of handle(s) or grasping surface(s) identified in accordance with 8.14.2 b) 6) of Part 1, to determine if it is possible to actuate the locked-off control (i.e. the **power switch** or the **operator presence sensor**, as applicable) and the lock-off device with a single grasping motion or a straight line motion, compliance is checked by the following test:*

*With the **power switch** or the **operator presence sensor**, as applicable, in the "off" position, the lock-off device shall not be actuated by the cylindrical face of a 25 mm diameter × 75 mm long steel rod when applied with a force not exceeding 20 N. The axis of the rod is applied perpendicular to the axis of the handle and is:*

– *first rotated around the handle, see Figure 122, and*
– *then applied in the direction perpendicular to the handle axis, see Figure 123,*

while bridging the handle surface and surface of the lock-off device and any surface adjacent to the lock-off device. When applying the steel rod, the circular end faces and edges shall not be used for probing.

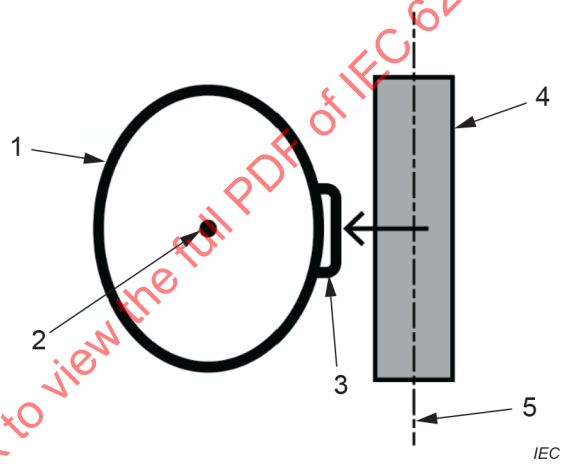
During the test, it shall not be possible to actuate the locked-off control by applying a force as specified in Table 7.



Key

1 **handle**
2 **handle axis**
3 lock-off device
4 steel rod
5 steel rod axis

Figure 122 – Application of steel rod when rotated around the handle



Key

1 **handle**
2 **handle axis**
3 lock-off device
4 steel rod
5 steel rod axis

Figure 123 – Application of steel rod when applied in the direction perpendicular to the handle axis

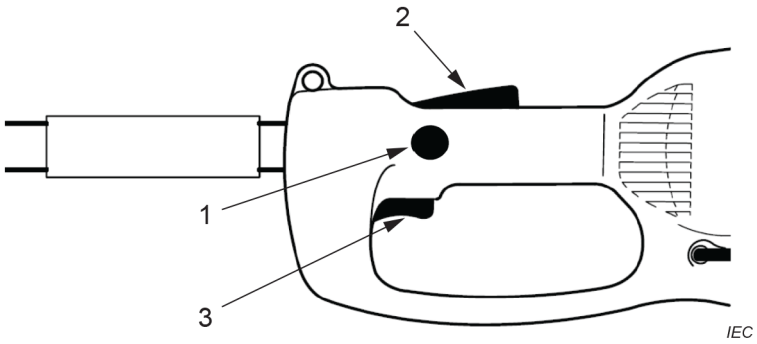
21.18.102 Operator presence sensor

The **operator presence sensor,** if any, shall be incorporated in the handle or grasping surface associated with the **power switch**.

The function of the **operator presence sensor** may be achieved by one or any combination of mechanical, electrical or electronic means.

NOTE 101 An example of an **operator presence sensor** is shown in Figure 119.

Compliance is checked by inspection.



Key

1 lock-off device

2 **operator presence sensor**

3 **power switch**

Figure 119 – Example of an operator presence sensor

21.18.103 Reverse rotation selector

If the machine is provided with a reverse rotation selector, it shall permit reverse rotation of the **cutting means** or **cutting accessory** at a rotational speed

– no greater than 30 % of the **maximum speed** in the primary rotation direction; or

– up to **maximum speed**, provided the machine when operating in the reverse rotation direction, fulfils all of the requirements of this standard.

Compliance is checked by inspection, by measurement and by relevant tests.

21.30 *Replacement:*

For **grass trimmers** that can be converted to a **brush cutter** or **brush saw** in accordance with 8.14.2 a) 104), **brush cutter** and **brush saw**, handles, as specified in the instruction manual in accordance with 8.14.2 b) 6) of Part 1, shall be formed of insulating material or, when of metal, shall be either adequately covered by insulating material or their **accessible parts** shall be separated by insulating barrier(s) from metal parts that can become live by the spindle or any surface within 300 mm of the spindle.

Compliance is checked by inspection and by the tests of 20.5.

21.35 This subclause of Part 1 is not applicable.

21.101 Lawn trimmer and lawn edge trimmer cutting elements

For **lawn trimmers** and **lawn edge trimmers**, the **cutting means** shall consist of one or more non-metallic **cutting elements** mounted on or emerging from a **cutting head**.

Compliance is checked by inspection and by functional test.

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

– a non-metallic filament line; or

– a non-metallic freely pivoting cutter.

Machines 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 incorporate a means to automatically limit the filament line to its correct operating length after the line has been extended and/or the machine is operated.

Compliance is checked by inspection.

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

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

$$kinetic\ energy = ½\ mv^2$$

where

m is the mass of the length *L* of the conditioned **cutting element**, in kilograms (see Figure 120), where **cutting elements** of hygroscopic material are stored for at least seven days in a humidity cabinet under the same conditions as those required for the test of 14.1 before carrying out the test and measurement;

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

Therefore: $v = 0{,}104\ 7\ n\ (r - (L/2))$

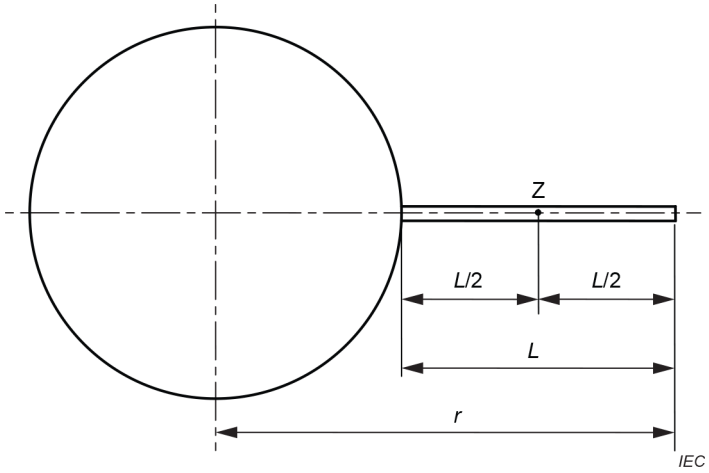
where

n is the **maximum speed** of the machine, in revolutions per minute;

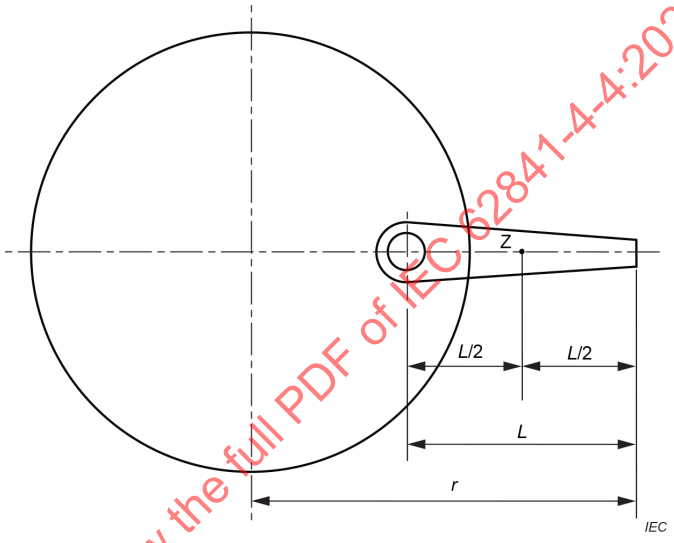
r is the distance from the axis of rotation of the **cutting head** to the outer tip of the **cutting means**, in metres;

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

Compliance is checked by measurement and by calculation.



a) Filament line



b) Pivoting cutter

Key

L length of the **cutting element**

r distance from the axis of rotation of the **cutting head** to the outer tip of the **cutting means**

Z point which is half-way along the length *L* of the **cutting element**

Figure 120 – Lawn trimmer and lawn edge trimmer cutting means measurement

21.102 Lawn trimmer, lawn edge trimmer and grass trimmer distances to guard

For **lawn trimmers** and **lawn edge trimmers**, the minimum distance from the **guard** specified in 19.101 to the nearest point of the **power switch** shall be at least 600 mm with the handle adjusted to its shortest operating position in accordance with 8.14.2 b) 109).

NOTE 101 Minimum distance requirements for **lawn trimmers** with a **guard** in accordance with Figure 107 c) are specified in 19.101.1.4.

For **grass trimmers**, the minimum distance from the **guard** specified in 19.101 to the nearest point of the **power switch** shall be at least 750 mm with the handle adjusted to its shortest operating position in accordance with 8.14.2 b) 109).

Compliance is checked by measurement.

21.103 Lawn edge trimmer cutting head ground contact

Lawn edge trimmers shall be designed so as to prevent contact of the **cutting head** with the ground during **normal use**. This may be fulfilled by the design of the **guard** specified in 19.101.2.

Compliance is checked by the following test.

*A **lawn edge trimmer** with its **cutting means** removed is placed on a flat level surface such that the plane of the **cutting means** is perpendicular to the surface. With the machine in any operating configuration in accordance with 8.14.2 b), there shall be no contact between the **cutting head** and the surface.*

21.104 Cutting head and cutting accessory retention

Machines shall be provided with a means for securing the **cutting head** and **cutting accessory** to prevent loosening during use.

For machines not provided with a reverse rotation selector, the **cutting head** or **cutting accessory** may be retained by a thread that is self-tightened by the driving torque of the spindle.

For machines that are provided with a reverse rotation selector, the retention system shall not allow relative motion exceeding 15° of the **cutting head** or **cutting accessory** and its retainer in either direction upon application of a torque applied to the **cutting head** or **cutting accessory**.

*Compliance is checked by inspection and by the following test for all **cutting heads** and **cutting accessories**, except for those that are only retained by a thread that is self-tightened by the driving torque of the spindle:*

*a) The **cutting head** or **cutting accessory** is installed in accordance with 8.14.2.*

b) The spindle of the machine is locked.

*c) A torque of 5 Nm is applied for 5 s to the **cutting head** or a torque of 15 Nm is applied for 5 s to the **cutting accessory**, as applicable.*

The test is conducted five times in each direction of rotation.

21.105 Grass trimmer cutting means

21.105.1 The **cutting means** of **grass trimmers** 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.

21.105.2 A **cutting element** shall consist of one of the following:

– a non-metallic filament line; or

– a non-metallic freely pivoting cutter.

Grass trimmers using one or more flexible **cutting elements** of continuous filament line (e.g. wound on a spool contained either in the **cutting head** or other **attachment**) shall incorporate a means to automatically limit the filament line to its correct length after the line has been extended and/or the machine is operated.

Compliance is checked by inspection and by functional test.

21.106 Shoulder harness

Walk-behind trimmers do not require a harness to be provided.

Hand-held trimmers and **grass trimmers**, having a mass below 7 kg, do not require a harness to be provided.

Hand-held trimmers and **grass trimmers** having a mass of 7,0 kg to 8,5 kg shall at least be provided with a single shoulder harness.

Brush cutters having a mass of 8,5 kg or less shall at least be provided with a single shoulder harness.

Hand-held trimmers, grass trimmers and **brush cutters** having a mass exceeding 8,5 kg shall be provided with a double shoulder harness and a hip pad. The hip pad shall be made of flexible material and designed to be attached to either the machine or the harness, in order to cushion the operator from impacts caused by the machine and to reduce the transmission of vibrations.

All **brush saws** shall be provided with a double shoulder harness and a hip pad. The hip pad shall be made of flexible material and designed to be attached to either the machine or the harness, in order to cushion the operator from impacts caused by the machine and to reduce the transmission of vibrations.

Any shoulder harness provided with the machine shall be adjustable to the size of the operator and its operation shall be in accordance with 8.14.2 b) 110) and shall be

– designed in a way for easy removal; or
– equipped with a quick release mechanism that ensures that the machine can be removed or released quickly from the operator.

A quick release mechanism, if provided, shall be positioned either at the connection between the machine and harness or between the harness and operator. The quick release mechanism shall only allow separation by deliberate action of the operator.

If a quick release mechanism is provided, it shall be possible to open it while under the weight of the machine. It shall require the use of only one hand and have no more than two release points.

NOTE 101 An example of a release point is a buckle that requires squeezing between a thumb and finger before releasing, e.g. side release buckles.

NOTE 102 Examples of shoulder harnesses that are designed in a way for easy removal include

– a single shoulder harness; or
– a double shoulder harness where the left and right shoulder straps are not connected to each other in front of the operator's body; or
– a double shoulder harness with a strap(s) connecting the left and right shoulder straps that can be released under the load of the machine by using one hand and has no more than two release points.

Compliance is checked by inspection, by measurement and by functional test using the heaviest machine configuration as identified in 8.14.2.

21.107 Balance

21.107.1 Machines intended to be used with a harness in accordance with 8.14.2 b) 110), except for machines as specified in 21.107.2, shall be provided with at least one suspension point for attaching the harness. The suspension point(s) shall be designed such that the machine is balanced when it is suspended.

Compliance is checked by inspection, by measurement and by the following test, with the lightest and heaviest machine configurations in accordance with 8.14.2. If the machine is provided with more than one suspension point or if the suspension point is adjustable, the most favourable suspension point or position is selected for each test.

*For machines provided with an appliance inlet or a **supply cord** with a length between 0,2 m and 0,5 m, a mass of (300 ± 20) g is suspended from either*

– *the appliance inlet; or*
– *the **supply cord** plug; or*
– *any **supply cord** retaining device in accordance with 8.14.2,*

whichever is the most unfavourable.

*For machines provided with a **supply cord** with a length not less than 6 m, the **supply cord** is placed resting on the ground.*

The suspension point is positioned at a vertical distance of (775 ± 25) mm above the ground, the machine is suspended from this point and the following dimensional requirements shall be fulfilled:

– *for **hand-held trimmers** and **grass trimmers**: a distance from the ground to the nearest point of the **cutting means** or **cutting accessory** shall be (150 ± 150) mm; and*
– *for **brush cutters** and **brush saws**: a distance from the ground to the nearest point of the **cutting accessory** shall be (200 ± 100) mm.*

21.107.2 Grass trimmers, **brush cutters** and **brush saws** intended to be used with a harness in accordance with 8.14.2 b) 110), and designed to be supported by the ground shall be provided with at least one suspension point to which the harness is attached, so the ground contact force is not greater than 20 N.

*Compliance is checked by inspection, by measurement and by the following test with the lightest and heaviest **cutting means** or **cutting accessories** specified in accordance with 8.14.2.*

A mass of (300 ± 20) g is suspended from either

– *the appliance inlet; or*
– *the **supply cord** plug; or*
– *any **supply cord** retaining device in accordance with 8.14.2,*

whichever is the most unfavourable.

If the machine is provided with more than one suspension point or if the suspension point is adjustable, the most favourable suspension point or position is selected for each test.

The force applied to the ground by the machine is measured.

21.108 Cutting accessory cover

Machines with a metallic **cutting accessory** shall be provided with a cover, which shall be so designed that it remains attached to the **cutting accessory** during transport and storage.

Compliance is checked by inspection.

22 Internal wiring

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

22.6 *Addition:*

For machines without rotation limiting end stops, the rotatable parts of the machine are subjected to 2 000 continuous rotations in each direction with any intermediate locking detents disabled.

For machines with rotation limiting end stops, the rotatable parts of the machine are subjected to 2 000 cycles stop to stop, with any intermediate locking detents disabled.

For machines with rotation limiting end stops, after the 2 000 cycles are completed, each end stop shall be subjected to a gradually applied torque of 6 Nm for 1 min. The end stop shall not allow the rotating element to go beyond the limits of its intended travel.

NOTE 101 Intermediate locking detents are not considered to be rotation limiting end stops.

23 Components

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

23.1.10.1 *Replacement of the sixth paragraph:*

Switches shall further be classified as follows with respect to endurance:

– **power switches** for **grass trimmers**, **brush cutters** and **brush saws**: for 50 000 operating cycles;

– **power switches** for **lawn trimmers** and **lawn edge trimmers**: for 10 000 operating cycles;

– **power switches** which possess series electronics in addition shall also endure 1 000 operating cycles with the electronics bypassed;

NOTE Switches without any declared endurance with the electronics bypassed have been tested, by default, to 1 000 operating cycles in accordance with IEC 61058-1:2008.

– switches other than **power switches**, such as speed selector switches, which are likely to be switched under electrical load: for 1 000 operating cycles. However, this test is not required, if the requirements of this standard are met with the switch short-circuited;

– switches other than **power switches** that either

  - are intended for operation without electrical load, and which can be operated only with the aid of a tool or are interlocked so that they cannot be operated under electrical load; or
  - provide a motor direction reversing function; or
  - are switches for 20 mA load as classified in 7.1.2.6 of IEC 61058-1:2008

  are not required to possess any particular endurance characteristic.

23.1.10.2 *Replacement of the third paragraph:*

***Power switches** for **grass trimmers**, **brush cutters** and **brush saws** are tested for 50 000 operating cycles. **Power switches** for **lawn trimmers** and **lawn edge trimmers** are tested for 10 000 operating cycles.*

23.3 This subclause of Part 1 is not applicable.

24 Supply connection and external flexible cords

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

24.1 *Replacement:*

Lawn trimmers and **lawn edge trimmers** shall be provided with one of the following means of connection to the supply:

– an appliance inlet having at least the same degree of protection against moisture as marked in accordance with 8.1 for the machine; or

– a **supply cord** with a length between 0,2 m and 0,5 m and fitted with a plug or other connector having at least the same degree of protection against moisture as marked in accordance with 8.1 for the machine; or

– a **supply cord** with a minimum length of 6 m and fitted with a plug.

Grass trimmers, **brush cutters** and **brush saws** shall be provided with one of the following means of connection to the supply:

– an appliance inlet having at least the same degree of protection against moisture as marked in accordance with 8.1 for the machine; or

– a **supply cord** with a length between 0,2 m and 0,5 m and fitted with a plug or other connector having at least the same degree of protection against moisture as marked in accordance with 8.1 for the machine.

Plugs, connectors and appliance inlets shall be suitable for the ratings of the machine.

Appliance inlets shall not allow the introduction of a connector complying with the standard sheets of IEC 60320 except for IEC 60320-2-3, unless the machine is rated IPX0.

Compliance is checked by inspection and by measurement.

The cord is measured from where it exits the machine to where it enters the plug. The length of a cord guard projecting from the body of the machine or from the body of the plug is included in the measurement when determining the length of the cord.

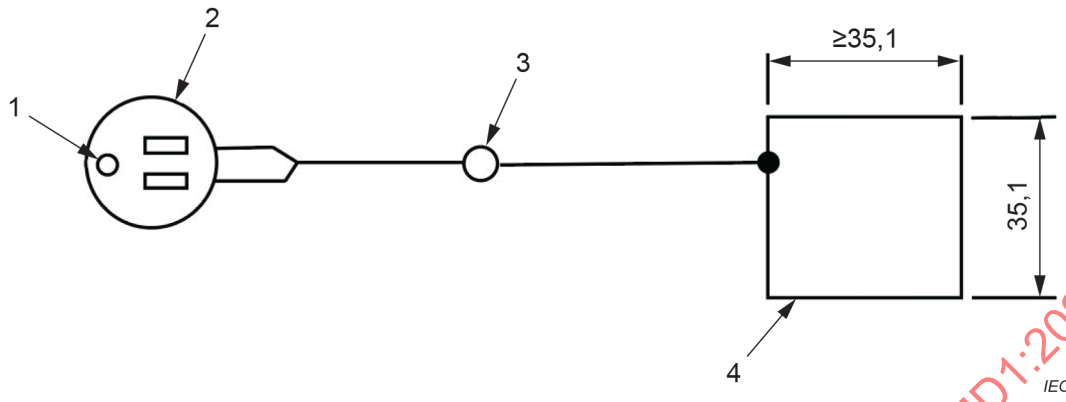
NOTE In Canada and the United States of America, the following additional conditions apply:

The appliance inlet or the attachment plug on the **supply cord** shall be constructed so that, when inserted in the connector of an extension cord, the blades will not be energized until they are inaccessible to contact.

Compliance is checked by the following test.

The receptacle shall be connected to the extension cord of the test assembly illustrated in Figure 121 with the plug inserted in the receptacle as far as possible. The plug shall be withdrawn not more than the distance necessary to permit the test probe to be inserted between the plug body and the extension cord receptacle. The test probe shall be inserted with a force of 18 N (4,1 lb) or less, until the probe contacts one blade of the plug. While the probe is in contact with the blade, the electrical continuity shall be determined by an ohmmeter or similar instrument between the contacts of the extension cord receptacle and the test probe. The test probe shall not contact any current-carrying blade of the attachment plug while the plug is conductively connected to the connector of the extension cord. The test shall be repeated for the other blade of the attachment plug.

Dimensions in millimetres



Key

1 GH (grounding open)

2 extension cord receptacle (three wire grounded)

3 continuity tester

4 test probe made of 1,5 mm thick metal

Figure 121 – Test assembly for accessibility of attachment plug blades

24.2 *Addition:*

A **type Z attachment** is allowed on **lawn trimmers** and **lawn edge trimmers**. A **type Z attachment** is not allowed on **grass trimmers**, **brush cutters** and **brush saws**.

24.4 *Replacement of NOTE 1 and NOTE 2:*

NOTE 1 In the United States of America, the following conditions apply:

Supply cords shall be not lighter than type SJOW, SJTW, or the equivalent that is oil and weather resistant in accordance with the National Electrical Code, ANSI/NFPA 70.

Attachment plugs and cords shall be equal to or greater than the rating of the machine.

NOTE 2 In Canada, the following conditions apply:

Supply cords shall be not lighter than type SJOW, SJTW, or the equivalent that is oil and weather resistant in accordance with the Canadian Electrical Code, Part 1.

24.13 *Modification:*

This requirement applies to **supply cords** and **interconnection cords**.

Replacement of Table 9:

Table 9 – Pull and torque value

Mass of machine as specified in 5.17 kg	**Pull** N	**Torque** Nm
All machines	100	0,35

25 Terminals for external conductors

This clause of Part 1 is applicable.

26 Provision for earthing

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

26.1 *Replacement:*

Machines shall have no provision for protective earthing.

Compliance is checked by inspection.

26.2 to **26.5** These subclauses of Part 1 are not applicable.

27 Screws and connections

This clause of Part 1 is applicable.

28 Creepage distances, clearances and distances through insulation

Replacement:

28.1 **Creepage distances** and **clearances** shall not be less than the values in millimetres shown in Table 12. The values specified in Table 12 do not apply to cross-over points of motor windings.

The values in Table 12 are equal or larger than the values required by IEC 60664-1, when all the following:

– an overvoltage category II;
– a material group III;
– a pollution degree 1 for parts protected against deposition of dirt and for lacquered or enamelled windings;
– a pollution degree 3 for other parts;
– inhomogeneous electric field;
– transient overvoltages originating in the equipment not exceeding 4 000 V

are applied.

Protection against deposition of dirt may be achieved through the use of

– encapsulation with a minimum thickness of 0,5 mm; or
– protective coatings that prevent the combined deposition of fine particles and moisture on surfaces between conductors. Requirements for these types of protective coatings are described in IEC 60664-3; or
– enclosures that prevent the ingress of dust by means of filters or seals, provided that no dust is generated within the enclosure itself.

NOTE 1 An example of encapsulation is potting.

If a resonance voltage occurs between the point where a winding and a capacitor are connected together, and metal parts which are separated from **live parts** by **basic insulation** only, the **creepage distance** and **clearance** shall not be less than the values specified for the value of the voltage imposed by the resonance, these values being increased by 4 mm in the case of **reinforced insulation**.

Compliance is checked by measurement.

For machines provided with an appliance inlet, the measurements are made with an appropriate connector inserted. For other machines, they are made on the machine as delivered.

For machines provided with belts, the measurements are made with the belts in place, and the devices intended for varying the belt tension adjusted to the most unfavourable position within their range of adjustment, and also with the belts removed.

Movable parts are placed in the most unfavourable position; nuts and screws with non-circular heads are assumed to be tightened in the most unfavourable position.

*The **clearances** between terminals and accessible metal parts are also measured with the screws or nuts unscrewed as far as possible, but the **clearances** shall then be not less than 50 % of the value shown in Table 12.*

Table 12 – Minimum creepage distances and clearances

Dimensions in millimetres

Distances	Class III tools (machines)		Other machines					
			Working voltage ≤ 130 V		Working voltage > 130 V and ≤ 280 V		Working voltage > 280 V and ≤ 480 V	
	Creepage distance	Clear-ance	Creepage distance	Clear-ance	Creepage distance	Clear-ance	Creepage distance	Clear-ance
Between parts of different potential [a]:								
– if lacquered or enamelled windings or if protected against deposition of dirt	1,0	1,0	1,0	1,0	2,0	2,0	2,0	2,0
– if not protected against deposition of dirt	2,0 [c]	1,5	2,0 [b]	1,5	3,0 [b]	2,5	8,0 [e]	3,0
Between **live parts** and other metal parts over **basic insulation**:								
– if the **live parts** are lacquered or enamelled windings [d] or if protected against deposition of dirt	–	–	1,0	1,0	2,0	2,0	2,0	2,0
– if not protected against deposition of dirt	–	–	2,4 [c]	1,5	4,0 [c]	3,0	8,0 [e]	3,0
Between **live parts** and other metal parts over **reinforced insulation**:								
– if the **live parts** are lacquered or enamelled windings or protected against deposition of dirt	–	–	5,0	5,0	6,0	6,0	10,0 [e]	6,0
– for other **live parts** not protected against deposition of dirt	–	–	5,0	5,0	8,0	8,0	16,0 [e]	8,0
Between metal parts separated by **supplementary insulation**	–	–	2,5	2,5	4,0	4,0	8,0 [e]	4,0

[a] The **clearances** specified do not apply to the air gap between the contacts of thermal controls, **protective devices**, switches of micro-gap construction, and the like, or to the air gap between the current-carrying members of such devices where the **clearance** varies with the movement of the contacts.

[b] These **creepage distances** are slightly lower than suggested by IEC 60664-1. **Creepage distances** between parts of different potential (functional insulation) are only associated to fire hazard, not to electric shock hazard. As products in the scope of IEC 62841 are products supervised during **normal use**, lower distances are justified.

[c] These **creepage distances** may be reduced to values in accordance with IEC 60664-1, if the insulation parts are of material group II or lower.

[d] Windings are considered to have **basic insulation** if they are wrapped with tape and then impregnated, or if they are covered with a layer of self-hardening resin, and if, after the test of 14.1, an electric strength test as specified in Clause D.2 is withstood, the test voltage being applied between the conductors of the winding and metal foil in contact with the surface of the insulation.

It is sufficient that the wrapping and impregnation, or the layer of self-hardening resin, cover the windings only at places where it is not possible to obtain the **creepage distance** or **clearance** specified for lacquered or enamelled windings.

[e] These **creepage distances** are valid for frequencies up to 30 kHz. For higher frequencies, creepage distances shall be in accordance with IEC 60664-4. **Creepage distances** and **clearances** can be reduced in accordance with IEC 60664-1 if the insulation parts are of material group II or lower and/or for **working voltages** ≤ 400 V, however they shall not be lower than the values required in the column "**Working voltage** > 130 V and ≤ 280 V".

Distances through slots or openings in external parts of insulating material are measured to metal foil in contact with the accessible surface; the foil is pushed into corners and the like by means of the test probe B of IEC 61032:1997, but it is not pressed into openings.

If necessary, a force is applied to any point on internal wiring and bare conductors, other than those of heating elements, to any point on uninsulated metal capillary tubes of ***thermostats*** *and similar devices, and to the outside of metal enclosures, in an endeavour to reduce the* ***creepage distances*** *and* ***clearances*** *while taking the measurements.*

The force is applied by means of the test probe B of IEC 61032:1997, and has a value of:

– *2 N for internal wiring and bare conductors and for uninsulated capillary tubes of* ***thermostats*** *and similar devices;*

– *30 N for enclosures.*

The way in which ***creepage distances*** *and* ***clearances*** *are measured is indicated in Annex A.*

For machines having parts with ***double insulation*** *where there is no metal between* ***basic insulation*** *and* ***supplementary insulation****, the measurements are made as though a metal foil were present between the two insulations.*

Means provided for fixing the machine to a support are considered to be accessible.

Creepage distances *and* ***clearances*** *within optocouplers are not measured if the individual insulations are adequately sealed, and if air is excluded between individual layers of the material.*

For parts of different potential, including conductive patterns on printed circuit boards, except for external mains connection, ***creepage distances*** *and* ***clearances*** *smaller than the minimum values specified*

– *in Table 12; or*

– *for conductive patterns on printed circuit boards as specified below*

are allowed, provided

– *the requirements of Clause 18 are met if these* ***creepage distances*** *and* ***clearances*** *are short-circuited in turn; or*

– *for* ***electronic circuits****, they comply with 18.6 and 18.8.*

For conductive patterns on printed circuit boards, except at their edges, the minimum ***creepage distances*** *and* ***clearances*** *in Table 12 between parts of different potential may be reduced, as long as the peak value of the voltage stress does not exceed:*

– *150 V per mm with a minimum value of 0,2 mm, if protected against the deposition of dirt;*

– *100 V per mm with a minimum value of 0,5 mm, if not protected against the deposition of dirt.*

When the limits mentioned above lead to higher values than those of Table 12, the values of Table 12 apply.

NOTE 2 The above values are equal to or larger than the values required by IEC 60664-3.

28.2 Depending on the **working voltage**, the distance through insulation shall be as follows:

– For **working voltages** up to and including 130 V, the distance through insulation between metal parts shall not be less than 1,0 mm, if they are separated by **supplementary insulation**, and not be less than 1,5 mm, if they are separated by **reinforced insulation**.

– For **working voltages** over 130 V, the distance through insulation between metal parts shall not be less than 1,0 mm, if they are separated by **supplementary insulation**, and not be less than 2,0 mm, if they are separated by **reinforced insulation**.

– For all **working voltages**, the distance through **reinforced insulation** used between enamelled or lacquered windings and accessible metal shall not be less than 1,0 mm.

The required distance through insulation may be achieved through several thicknesses of solid insulation layers that may have intervening air between the layers such that the sum of the thicknesses of the solid insulation equals the required thickness.

This requirement does not apply, if either a) or b) is fulfilled.

a) The insulation is applied in thin sheet form, other than mica or similar scaly material, and consists:

   – for **supplementary insulation**, of at least two layers, provided that any one of the layers withstands the electric strength test prescribed for **supplementary insulation**;

   – for **reinforced insulation**, of at least three layers, provided that, when any two of the layers are placed in contact, they withstand the electric strength test prescribed for **reinforced insulation**.

   The test voltage is applied between the outer surfaces of the layer, or of the two layers, as applicable.

b) The **supplementary insulation** or the **reinforced insulation** is inaccessible and meets the following condition:

   The insulation, after having been conditioned for seven days (168 h) in an oven maintained at a temperature equal to 50 K greater than the maximum temperature rise determined during the test of Clause 12 withstands an electric strength test as specified in Annex D, this test being made on the insulation both at the temperature occurring in the oven, and at approximately room temperature.

Compliance is checked by inspection and by measurement.

For optocouplers, the conditioning procedure is carried out at a temperature of 50 K in excess of the maximum temperature rise measured on the optocoupler during the tests of Clause 12 and Clause 18, the optocoupler being operated under the most onerous conditions which occur during these tests.