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Edition 1.1 2024-10
CONSOLIDATED VERSION

INTERNATIONAL STANDARD

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Electric motor-operated hand-held tools, transportable tools and lawn and garden machinery – Safety –
Part 4-1: Particular requirements for chain saws

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FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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This consolidated version of the official IEC Standard and its amendment has been prepared for user convenience.

IEC 62841-4-1 edition 1.1 contains the first edition (2017-10) [documents 116/339/FDIS and 116/344/RVD] and its amendment 1 (2024-10) [documents 116/816/FDIS and 116/837/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 62841-4-1 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 4-1 is to be used in conjunction with the first edition of IEC 62841-1 (2014).

This Part 4-1 supplements or modifies the corresponding clauses in IEC 62841-1, so as to convert it into the IEC Standard: Particular requirements for chain saws.

Where a particular subclause of Part 1 is not mentioned in this Part 4-1, that subclause applies as far as relevant. 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;
– **terms defined in Clause 3: in bold typeface.**

Subclauses, notes, tables and figures which are additional to those in 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 4-1 as well as Annex K and Annex L of Part 1 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 publication 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.

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

Part 4-1: Particular requirements for chain saws

1 Scope

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

Addition:

This standard applies to **chain saws** for cutting wood and designed for use by one person. This standard does not cover **chain saws** designed for use in conjunction with a guide-plate and riving knife or in any other way such as with a support or as a stationary or transportable machine.

This standard does not apply to

– **chain saws** for tree service as defined in ISO 11681-2; or

– pole-mounted pruners.

NOTE 101 Pole-mounted pruners will be covered by a future part of IEC 62841.

The **chain saws** covered by this standard are designed only to be operated with the right hand on the **rear handle** and the left hand on the **front handle**.

2 Normative references

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

Addition:

IEC 60664-3:2016, *Insulation coordination for equipment within low-voltage systems – Part 3: Use of coating, potting or moulding for protection against pollution*

IEC 61672-1, *Electroacoustics – Sound level meters – Part 1: Specifications*

ISO 37:2017, *Rubber, vulcanized or thermoplastic – Determination of tensile stress-strain properties*

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

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*

ISO 6533:~~2012~~2020, *Forestry machinery – Portable chain-saw front hand-guard – Dimensions and clearances*

ISO 6534:2007, *Forestry machinery – Portable chain-saw hand-guards – Mechanical strength*

ISO 7914:2002, *Forestry machinery – Portable chain-saws – Minimum handle clearance and sizes*

ISO 7915:~~1991~~2021, *Forestry machinery – Portable chain-saws – Determination of handle strength*

ISO 9518:2018, *Forestry machinery – Portable chain-saws – Kickback test*

ISO 10726:1992, *Portable chain-saws – Chain catcher – Dimensions and mechanical strength*

ISO 11681-2:2011, *Machinery for forestry – Portable chain-saw safety requirements and testing – Part 2: Chain-saws for tree service*

ISO 13772:2009, *Forestry machinery – Portable chain saws – Non-manually actuated chain brake performance*

ISO 17080:2005, *Manually portable agricultural and forestry machines and powered lawn and garden equipment – Design principles for single-panel product safety labels*

ISO 22868:2011, *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:

3.101
bar tip guard
shield that prevents contact with the **saw chain** at the tip of the **guide bar**

3.102
chain brake
function or device for stopping the **saw chain** activated manually or non-manually when **kickback** occurs

3.102.1
manually activated chain brake
braking function triggered by the hand of the operator

3.102.2
non-manually activated chain brake
braking function triggered by **kickback** motion independent of operator activation

3.103
chain catcher
device for restraining the **saw chain** if it breaks or derails (see Figure 101)

3.104
chain saw
machine designed to cut wood with a **saw chain** and consisting of an integrated unit of handles, motor, **guide bar** and **saw chain**, designed to be supported with two hands (see Figure 101)

3.105
cutting length
approximate effective length of cut of the **chain saw**

Note 1 to entry: The method for determining **cutting length** is specified in 21.101.

3.106
drive sprocket
chain drive wheel with teeth

3.107
front hand guard
guard between the **front handle** and the **saw chain** for protecting the hand from injuries if the hand slips off the handle (see Figure 101)

3.108
front handle
support handle located at or towards the front of the machine (see Figure 101)

3.109
guide bar
attachment that supports and guides the **saw chain** (see Figure 101)

3.110
kickback
rapid upward and/or backward motion of the **chain saw** which can occur when the moving **saw chain** contacts an object such as a log or branch near the tip of the **guide bar** or when the wood closes in and pinches the moving **saw chain**

3.111
maximum speed
highest steady-state **saw chain** speed attainable under all conditions of **normal use**, including no-load, when adjusted in accordance with the manufacturer's specifications and/or instructions

Note 101 to entry: The steady-state **saw chain** speed excludes transients such as overshoot that can occur before attaining a steady-state condition.

3.112
operator presence sensor
device to detect the presence of an operator's hand

3.113
rear hand guard
extension on the lower part of the **rear handle** for protecting the hand from the **saw chain** if it breaks or derails (see Figure 101)

3.114
rear handle
support handle located towards the rear of the machine (see Figure 101)

3.115
saw chain
attachment, serving as a cutting tool, consisting of drive links and cutters (see Figure 101 and Figure 108)

3.116
spiked bumper
device, fitted in front of the **guide bar** mounting point, acting as a pivot when in contact with a tree or log (see Figure 101 and Figure 102)

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:

~~**5.14** *Addition:*~~

~~*For tests carried out at any percentage of **rated input** or **rated current**, except for no-load, the **saw chain** and the **guide bar** may be removed and the **chain saw** loaded by means of a brake.*~~

5.15 *Addition:*

*For tests carried out at any percentage of **rated input** or **rated current**, except for no-load, the **saw chain** and the **guide bar** may be removed and the **chain saw** loaded by means of a brake.*

5.17 *Addition:*

*The mass of the machine includes the heaviest **guide bar** and **saw chain** combination in accordance with 8.14.2 c) 101) as well as the lubrication tank, if any, filled to the maximum specified level, but excludes the **guide bar** cover.*

5.101 *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:

7.2 *Replacement:*

Chain saws shall not be classified with a degree of protection against harmful ingress of water higher than IPX0 according to IEC 60529:1989, IEC 60529:1989/AMD1:1999 and IEC 60529:1989/AMD2:2013.

Compliance is checked by inspection.

8 Marking and instructions

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

8.1 *Replacement:*

Chain saws shall be marked with rating information as follows:

– **rated voltage**(**s**) or **rated voltage range**, in volts. Machines for star-delta connection shall be clearly marked with the two **rated voltages** (for example 230 Δ/ 400 Y). A machine that complies with this standard for a voltage range, may also be marked with any single voltage or smaller voltage range within that range;

– symbol for nature of supply, unless the **rated frequency**(**ies**) or **rated frequency range** is marked. The symbol for nature of supply shall be placed next to the marking for **rated voltage**;

– **rated input**, in watts or **rated current**, in amperes. The **rated input** or **rated current** to be marked on the machine is the total maximum input or current that can be drawn from external circuit at the same time. If a machine has alternative components which can be selected by a **control device**, the **rated input** or **rated current** is that corresponding to the highest loading possible;

– symbol for **class II construction**, for **class II tools** (machines) only.

8.1.101 Chain saws shall not be marked with an IP rating for the degree of protection against harmful ingress of water higher than IPX0 in accordance with IEC 60529:1989, IEC 60529:1989/AMD1:1999 and IEC 60529:1989/AMD2:2013. **Chain saws** may be marked with an IP rating for the degree of protection against solid foreign objects and access to hazardous parts in accordance with IEC 60529:1989, IEC 60529:1989/AMD1:1999 and IEC 60529:1989/AMD2:2013.

Compliance is checked by inspection.

8.2 *Addition:*

Chain saws shall be marked with safety information which shall be written in one of the official languages of the country in which the machine is to be sold or marked with the appropriate symbol:

– “Wear eye protection” or a relevant safety sign of ISO 7010 or the safety sign specified in Annex AA;

– “Wear ear protection”, a relevant safety sign of ISO 7010 or the safety sign specified in Annex AA. This marking may be omitted if the measured sound pressure level at the operator’s ear in accordance with Annex I does not exceed 85 dB(A).

A combination of ISO safety signs, such as eye, ear, dust and head protection, is allowed. In addition, a combination of safety signs as specified in Annex AA is allowed.

– “Do not expose to rain” or the safety sign specified in Annex AA~~, unless the **chain saw** has a degree of protection of at least IPX4~~.

– "Beware of chain saw kickback and avoid contact with bar tip”, or A.1.3 of ISO 17080:2005.

– “Always use chain saw two-handed” or A.3.1 of ISO 17080:2005.

For mains supplied machines:

“Remove plug from the mains immediately if the cable is damaged or cut” or the safety sign specified in Annex AA.

8.3 *Addition:*

Chain saws shall be marked with the following:

– specified nominal **guide bar** size or size range;

NOTE 101 The nominal **guide bar** size is not necessarily the same as the **cutting length**.

– identification of the direction of rotation of the **saw chain** by a legible and durable mark on the body of the machine. This may be located under the **drive sprocket** cover.

8.14.1 *Addition:*

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

8.14.1.101 Safety instructions for chain saws

1) **General chain saw safety warnings:**

a) **Keep all parts of the body away from the saw chain when the chain saw is operating. Before you start the chain saw, make sure the saw chain is not contacting anything.** *A moment of inattention while operating chain saws may cause entanglement of your clothing or body with the saw chain.*

b) **Always hold the chain saw with your right hand on the rear handle and your left hand on the front handle.** *Holding the chain saw with a reversed hand configuration increases the risk of personal injury and should never be done.*

c) **Hold the chain saw by insulated gripping surfaces only, because the saw chain may contact hidden wiring or its own cord.** *Saw chains contacting a "live" wire may make exposed metal parts of the chain saw "live" and could give the operator an electric shock.*

d) **Wear eye protection. Further protective equipment for hearing, head, hands, legs and feet is recommended.** *Adequate protective equipment will reduce personal injury from flying debris or accidental contact with the saw chain.*

e) **Do not operate a chain saw in a tree, on a ladder, from a rooftop, or any unstable support.** *Operation of a chain saw in this manner could result in serious personal injury.*

f) **Always keep proper footing and operate the chain saw only when standing on fixed, secure and level surface.** *Slippery or unstable surfaces may cause a loss of balance or control of the chain saw.*

g) **When cutting a limb that is under tension, be alert for spring back.** *When the tension in the wood fibres is released, the spring loaded limb may strike the operator and/or throw the chain saw out of control.*

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

i) **Carry the chain saw by the front handle with the chain saw switched off and away from your body. When transporting or storing the chain saw, always fit the guide bar cover**. *Proper handling of the chain saw will reduce the likelihood of accidental contact with the moving saw chain.*

j) **Follow instructions for lubricating, chain tensioning and changing the bar and chain.** *Improperly tensioned or lubricated chain may either break or increase the chance for kickback.*

k) **Cut wood only. Do not use chain saw for purposes not intended. For example: do not use chain saw for cutting metal, plastic, masonry or non-wood building materials.** *Use of the chain saw for operations different than intended could result in a hazardous situation.*

l) **Do not attempt to fell a tree until you have an understanding of the risks and how to avoid them.** *Serious injury could occur to the operator or bystanders while felling a tree.*

NOTE The above warning is omitted for **chain saws** that are not suitable for tree felling as specified by the manufacturer. See 8.14.2 b) 104).

m) **This chain saw is not intended for tree felling.** *Use of the chain saw for operations different than intended could result in serious injury to the operator or bystanders*.

NOTE The above warning is omitted for **chain saws** that are suitable for tree felling.

2) **Causes and operator prevention of kickback:**

Kickback may occur when the nose or tip of the guide bar touches an object, or when the wood closes in and pinches the saw chain in the cut.

Tip contact in some cases may cause a sudden reverse reaction, kicking the guide bar up and back towards the operator.

Pinching the saw chain along the top of the guide bar may push the guide bar rapidly back towards the operator.

Either of these reactions may cause you to lose control of the saw which could result in serious personal injury. Do not rely exclusively upon the safety devices built into your saw. As a chain saw user, you should take several steps to keep your cutting jobs free from accident or injury.

Kickback is the result of chain saw misuse and/or incorrect operating procedures or conditions and can be avoided by taking proper precautions as given below:

a) **Maintain a firm grip, with thumbs and fingers encircling the chain saw handles, with both hands on the saw and position your body and arm to allow you to resist kickback forces.** *Kickback forces can be controlled by the operator, if proper precautions are taken. Do not let go of the chain saw.*

NOTE Figure 103 may be used as an illustration in the instruction manual for holding the machine properly.

b) **Do not overreach and do not cut above shoulder height.** *This helps prevent unintended tip contact and enables better control of the chain saw in unexpected situations.*

c) **Only use replacement guide bars and saw chains specified by the manufacturer.** *Incorrect replacement guide bars and saw chains may cause chain breakage and/or kickback.*

d) **Follow the manufacturer's sharpening and maintenance instructions for the saw chain.** *Decreasing the depth gauge height can lead to increased kickback.*

8.14.2 a) *Addition:*

101) Explanation of **chain saw** safety devices;

102) Instructions for properly installing and adjusting the **guide bar** and **saw chain**;

103) Instruction for selection and use of protective equipment for eyes, ears, head, hands, legs and feet, as applicable.

8.14.2 b) *Addition:*

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

102) Statement to position the cord so that it will not be caught on branches and the like, during cutting;

103) Recommendation that the first-time user should, as a minimum, practise cutting logs on a saw-horse or cradle;

104) Information that the **chain saw** is not suitable for tree felling, if applicable;

105) Instructions to explain the proper techniques for basic felling, limbing, and cross-cutting. Examples for the required instructions are given in Clause BB.1 to BB.5. If the **chain saw** is not suitable for tree felling as specified by the manufacturer, then instructions for felling techniques may be omitted;

106) If applicable, instruction on the use of a manual lubrication control;

107) If applicable, instruction not to operate the **chain saw** without lubrication and to replenish it in due time before the container is empty;

108) Instruction to use only recommended lubricants;

109) Information on the **maximum speed** of the **saw chain**, or if the **maximum speed** of the **saw chain** is less than 20 m/s, this may be stated.

8.14.2 c) *Addition:*

101) Information on recommended **guide bar** and **saw chain** combination(s) that can be used and that maintains compliance with this standard;

102) Instructions on sharpening and maintenance of the **saw chain** and/or a recommendation to have sharpening and maintenance of the **saw chain** performed by authorised service centres.

8.14.3 *Replacement:*

If information about the mass or weight of the machine is provided, it shall be the mass of the machine without the **saw chain, guide bar**, **guide bar** cover, oil and optional **accessories**.

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.

12 Heating

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

12.2.1 *Replacement:*

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

The machine is operated with a torque load applied such that rated input or rated current is drawn. The machine is operated for 30 min. During this period, the torque load is adjusted as necessary to maintain rated input or rated current.

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:

Addition:

NOTE 101 **Saw chain** lubrication tanks and lubrication systems intended for use with oil as specified in 8.14.2 are not considered to be **liquid systems**.

14.2 This subclause of Part 1 is not applicable.

14.2.1 ~~*Replacement:*~~

~~*The machine is not connected to the supply.*~~

~~*The machine is placed in its normal rest position on a perforated turntable. The turntable is then turned continuously at approximately 1 rev/min during the test.*~~

~~*Electrical components, covers and other* ***detachable parts*** *are removed and subjected, if necessary, to the relevant treatment with the main part. Movable covers that are* ***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.~~

This subclause of Part 1 is not applicable.

14.2.2 This subclause of Part 1 is not applicable.

14.3 to 14.5 ~~This~~These subclauses of Part 1 ~~is~~ are not applicable for **saw chain** lubrication tanks and lubrication systems intended for use with oil as specified in 8.14.2.

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 *Modification:*

This subclause is applicable as for **hand-held tools**. The **saw chain** is removed for the endurance test.

18 Abnormal operation

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

18.3 *Replacement:*

Machines incorporating a series motor are operated without the ***saw chain*** *at a voltage equal to 1,3 times* **rated voltage** *for 1 min at no-load.*

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 *Modification:*

The requirements for tools other than **lawn and garden machinery** are applicable.

18.6.1 *Addition:*

*Components intended to discharge capacitors to comply with 21.21 and K.21.21 are only subjected to the fault conditions a) to f) whilst connected to the mains or **battery**, as applicable, and no evaluation for compliance is conducted whilst disconnected from the mains or **battery**, as applicable.*

18.8.1 *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	~~Shall be evaluated using the fault conditions of 18.6.1 without the loss of this **SCF**~~ c
Power switch – provide desired switch-off	~~Shall be evaluated using the fault conditions of 18.6.1 without the loss of this **SCF**~~ c
Provide desired direction of rotation for **cutting lengths** ≤ 300 mm	a
Provide desired direction of rotation for **cutting lengths** > 300 mm	b
Starting current limitation as in 10.2	Not an **SCF**
Prevent exceeding thermal limits as in ~~Clause~~ 18.4 and 18.5.3	a
Manually activated chain brake function if required in 19.107.1 for **chain saws**	b
~~Overspeed prevention~~ Prevent **saw chain** speed from exceeding 6 m/s for **chain saws** with no chain brake, if such overspeed would cause non-compliance with 19.107.1	a
~~Overspeed prevention if such overspeed would cause non-compliance with 19.107.1.2~~	~~a~~
Prevent exceeding the required average braking time and the maximum braking time in 19.107.1.2 by more than 0,03 s	a
Overspeed prevention for **chain saws** without a **non-manually activated chain brake** to prevent **saw chain** speed above ~~15~~18 m/s as in 19.107.2	a
Non-manually activated chain brake function as in 19.107.2	b
Overspeed prevention if such overspeed would cause non-compliance with 19.107.4	a
Provide automatic lubrication of the **saw chain** as in 19.110	Not an **SCF**
Prevent exceeding the maximum run-down time in 19.112 by more than 1 s	a
Operator presence sensor as in 21.18.102	a
Lock-off function as required by 21.18.102	b
Visual or audible indicator as referenced in 21.18.102	Not an **SCF**
Function to fulfil the requirements of 21.21 or K.21.21	Not an **SCF**
Prevent self-resetting as required in 23.3	a

19 Mechanical hazards

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

19.1 *Modification:*

The requirements of this subclause do not apply to those moving parts and **guards** which are separately covered by 19.102, 19.103 and 19.104.

19.6 This subclause of Part 1 is not applicable.

19.7 This subclause of Part 1 is not applicable.

19.8 This subclause of Part 1 is not applicable.

19.9 *Replacement:*

If, in accordance with 8.14.2, the user is instructed to remove a **drive sprocket** cover, such as for maintenance, to change the **saw chain** or **guide bar**, then the fastenings shall remain attached to the **drive sprocket** cover or to the machinery, unless the **drive sprocket** cover fastenings are the only means for retaining the **guide bar**. If a fastening is not removed for removing the **drive sprocket** cover, it is considered as still attached.

Compliance is checked by inspection and by manual test.

19.101 Handles

Chain saws shall be fitted with at least two handles to provide safe control. The length of the grip area of the **front handle** shall be at least 100 mm. The handle surfaces shall be so designed and shaped that firm grip may be applied. Minimum clearances and sizes of the handles shall be in accordance with ISO 7914 for forest work **chain saws**, except for the determination of dimension *D*. Dimension *D* shall be the straight line distance from the rear side of the **power switch** to a point on the axis of the **front handle**, 50 mm to the left of X_0, where X_0 is determined in accordance with ISO 6533. For **chain saws** with a **maximum speed** of the **saw chain** not exceeding 8 m/s and a maximum **cutting length** not exceeding 300 mm, however, the dimension *D* in Table 1 of ISO 7914:2002 may be reduced to a minimum of 125 mm.

Compliance is checked by inspection and by measurement.

19.102 Front hand guard

A guard shall be fitted in the vicinity of the **front handle** to protect the operator's fingers from injury by contact with the **saw chain**. The dimensions and clearances of this **front hand guard** and the prevention of access from the **front handle** to the **saw chain** shall comply with ISO 6533.

Compliance is checked by inspection and by measurement.

19.103 Rear hand guard

A **rear hand guard** shall be provided along the length of the right side of the bottom of the **rear handle** to protect the operator's hand from contact in case the **saw chain** breaks or derails.

The **rear hand guard** shall extend from the right edge of the **rear handle** for at least 30 mm on the **guide bar** side (see Figure 104) and

– at least 100 mm lengthwise from the inner rear part of the **chain saw** body (see Figure 104); or
– at least three times the diameter of 25 mm behind the **power switch**, as defined by three cylinders pressed against the **rear handle** and the **power switch**;

whichever of these options is further back.

This requirement may also be fulfilled by parts of the machine.

Compliance is checked by inspection and by measurement.

19.104 Drive sprocket cover

The **drive sprocket** and **saw chain** shall be covered ~~within the area of the body of the **chain saw**~~ to provide protection against personal injury. This cover shall not be removable without the aid of a tool unless the **drive sprocket** cover fastenings are the only means for retaining the **guide bar**.

The **chain saw** shall comply with ISO 6533:2020, 7.3.

There may be openings at the front, the front upper section and the bottom section to allow the ejection of wood chips and to allow passage of the **guide bar** and **saw chain**.

Compliance is checked by inspection, by measurement and by the following test:

*With the **drive sprocket** cover, **guide bar** and **saw chain** fitted, it shall not be possible to touch the **drive sprocket** ~~and **saw chain**~~ with the straight test probe (see Figure 105) introduced with a force not exceeding 5 N from the top, the rear and the sides of the **drive sprocket** cover ~~within the area of the body of the **chain saw**~~.*

19.105 Chain catcher

The **chain saw** shall be fitted with a **chain catcher** device placed under the **saw chain** as far to the front as practicable. The **chain catcher** shall extend sideways at least 5 mm from the centre-plane of the **guide bar**.

Compliance is checked by inspection and by measurement.

19.106 Void

19.107 Protection against injury by kickback

Chain saws shall be designed to minimize the risk of injury due to the effect of **kickback**.

19.107.1 Chain saws shall be equipped with a **manually activated chain brake,** operated by the **front hand guard** in a direction away from the operator, that stops movement of the **saw chain.**

A **manually activated chain brake** is not required if the **chain saw** is fitted with a **non-manually activated chain brake** that meets the requirements of 19.107.2 or provided the following requirements are fulfilled:

– the **maximum speed** of the **saw chain** does not exceed 5 m/s; and

– the **cutting length** without **bar tip guard** does not exceed 300 mm.

*Compliance is checked by inspection and by measurement with the **chain saw** fitted with a **saw chain** and **guide bar** as specified in 8.14.2.*

NOTE In New Zealand, the following conditions apply:

All **chain saws** shall be fitted with a **manually activated chain brake**.

19.107.1.1 The **manually activated chain brake** shall be designed so that the static activation force required is not more than 60 N and not less than 20 N.

Compliance is checked by the following test.

*With the **power switch** in the "on" position and the **chain saw** disconnected from the power source, the force on the **front hand guard** needed to activate the brake shall be measured at the centre of the top (horizontal) part of the **front hand guard** and in the direction of 45° forward and downward in relation to the **guide bar** centreline, see Figure 106.*

The force shall be applied at a uniform rate.

19.107.1.2 The average braking time shall not exceed 0,12 s and the maximum braking time shall not exceed 0,15 s.

Compliance is checked by the following test.

*The **chain saw** and **saw chain** tension shall be adjusted as for **normal use**, as specified in 8.14.2. The **chain saw** shall be run in before starting the test by performing 10 on"/"off" cycles with the **power switch**. One cycle consists of 30 s running and 30 s rest. After the run-in, the **saw chain** tension shall be adjusted according to the manufacturer's recommendations. If no recommendations are provided, the **saw chain** tension shall generally be adjusted so that, when a (0,9 ± 0,1) kg mass is hanging from the centre of the **cutting length** along the lower portion of the **saw chain,** the gap between the **saw chain** side link and the **guide bar** is ~~a minimum of 0,017~~ (0,020 ± 0,003) mm per millimetre of **guide bar** length.*

*With the **saw chain** lubricated as in **normal use,** and operated at **rated voltage** and **maximum speed**, the **front hand guard** is set in motion by the impact of a pendulum. This pendulum shall have a mass of 0,70 kg, a hammer with a flat strike face of 50 mm diameter and an arm of 700 mm length. The pendulum drop height shall be 200 mm. Any special hardware and/or software used to achieve **maximum speed** in accordance with 5.101 shall not influence the braking performance provided by the chain brake. The time for the **saw chain** to stop shall be measured from the moment of impact with the **front hand guard** (see Figure 107).*

*The **chain brake** shall be operated a total of 25 times. The maximum stopping time and the average stopping time of the **saw chain** shall be determined at the first five and the last five braking operations.*

*The **saw chain** is considered to be stopped when the time taken for two successive drive links (see dimension a in Figure 108) to pass a fixed point exceeds 5 ms.*

*The tests shall be done in 2 min intervals, comprising a no-load running period of 1 min prior to each impact of the pendulum. Immediately after the operation of the **chain brake** and the **saw chain** has stopped, the **chain saw** shall be switched off for the remainder of the interval. The **chain brake** actuation mechanism shall be reset during this off period.*

19.107.2 Chain saws with a **maximum speed** of the **saw chain** above 15 m/s shall be equipped with a **non-manually activated chain brake** that is sufficiently sensitive to operate when **kickback** occurs.

*Compliance is checked by inspection and by the test of ISO 13772:2009, with the **power switch** in the "on" position and the **chain saw** disconnected from the power source. For ~~**cutting lengths**~~ **chain saws** with the longest nominal **guide bar** size in accordance with 8.3 less than 500 mm, the threshold level of **chain saws** for forest service with ≤ 40 cm^3 engine displacement shall apply. For ~~**cutting lengths**~~ **chain saws** with the longest nominal **guide bar** size in accordance with 8.3 of 500 mm or greater, the threshold level of **chain saws** for forest service with > 40 cm^3 engine displacement shall apply. Measurements shall not be carried out on **guide bars** longer than 500 mm nominal length, except if no **guide bar** below 500 mm is specified in accordance with 8.3, measurements shall be carried out with the shortest specified **guide bar** only.*

19.107.2.1 If the actuation of the **non–manually activated chain brake** is independent of the **front hand guard,** the stopping time requirements shall apply as specified in 19.107.1.2.

*Compliance is checked by the test described by 19.107.1.2. The pendulum, however, is replaced by any arrangement suitable to measure the time from the moment the simulated **kickback** is detected by the **non-manually activated chain brake** until the **saw chain** has stopped.*

NOTE Examples of suitable test arrangements include the use of timing devices, sensors, high speed video, etc.

19.107.2.2 If the **non-manually activated chain brake** functions through the activation of the **front hand guard**, then the stopping time requirements in 19.107.1.2 shall apply.

*Compliance is checked by test described by 19.107.1.2. If this test was already performed for a **manually activated chain brake**, this test need not be repeated.*

19.107.3 After activation of a **chain brake**, if any, the motion of the **saw chain** shall stop and operation of the **chain saw** shall not resume without deliberate operator action of either:

– deactivation and reactivation of the **power switch**; or

– resetting of the **front hand guard**, if the operational state of the **chain brake** is recognizable by position or other means.

Compliance is checked by inspection and by manual test.

19.107.4 The computed kickback angle or the chain stop angle, whichever is lower, shall be determined for the most unfavourable **guide bar** and **saw chain** combination specified in 8.14.2. The angle shall not exceed 45°.

NOTE The most unfavourable combination can be determined by testing for the worst case **saw chain** on a single **guide bar** and independently testing for the worst case **guide bar** using the worst case **saw chain**.

This requirement does not apply to **guide bars** with a nominal **cutting length** of more than 630 mm.

NOTE 101 ISO 9518:2018 is not intended for testing **chain saws** with a **cutting length** in excess of 630 mm.

If the **chain saw** is provided with a **guide bar** incorporating a **bar tip guard**, whether removable or permanently attached, this shall be removed prior to testing.

The medium-density fibreboard (MDF) samples shall be as specified in ISO 9518:2018.

*Compliance is checked by determination of the computed kickback angle or the chain stop angle in accordance with ISO 9518:2018, except that the speed of the **drive sprocket** shall be in accordance with ISO 9518:2018, Table 1 or ISO 9518:2018, Table 2. For **chain saws** that exceed the speeds of ISO 9518:2018, Table 1 or ISO 9518:2018, Table 2, and where it is not possible to control the speed, the test shall be done at the nearest speed exceeding the values of ISO 9518:2018, Table 1 or ISO 9518:2018, Table 2.*

19.108 Guide bar cover

A protective cover shall be provided with the **chain saw** to cover the **guide bar** in order to prevent injuries during transportation.

The **guide bar** cover shall not be displaced by more than 50 mm when the **guide bar** is in a vertical downward position.

When the **guide bar** is adjusted to its maximum length and the **guide bar** cover is fully engaged on the **guide bar**, no more than 50 mm of the **saw chain** on the top or bottom of the **guide bar** shall remain exposed.

Compliance is checked by inspection and by measurement.

19.109 Saw chain tension

Chain saws shall be provided with means of tensioning the **saw chain**.

Compliance is checked by inspection.

19.110 Saw chain lubrication

Chain saws with a **maximum speed** of the **saw chain** of 5 m/s and above shall be equipped with a provision for lubricating the **saw chain**.

If the **chain saw** is fitted with a manual lubrication control, it shall be so located that it can be operated while holding the **chain saw** with both hands in a normal operating position.

Compliance is checked by inspection.

19.111 Balance

Chain saws shall be in longitudinal balance.

Compliance is checked by the following test.

*The **chain saw** shall be fitted with the most unfavourable **guide bar** and **saw chain** as specified in 8.14.2. The lubrication tank, if any, shall be half full. The **spiked bumper**, if any, shall be fitted. The **supply cord** is removed at its point of exit from the **chain saw** or, if supplied with a cord guard, at its point of exit from the cord guard. If the **chain saw** is fitted with an appliance inlet, then no connection shall be made at the appliance inlet. The **chain saw guide bar** cover shall not be fitted.*

*The **chain saw** shall be supported on the **front handle**, positioned so that the **guide bar** plane is vertical. This support shall produce the lowest possible friction to allow **chain saw** rotation. A segment of a suitable size of ball bearing may be used to achieve the low friction. See Figure 109.*

*The angle α between the centreline of the **guide bar** and the horizontal plane as shown in Figure 109 shall not exceed $\pm$ 30°.*

19.112 Run down time

The run down time of **chain saws** shall be limited.

Compliance is checked by the following test.

*The **chain saw** and **saw chain** tension shall be adjusted as for **normal use**, as specified in 8.14.2. The **chain saw** shall be run in before starting the test by performing 10 "on"/"off" cycles with the **power switch**. One cycle consists of 30 s running and 30 s rest. After the run-in, the **saw chain** tension shall be adjusted according to the manufacturer's recommendations. If no recommendations are provided, the **saw chain** tension shall generally be adjusted so that, when a (0,9 ± 0,1) kg mass is hanging from the centre of the **cutting length** along the lower portion of the chain, the gap between the **saw chain** side link and the **guide bar** is ~~a minimum of 0,017~~ (0,020 ± 0,003) mm per millimetre of **guide bar** length.*

The test is made under no-load. The test sequence shall consist of a total of 2 500 cycles.

*The run down time of the **saw chain** shall not exceed 2 s for the first 6 cycles of operation and shall not exceed 3 s for the final 6 cycles of the test sequence.*

*The stop time is measured from the moment of release of the **power switch** actuator until the **saw chain** is stopped. The **saw chain** is considered to be stopped when the time taken for two successive drive links (see dimension a in Figure 108) to pass a fixed point exceeds 5 ms.*

20 Mechanical strength

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

20.1 *Addition:*

*Damage to the **guide bar**, **saw chain** and **chain catcher** are ignored.*

*Prior to performing the electric strength test, there shall be no leakage of lubrication through cracks in lubrication tanks and tank caps while the **chain saw** is being held in each of the six orthogonal directions for 30 s. Seepage through ventilation systems is not considered a failure.*

20.3.1 *Replacement:*

*The **chain saw**, ~~fully assembled~~ equipped with the longest **guide bar** in accordance with ~~8.14.2~~ 8.3 and with the lubrication tank empty, is dropped three times in total on a concrete surface from a height of 1 m. For these three drops, the sample is tested in the three most unfavourable positions with the lowest point of the machine being 1 m above the concrete surface. Secondary impacts shall be avoided.*

NOTE A method for avoiding secondary impacts is tethering.

*If **attachments** other than **guide bars** are provided as specified and mounted in accordance with 8.14.2, the test is repeated with each **attachment** or combination of **attachments** mounted to a separate machine sample.*

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.

After the test, the lubrication tank is filled to the maximum level in accordance with 8.14.2.

*It is not necessary for the **chain saw** to be operable after the test. If it is operable after the test, then immediately following this test it shall be run at **maximum speed** at no-load for 30 s.*

20.101 Handles

The handles shall be of durable construction and capable of withstanding stress sustained under normal working conditions.

*Compliance is checked by the handle strength test of ISO 7915:2021, the test forces for a ~~machine with a displacement of "≤ 50 cm^3"~~ **chain saw** for forest service with an electric motor shall apply.*

20.102 Front and rear hand guard

The **front hand guard** and **rear hand guard** shall be of durable construction and capable of withstanding impacts sustained in normal working conditions.

Compliance is checked by applying the dynamic and durability tests of ISO 6534. In 5.2 of ISO 6534:2007, a temperature of (–10 ± 3) °C shall apply.

20.103 The **chain catcher** shall have sufficient mechanical strength.

Compliance is checked by inspection and by the strength test of Clauses 3 and 4 of ISO 10726:1992. In 4.1 of ISO 10726:1992, a temperature of (–10 ± 3) °C shall apply.

21 Construction

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

21.18 *Replacement:*

Additional requirements for **power switches** for **chain saws** are given in 21.18.101 and 21.18.102.

21.18.101 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) or grasping surface(s) required by 19.101.

When the lock-off function as specified in 21.18.102 is in the unlocked state, the **chain saw** shall operate within 1 s after actuation of the **power switch**.

The **chain saw** shall only operate when the **chain brake**, if any, is deactivated.

Compliance is checked by inspection and by manual test.

21.18.102 The machine 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 **saw chain** 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 b) 6).

The lock-off device ~~and the **operator presence sensor** (if any)~~ shall be actuated before the **power switch** can enable drive to the **saw chain**.

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** is activated;

or

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

NOTE 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 ~~within 1 s when the **power switch** is released~~ (i.e. at least two separate and dissimilar actions are required before drive to the ~~**saw chain**~~ **cutting means** or **cutting accessory** is possible)~~,~~ within 5 s 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 a lock-off device located within any grasping surface identified in accordance with 8.14.2 b) 6), in order to determine if it is possible to actuate the ***power switch*** *and the lock-off device with a single grasping motion or a straight line motion, compliance is checked by the following test:*

~~*The lock-off device shall not be actuated by a 25 mm diameter x 75 mm long rod with a force not exceeding 20 N on the lock-off device in any direction. The 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.*~~

With the ***power switch*** *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 111; and*

– *then applied in the direction perpendicular to the handle axis, see Figure 112*

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.

21.35 This subclause of Part 1 is not applicable.

21.101 Determination of cutting length

The **cutting length** *L* shall be measured with the **guide bar** adjusted to its midway point. The measurement shall be made along the centreline of the **guide bar** in accordance with a) – d) below.

a) For **chain saws** without a **bar tip guard** and where no **spiked bumper** is provided or the **spiked bumper** is removable, the **cutting length** *L* is determined as $L = L_1 + L_3$ as shown in Figure 102 a), where

   – L_1 is the distance from the **chain saw** body (*A*), to the tip end of the **guide bar** (not including the bar tip sprocket, if any); and

   – L_3 is 6 mm, which is an approximation for the height of the **saw chain** cutter.

b) For **chain saws** without a **bar tip guard** and where the **spiked bumper** is permanently attached to the **chain saw**, the **cutting length** *L* is determined as $L = L_2 + L_3$ as shown in Figure 102 a), where

   – L_2 is the distance from root of the spike nearest the centreline of the **guide bar** on the **spiked bumper** (*B*); and

   – L_3 is 6 mm, which is an approximation for the height of the **saw chain** cutter.

c) For **chain saws** with a **bar tip guard** and where no **spiked bumper** is provided or the **spiked bumper** is removable, the cutting length *L* is determined as $L = L_1$ as shown in Figure 102 b), where L_1 is the distance from the **chain saw** body (*A*) and the inside part of the **bar tip guard.**

d) For **chain saws** with a **bar tip guard** and where the **spiked bumper** is permanently attached to the **chain saw**, the **cutting length** *L* is determined as $L = L_2$ as shown in Figure 102 b), where L_2 is the distance from the root of the spike nearest the centreline of the **guide bar** on the **spiked bumper** (*B*) and the inside part of the **bar tip guard.**

21.102 Operator presence sensor

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

It is not required that the **operator presence sensor** is capable of distinguishing between an operator's hand and other objects.

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

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

Compliance is checked by inspection.

21.103 Spiked bumper

Chain saws with a nominal **guide bar** size or size range in accordance with 8.3 exceeding 400 mm ~~may~~ shall

– be equipped with a **spiked bumper** (see Figure 101); or
– have provision for mounting one.

~~NOTE A **spiked bumper** provides operator convenience for certain types of cuts.~~

Compliance is checked by inspection.

21.104 Bar tip guard

Chain saws may be equipped with a **bar tip guard** (see Figure 102 b)).

NOTE A **bar tip guard**, if provided, influences the determination of **cutting length** in 21.101.

Compliance is checked by inspection.

22 Internal wiring

This clause of Part 1 is applicable.

23 Components

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

23.1.10.1 *Modification of the sixth paragraph:*

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

power switches for **chain saws** – for 50 000 cycles.

Addition:

Auxiliary switches, if any, associated with the **chain brake** are considered to be switches other than **power switches** and shall be classified as follows with respect to endurance – for 10 000 cycles.

23.1.10.2 *Modification of the third paragraph:*

Power switches for **chain saws** are tested for 50 000 cycles.

23.3 *Addition:*

Protection devices (e.g. overload or over-temperature protection devices) or circuits that switch off the **chain saw** shall be of the non-self-resetting type.

24 Supply connection and external flexible cords

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

24.1 *Replacement:*

Machines 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 inlets shall be suitable for the ratings of the machine.

Compliance is checked by inspection and by measurement.

The cord is measured from where it exits the machine to where it enters the plug or connector. 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 101 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 110 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.

24.4 *Modification:*

Supply cords shall not be lighter than heavy polychloroprene sheathed flexible cable (code designation 60245 IEC 66) or equivalent.

Compliance is checked by inspection.

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.

25 Terminals for external conductors

This clause of Part 1 is applicable.

26 Provision for earthing

This clause of Part 1 is applicable.

27 Screws and connections

This clause of Part 1 is applicable.

28 Creepage distances, clearances and distances through insulation

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

28.1 *Replacement:*

Creepage distances and **clearances** shall not be less than the values in millimetres shown in Table 12. The values specified in the table 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

– 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 or larger than the values required by IEC 60664-3.

28.2 Depending on the w**orking voltage**, the distance through insulation shall be sufficient:

– 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**.

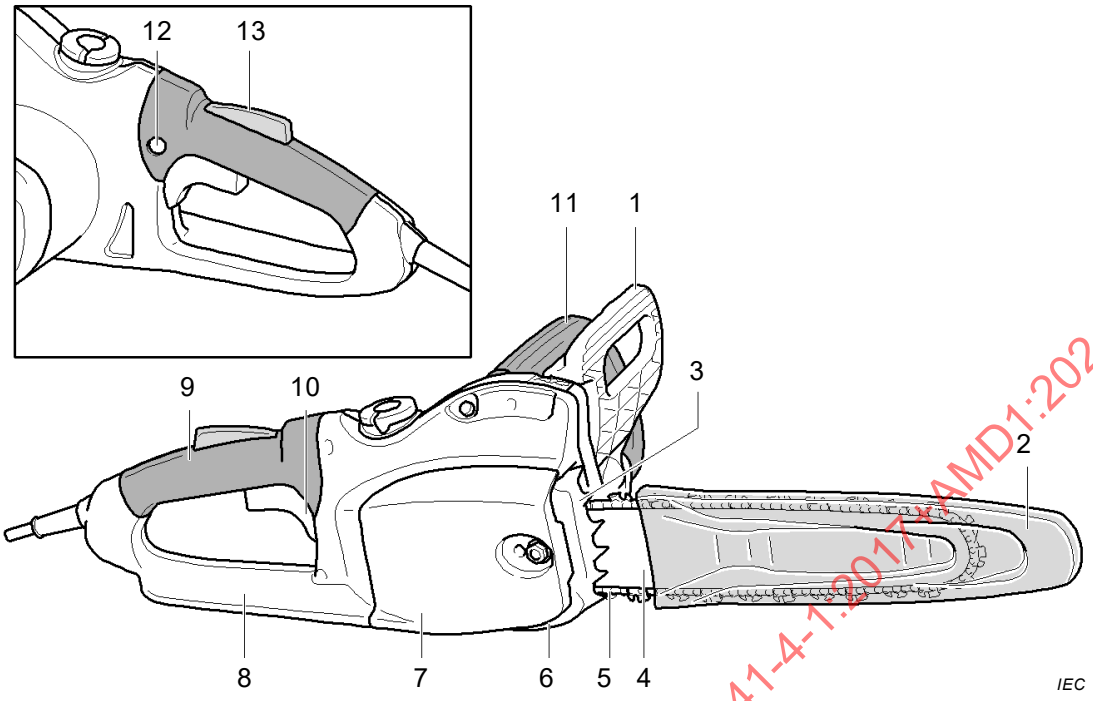
   The test voltage is applied between the outer surfaces of the layer, or of the two layers, as applicable.

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.

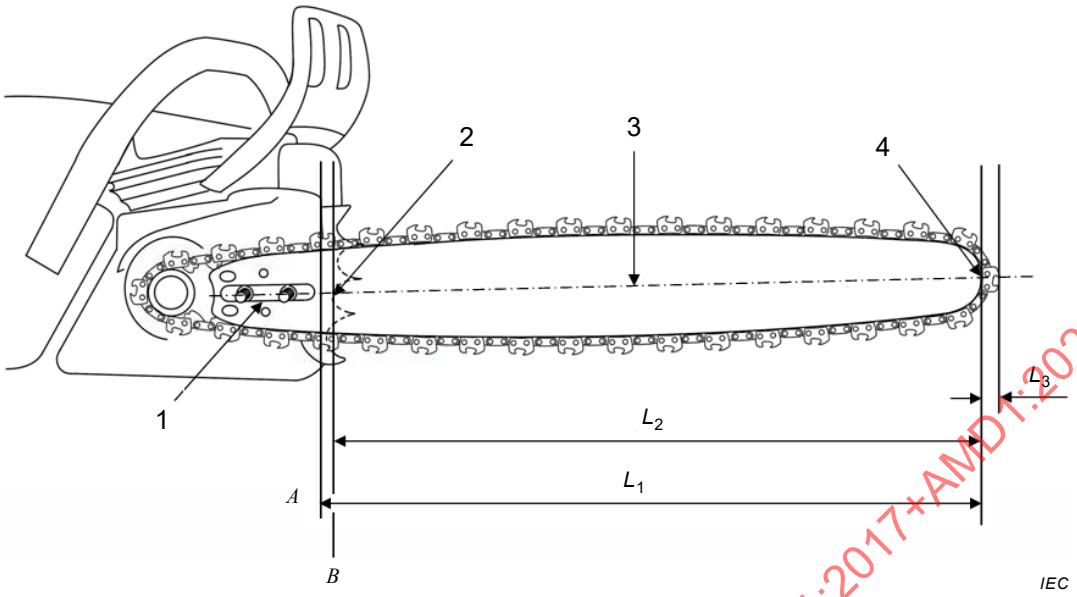
For optocouplers, the conditioning procedure is carried out at a temperature of 50 K in excess of the maximum temperature rise measured on the optocoupler during the tests of Clause 12 and Clause 18, the optocoupler being operated under the most onerous conditions which occur during these tests.



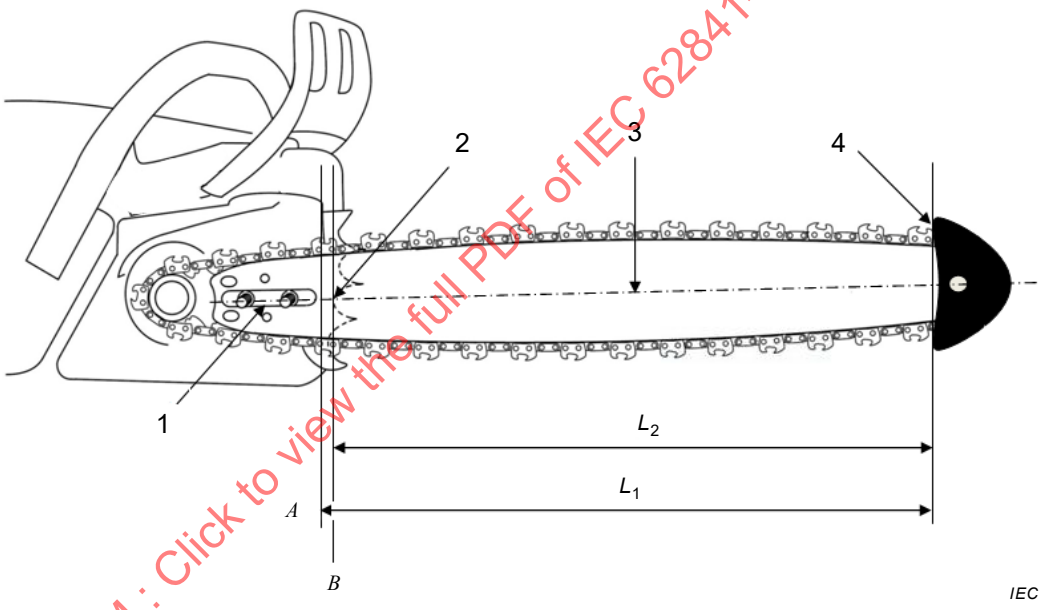
Key

1 **front hand guard**
2 **guide bar** cover
3 **spiked bumper**
4 **guide bar**
5 **saw chain**
6 **chain catcher**
7 **drive sprocket** cover
8 **rear hand guard**
9 **rear handle**
10 **power switch**
11 **front handle**
12 lock-off device
13 **operator presence sensor**

Figure 101 – Chain saw nomenclature



a) Chain saw without a bar tip guard



b) Chain saw with a bar tip guard

Key

1 **guide bar**

2 **spiked bumper**

3 centreline of **guide bar**

4 **bar tip guard**

A **chain saw** body

B root of the spike nearest the centreline of the **guide bar** on the **spiked bumper**

L_1 distance from *A* to the tip end of the **guide bar** (for **chain saws** with no **bar tip guard**) or the distance from *A* to the inside part of the **bar tip guard**

L_2 distance from *B* to the tip end of the **guide bar** (for **chain saws** with no **bar tip guard**) or the distance from *B* to the inside part of the **bar tip guard**

L_3 6 mm (approximation for the height of the **saw chain** cutter)

Figure 102 – Cutting length

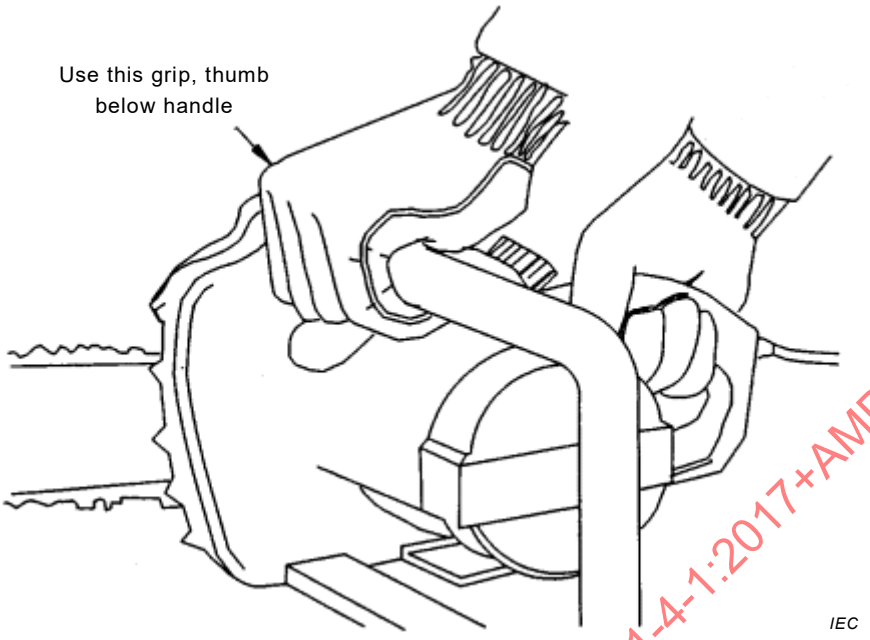


Figure 103 – Holding the chain saw

Dimensions in millimetres

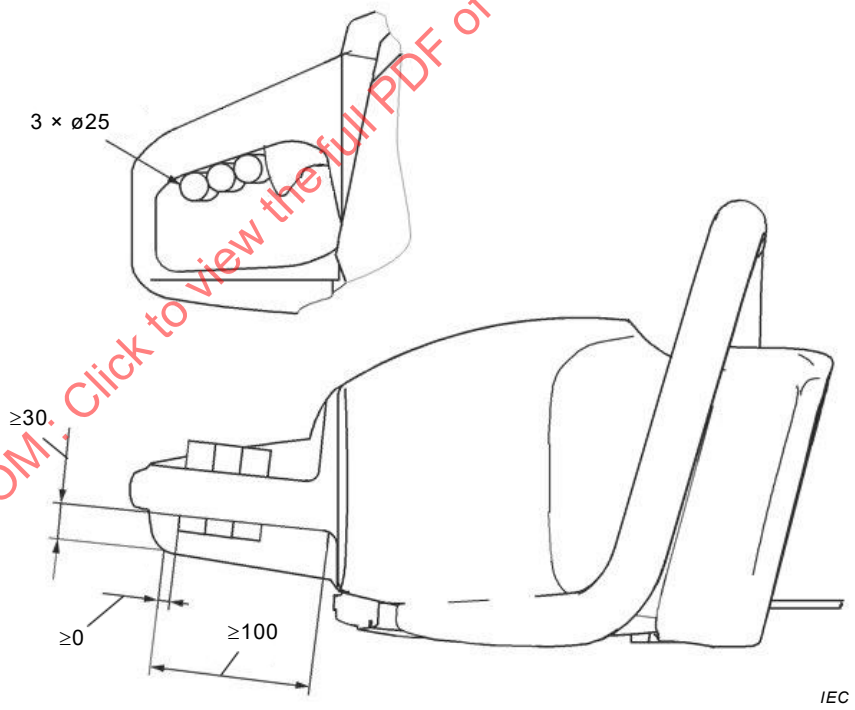
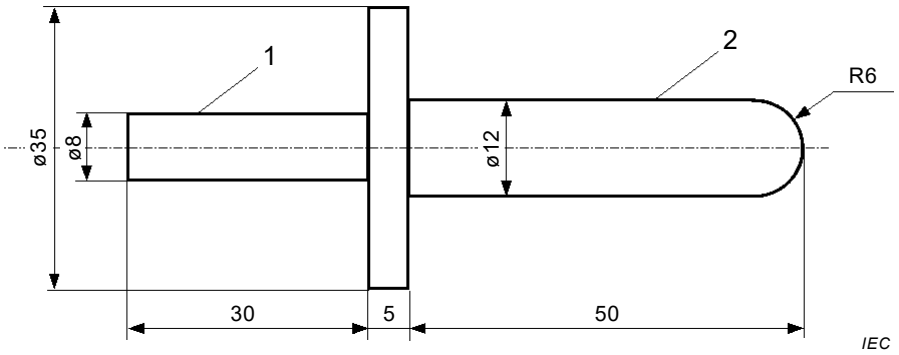


Figure 104 – Minimum rear hand guard dimensions

Dimensions in millimetres



Key

1 handle section

2 test section

Figure 105 – Straight test probe

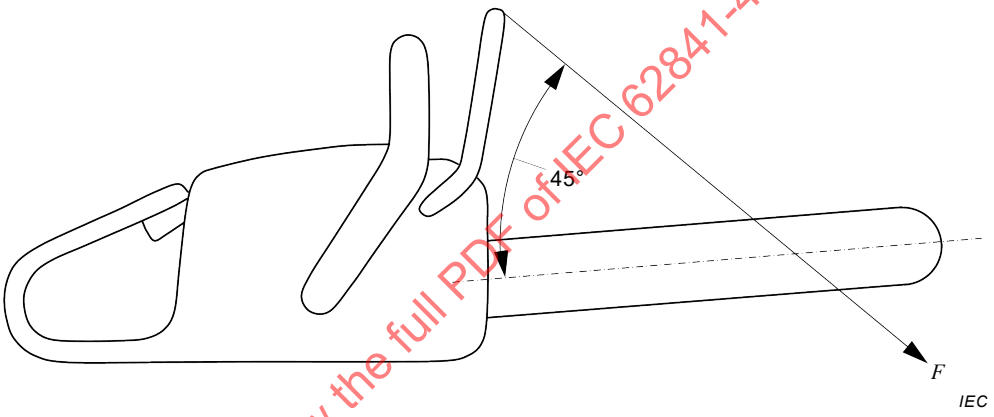
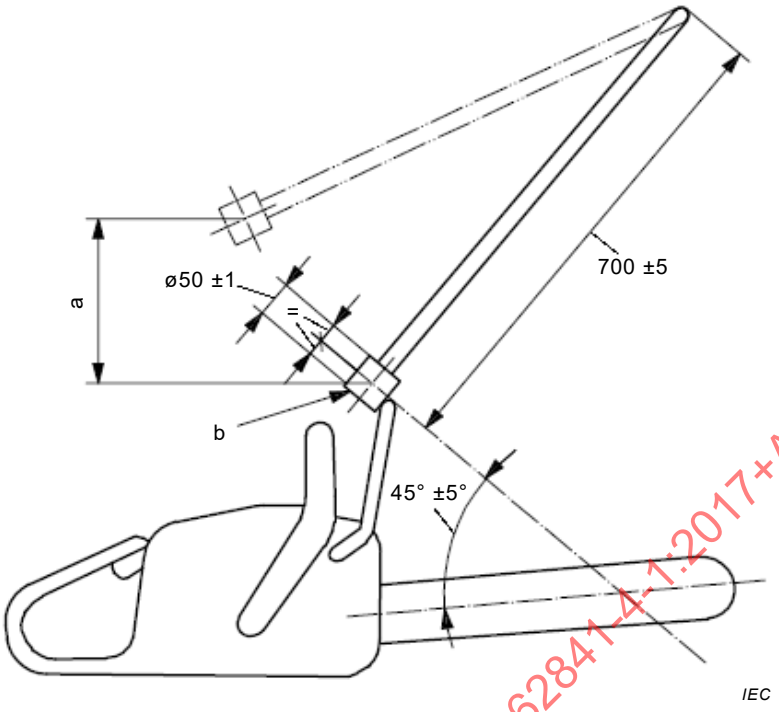


Figure 106 – Measuring direction of static activation force *F*

Dimensions in millimetres

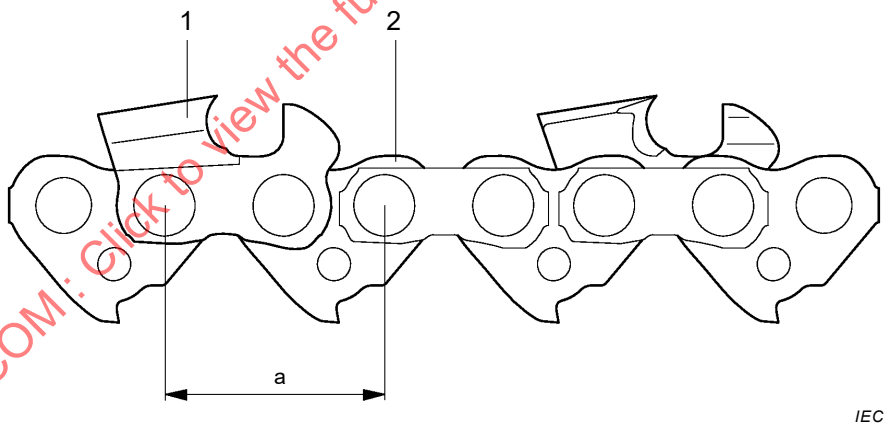


Key

a pendulum drop height

b sharp edges shall be chamfered

Figure 107 – Impact direction and pendulum



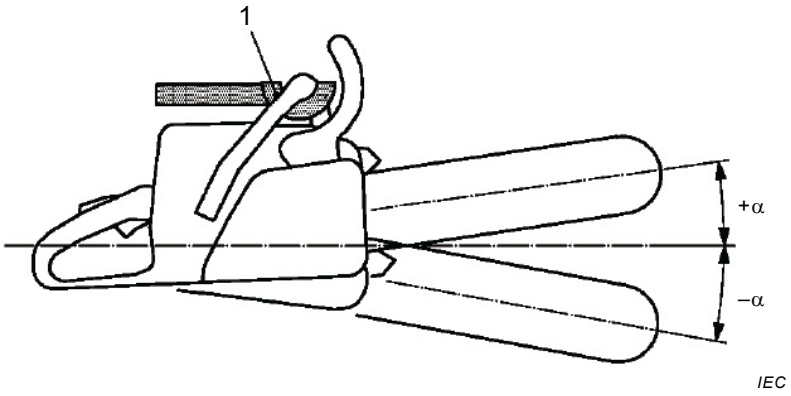
Key

1 cutter

2 drive link

a distance between drive links

Figure 108 – Saw chain drive link spacing



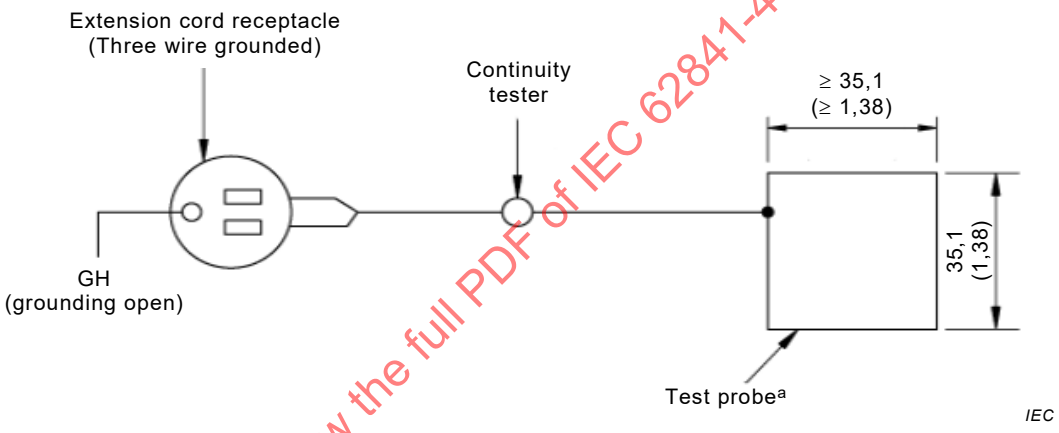
Key

1 segment of a ball bearing or equivalent

α angle between the centreline of the **guide bar** and the horizontal plane

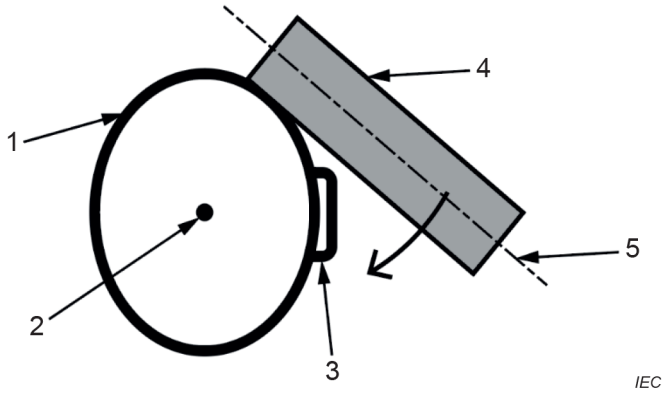
Figure 109 – Chain saw balance

Dimensions in millimetres (in inches)



[a] Test probe shall be made of 1,5 mm (0,006 inch)thick metal

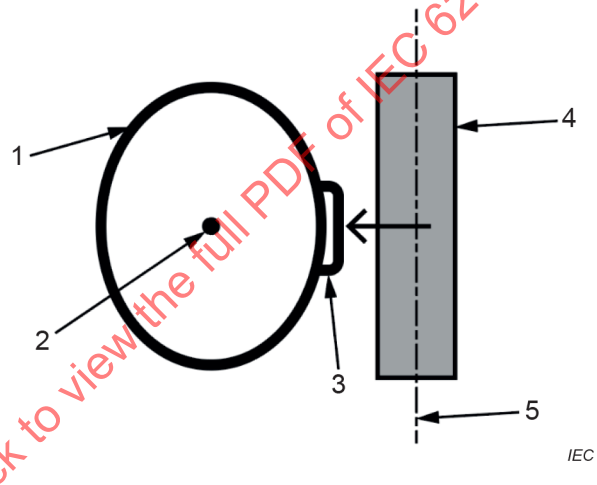
Figure 110 – Test assembly for accessibility of attachment plug blades



Key

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

Figure 111 – Application of steel rod when rotated around the rear handle



Key

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

Figure 112 – Application of steel rod when applied in the direction perpendicular to the rear handle axis

Annexes

The annexes of Part 1 are applicable except as follows:

Annex C
(normative)

Leakage current

Addition:

C.101 Measurement of insulation touch current for battery-operated machines

*The **insulation touch current** is measured for machines with a **working voltage** that is a **hazardous voltage**, where there is an **accessible part** or surface conductively connected to internal circuitry, other than through **protective impedance**.*

The network used for measurement as shown in Figure C.3 of Part 1 is modified such that the value of R_s is decreased to 375 Ω.

The test is conducted by using two foil probes connected to the inputs of the modified network of Figure C.3 of Part 1, each of 25 mm diameter consisting of metal foil backed by foam or other compliant medium such that the probe conforms to the contour of the surfaces being checked. The probes are positioned where a large potential difference is likely.

*In addition, the foil probing test shall be conducted between handles and grasping surfaces as identified in 8.14.2 b) 6) of Part 1 even if there are no **accessible parts** or surfaces connected to internal circuitry.*

*When probing **batteries**, the test is not conducted on terminals of **detachable battery packs** or **separable battery packs** that comply with the contact surface and voltage limitation in accordance with K.9.3.*

The measurement circuit of Figure C.3 of Part 1 shall have a measurement accuracy of 5 %, evaluated at d.c., 100 Hz, 1 kHz and 10 kHz.

*The **insulation touch current** limit (I_{limit}) in mA shall be calculated dependent on the value of the conductivity or resistivity of the water used for testing, as applicable.*

If the water conductivity is measured,

$I_{limit} = 1/25 \times \sigma$

with σ being the conductivity of the water in mS/m.

If the water resistivity is measured,

$I_{limit} = 40 / \rho$

with ρ being the resistivity of the water in Ωm.

NOTE 101 The value of I_{limit} is 2,0 mA if water with the highest conductivity or lowest resistivity is used for the test. Water with lower conductivity or higher resistivity will result in lower values of I_{limit}.

Annex I
(informative)

Measurement of noise and vibration emissions

NOTE In Europe (EN 62841-4-1), Annex I is normative.

I.2 Noise test code (grade 2)

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

I.2.2.1 General

Replacement:

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

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.

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 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;
– 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 –10 °C to 30 °C and the wind speed shall be less than 8 m/s and preferably 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 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;
– measurements shall be made using an integrating-averaging sound level meter as defined in IEC 61672-1; alternatively, instruments with the time-weighting characteristics "slow", as defined in IEC 61672-1, may be used.

The A-weighted sound power level, L_{WA}, shall be calculated in accordance with 8.6 of ISO 3744:2010, as follows:

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

with $\overline{L_{pfA}}$ determined from

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

where

$\overline{L_{pfA}}$ is the A-weighted surface sound pressure level according to ISO 3744;

$L'_{pA,i}$ 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;

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:

$$S = 2\pi r^2, \text{ in } m^2.$$

where the radius of the hemisphere, r = 4 m

so, from equation (I.101)

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

Table I.101 – Co-ordinates of microphone positions

Position No.	*x*	*y*	*z*
1	+ 0,65 *r*	+ 0,65 *r*	0,38 *r*
2	– 0,65 *r*	+ 0,65 *r*	0,38 *r*
3	– 0,65 *r*	– 0,65 *r*	0,38 *r*
4	+ 0,65 *r*	– 0,65 *r*	0,38 *r*
5	– 0,28 *r*	+ 0,65 *r*	0,71 *r*
6	+ 0,28 *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.

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 See Annex CC 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 ground at the centre of the test site shall be flat and have good sound-absorbing properties. The surface shall be either forest ground or grass, with the grass or other organic material having a height of (50 ± 20) mm.

I.2.3 Emission sound pressure level determination

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

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

I.2.3.3 *Replacement:*

The emission sound pressure for the **chain saw** shall be determined in accordance with I.2.3.1.

NOTE A **chain saw** is used in a similar way to hand-held tools, without a uniquely defined work station. The sound pressure at a distance of 1 m from the machine is applicable.

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

Replacement:

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

The machine under test shall be new and equipped with **attachments** which affect the acoustic properties, as specified in 8.14.2. Prior to commencing testing, the machine (including any required ancillary equipment) shall be set up in a stable condition as specified in 8.14.2.

The installation and mounting conditions for A-weighted sound power level measurement shall be in accordance with A.1 and A.2 of ISO 22868:2011, as far as applicable to electric **chain saws**.

The operator, if any, shall not be positioned directly between any microphone position and the machine.

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

I.2.5 Operating conditions

Replacement:

I.2.5.1 General

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

Measurements shall be carried out on a new machine.

Before starting the test, the machine shall be operated under the conditions of I.2.5.2 or I.2.5.3 for a period of at least 15 min.

Care shall be taken that the location of the test timber on its support does not adversely affect the result of the test.

I.2.5.2 Mains powered **chain saws** shall be tested at **rated voltage** using a **saw chain** and the longest **guide bar** as specified in 8.14.2 c) 101), under both of the following conditions:

– no-load speed, with the highest setting of the speed control, if any, without altering any hardware or software; and

– **rated input** or **rated current** using a water brake (or equivalent) as specified in A.2.1 of ISO 22868:2011.

Four consecutive sound power level tests at no-load speed and four at **rated input** or **rated current** shall be carried out. The resulting sound power level L_{WA} is calculated by:

$$L_{WA} = 10 \lg \frac{1}{2} \left[10^{0,1 L_{W1}} + 10^{0,1 L_{W2}} \right] \text{dB}$$

where

L_{W1} is the arithmetic mean, rounded to the nearest decibel, of the four sound power level tests performed at no-load speed; and

L_{W2} is the arithmetic mean, rounded to the nearest decibel, of the four sound power level tests performed at **rated input** or **rated current**.

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.2.5.3 Battery powered **chain saws** shall be tested with a fully charged battery using a **saw chain** and the longest **guide bar** combination(s) as specified in 8.14.2 c) 101), under both of the following conditions:

– no-load speed, with the highest setting of the speed control, if any, without altering any hardware or software; and

– **maximum speed** at no-load, in accordance with 5.101.

NOTE A water brake (or equivalent) as specified in A.2.1 of ISO 22868:2011 is not used for the test of I.2.5.3.

Four consecutive sound power level tests at no-load speed and four at **maximum speed** at no-load shall be carried out. The resulting sound power level L_{WA} is calculated by:

$$L_{WA} = 10 \lg \frac{1}{2} \left[10^{0,1 L_{W1}} + 10^{0,1 L_{W2}} \right] \text{dB}$$

where

L_{W1} is the arithmetic mean, rounded to the nearest decibel, of the four sound power level tests performed at no-load speed; and

L_{W2} is the arithmetic mean, rounded to the nearest decibel, of the four sound power level tests performed at **maximum speed** at no-load.

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:

Figure I.102 shows the positions of the transducers for **chain saws**.

I.3.5.3 Operating conditions

Addition:

Chain saws are tested under load observing the conditions shown in Table I.103.

Table I.103 – Test conditions

Material	Sound timber taken from freshly felled hardwood log, not seasoned or frozen. Width of the log to be trimmed to 75 % of the usable **cutting length** of the **guide bar**.
Orientation of workpiece	Log to be rigidly clamped horizontally so that the centre line of the log is at (800 ± 100) mm from the ground
Orientation of the **attachment**	The **chain saw** shall be held with the **guide bar** centreline horizontal and the **guide bar** plane vertical
Cutting **attachment**	The most unfavourable combination of a **saw chain** and the longest **guide bar** as specified in 8.14.2 c) 101)
Feed force	For mains powered **chain saws**, sufficient force to achieve **rated input** ± 10 %. For battery powered **chain saws**, sufficient force to achieve the fastest cut possible without overloading the machine.
Test cycle	Perform the measurements during crosscutting in a part substantially free of knots. The vibration measurements shall be taken in the middle third through the log with the complete **guide bar** tip free outside the log. There shall be no contact between the test timber and the motor part of the machine or the **spiked bumper**, if any. Only the **guide bar** and the **saw chain** shall come into contact with the test timber.

I.3.6.1 *Addition:*

The vibration data for each test shall be obtained from at least four measurements with a duration of at least 2 s each, totalling to at least 20 s. After each measurement, the **chain saw** shall be switched off.

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.

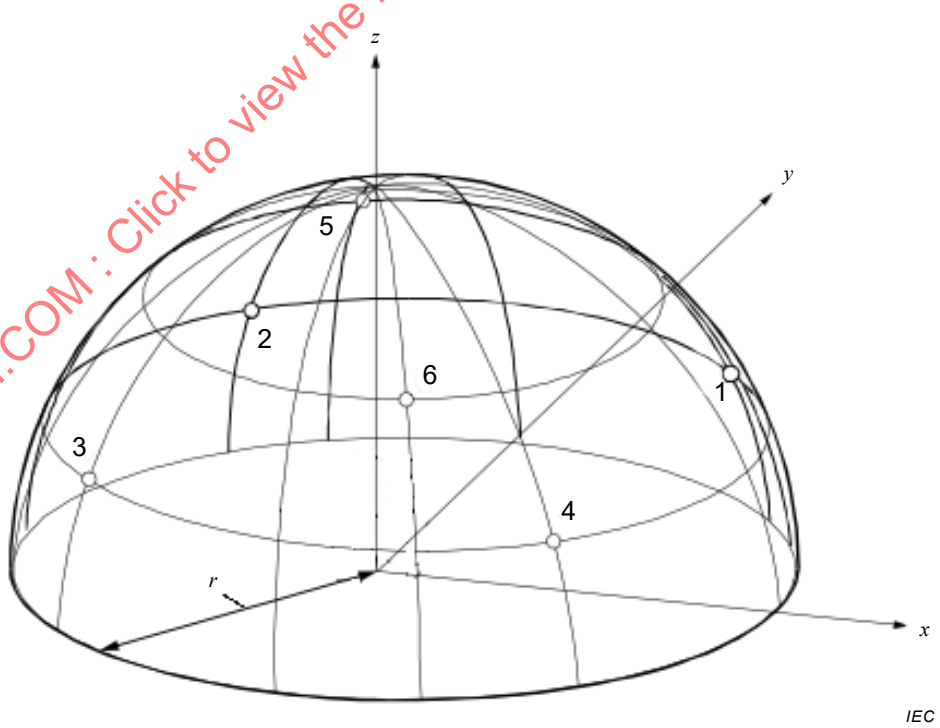


Figure I.101 – Microphone positions on the hemisphere (see Table I.101)

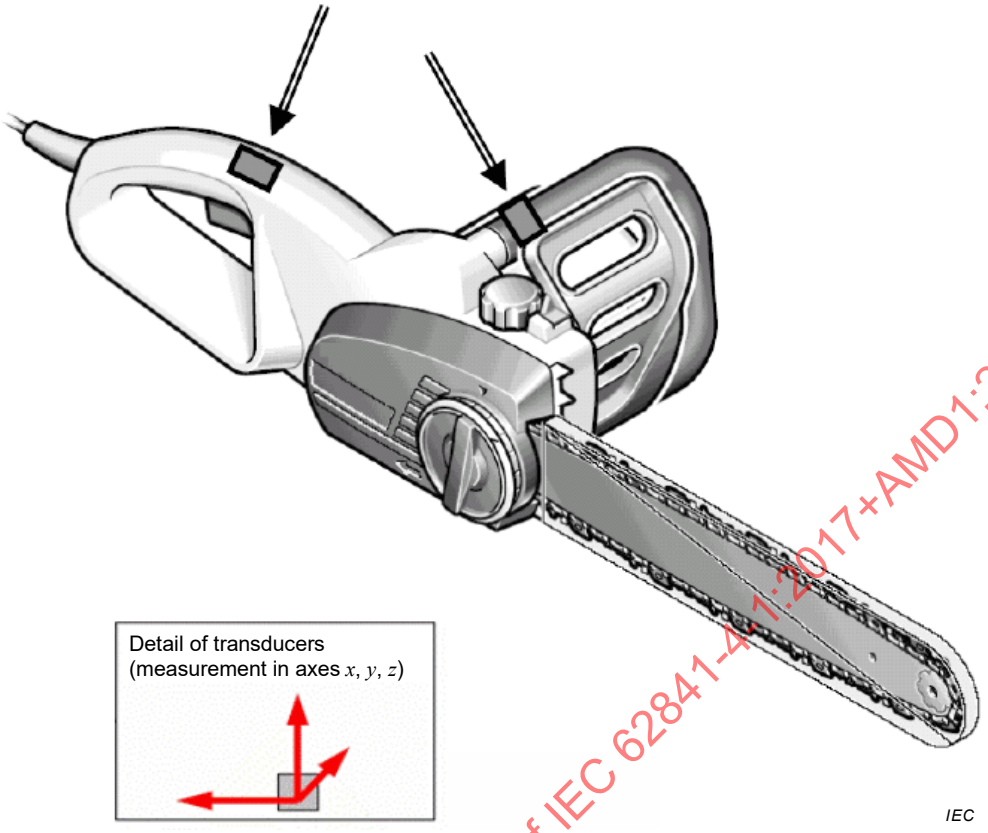


Figure I.102 – Positions of transducers for chain saws

Annex K
(normative)

Battery tools and battery packs

All clauses of the main body of this Part 4-1 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 4-1 unless otherwise specified.

K.1 Scope

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

Addition:

This standard applies to **chain saws** for cutting wood and designed for use by one person. This standard does not cover **chain saws** designed for use in conjunction with a guide-plate and riving knife or in any other way such as with a support or as a stationary or transportable machine.

This standard does not apply to

– **chain saws** for tree service as defined in ISO 11681-2; or
– pole-mounted pruners.

NOTE 101 Pole-mounted pruners will be covered by a future part of IEC 62841.

NOTE 102 In Europe (EN 62841-4-1), this annex does not apply to **chain saws** equipped with **integral batteries** and with a **maximum speed** of the **saw chain** exceeding 5 m/s.

The **chain saws** covered by this standard are designed only to be operated with the right hand on the **rear handle** and the left hand on the **front handle.**

K.3 Terms and definitions

Replacement of Definition 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 machine is supplied by (a) **fully charged battery**(**ies**) and operating at no-load, or with the machine in the "off" condition, whichever is greater

Replacement of Definition K.3.211 of Part 1:

K.3.211
hazardous voltage
voltage between parts

– for machines where use in rain, cleaning with low-pressure water and immersion in water to a depth of up to 1 m for cleaning is permitted, having
  - an average value exceeding 30 V d.c.; or
  - a peak value exceeding 21,2 V when the peak-to-peak ripple exceeds 10 % of the average value; or
– for other machines, having

- an average value exceeding 60 V d.c.; or
- a peak value exceeding 42,4 V when the peak-to-peak ripple exceeds 10 % of the average value

Note 301 to entry: For machines classified in accordance with K.7.2 as "Use in rain is permitted", "Cleaning with low-pressure water is permitted" or "Immersion in water to a depth of up to 1 m for cleaning is permitted", it is assumed that the operator's hands are wet during machine handling.

Add the following new definitions:

K.3.301
insulation touch current
current which flows through a person upon contact with **accessible parts** of a **battery-operated machine** with a **working voltage** that is a **hazardous voltage**

K.3.302
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.7.2 Chain saws shall be classified in accordance with the following categories with respect to moisture resistance:

– exposure to rain, cleaning with water and immersion in water are not permitted; or
– one or more of the following categories:
  - "Use in rain is permitted"; or
  - "Cleaning with low-pressure water is permitted"; or
  - "Immersion in water to a depth of up to 1 m for cleaning is permitted".

Compliance is checked by inspection and by the relevant tests, as applicable.

K.7.301 Detachable battery packs and **separable battery packs** shall be of one of the following categories with respect to moisture resistance:

– exposure to rain, cleaning with water and immersion in water are not permitted; or
– one or more of the following categories:
  - "Use in rain is permitted"; or
  - "Cleaning with low pressure water is permitted"; or
  - "Immersion in water to a depth of up to 1 m for cleaning is permitted".

Compliance is checked by inspection and by the relevant tests, as applicable.

K.8.1 This subclause of Part 4-1 is not applicable.

K.8.1.101 Chain saws, **detachable battery packs** and **separable battery packs** shall not be marked with an IPX1, IPX2, IPX3, IPX6, IPX8 or IPX9 rating.

Compliance is checked by inspection.

K.8.1.301 Chain saws shall be marked in accordance with their classification in K.7.2 as indicated in Table K.301.

Compliance is checked by inspection.

Table K.301 – Chain saw moisture resistance classification and marking

Moisture resistance classification	Required marking	Additional optional marking
Exposure to rain, cleaning with water and immersion in water are not permitted	In accordance with K.8.2	Markings prohibiting exposure to rain, cleaning with water or immersion in water are permitted. No additional markings related to moisture resistance classification, including IP markings, are permitted.
Use in rain is permitted	None	"OK to use in rain", the sign shown in Annex DD, "IPX4M", or any combination thereof. See NOTE 301 below.
Cleaning with low-pressure water is permitted	"May wash with water as indicated in instruction manual" or a symbol that is described in the instruction manual See NOTE 302 below.	IPX5S
Immersion in water up to a depth of 1 m for cleaning is permitted	"May immerse in water to a depth of up to 1 m for cleaning" or a symbol that is described in the instruction manual See NOTE 303 below.	IPX7S

NOTE 301 In Canada and the United States of America, for machines that are classified as "Use in rain is permitted" and where it is possible to fit a manufacturer-recommended **detachable battery pack** or a **separable battery pack** to the machine that does not fulfil the requirements of K.14.2.302.6, the additional optional marking on the machine must be one of the following:

– "OK to use in rain only when used with battery _____", where "_____" is replaced by an indication of the appropriate **battery** pack(s) for use, such as by a catalog number, series identification or the equivalent; or

– "OK to use in rain only when used with a battery marked "OK to use in rain"; or

– "OK to use in rain only when used with a battery marked  "; or

– "OK to use in rain only when used with a battery marked "IPX4".

The text "OK to use in rain" in the markings above can be replaced by "IPX4M" or "  ".

In Canada, the equivalent French wording of the above warnings is as follows:

– "OK à utiliser sous la pluie uniquement lorsqu'il est utilisé avec la batterie _____", où "_____" est remplacé par une indication du ou des blocs-batteries appropriés à utiliser, comme par un numéro de catalogue, une identification de série ou l'équivalent; or

– "OK pour une utilisation sous la pluie uniquement lorsqu'il est utilisé avec une batterie marquée "OK pour une utilisation sous la pluie"; or

– "OK à utiliser sous la pluie uniquement lorsqu'il est utilisé avec une batterie marquée  "; or

– "OK à utiliser sous la pluie uniquement lorsqu'il est utilisé avec une batterie marquée "IPX4".

"OK à utiliser sous la pluie" dans les marquages ci-dessus peut être remplacé par "IPX4M" or "  ".

NOTE 302 In Canada and the United States of America, for machines

– that are classified as "Cleaning with low-pressure water is permitted"; and

– where the manufacturer recommends cleaning the machine with the **battery** pack fitted; and

– where it is possible to fit a manufacturer-recommended **detachable battery pack** or a **separable battery pack** to the machine that does not fulfil the requirements of K.14.2.302.6,

the additional optional marking on the machine must be one of the following:

– "May wash with water as indicated in instruction manual only when used with battery _____", where "_____" is replaced by an indication of the appropriate **battery** pack(s) for use, such as by a catalog number, series identification or the equivalent; or

– "May wash with water as indicated in instruction manual only when used with a battery marked "May wash with water as indicated in instruction manual"; or

– "May wash with water as indicated in instruction manual only when used with a battery marked _____", where "_____" is replaced by a symbol that is described in the instruction manual.

In Canada, the equivalent French wording of the additional optional marking on the machine is as follows:

– "Peut être lavé à l'eau comme indiqué dans le manuel d'instructions uniquement lorsqu'il est utilisé avec la batterie _____", où "_____" est remplacé par une indication du ou des blocs-batteries appropriés à utiliser, par exemple par un numéro de catalogue, une identification de série ou l'équivalent; or

– "Peut se laver à l'eau comme indiqué dans le manuel d'instructions uniquement lorsqu'il est utilisé avec une batterie marquée "Peut se laver avec de l'eau comme indiqué dans le manuel d'instructions"; or

– "Peut être lavé à l'eau comme indiqué dans le manuel d'instructions uniquement lorsqu'il est utilisé avec une batterie marquée _____", où "_____" est remplacé par un symbole décrit dans le manuel d'instructions.

NOTE 303 In Canada and the United States of America, for machines

– that are classified as "Immersion in water up to a depth of 1 m for cleaning is permitted"; and

– where the manufacturer recommends immersing the machine with the **battery** pack fitted; and

– where it is possible to fit a manufacturer-recommended **detachable battery pack** or a **separable battery pack** to the machine that does not fulfil the requirements of K.14.2.302.6,

the additional optional marking on the machine must be one of the following:

– "May immerse in water to a depth of up to 1 m for cleaning only when used with battery _____", where "_____" is replaced by an indication of the appropriate **battery** pack(s) for use, such as by a catalog number, series identification or the equivalent; or

– "May immerse in water to a depth of up to 1 m for cleaning only when used with a battery marked "May immerse in water to a depth of up to 1 m for cleaning"; or

– "May immerse in water to a depth of up to 1 m for cleaning only when used with a battery marked _____", where "_____" is replaced by a symbol that is described in the instruction manual.

In Canada, the equivalent French wording of the additional optional marking on the machine is as follows:

– "Peut être immergé dans l'eau jusqu'à une profondeur de 1 m pour le nettoyage uniquement lorsqu'il est utilisé avec la batterie _____", où "_____" est remplacé par une indication du ou des blocs-batteries appropriés à utiliser, par exemple par un numéro de catalogue, une identification de série ou l'équivalent; or

– "Peut être immergé dans l'eau jusqu'à une profondeur de 1 m pour le nettoyage uniquement lorsqu'il est utilisé avec une batterie marquée "Peut être immergé dans l'eau jusqu'à une profondeur de 1 m pour le nettoyage"; or

– "Peut être immergé dans l'eau jusqu'à une profondeur de 1 m pour le nettoyage uniquement lorsqu'il est utilisé avec une batterie marquée _____", où "_____" est remplacé par un symbole décrit dans le manuel d'instructions.

K.8.1.302 Detachable battery packs and **separable battery packs** may be marked in accordance with their classification in K.7.301 as indicated in Table K.302.

Compliance is checked by inspection.

Table K.302 – Battery pack moisture resistance classification and marking

Moisture resistance classification	Required marking (if marked)	Additional optional marking (if marked)
Exposure to rain, cleaning with water and immersion in water are not permitted	None	Markings prohibiting exposure to rain, cleaning with water or immersion in water are permitted. No additional markings related to moisture resistance classification, including IP markings, are permitted.
Use in rain is permitted	None	"OK to use in rain", the sign shown in Annex DD, "IPX4", or any combination thereof.
Cleaning with low-pressure water is permitted	"May wash with water as indicated in instruction manual" or a symbol that is described in the instruction manual	IPX5
Immersion in water up to a depth of 1 m for cleaning is permitted	"May immerse in water to a depth of up to 1 m for cleaning" or a symbol that is described in the instruction manual	IPX7

K.8.2 *Replacement of the third dashed item:*

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

The marking above is not required if the **chain saw** is classified as one of the following in accordance with K.7.2:

- "Use in rain is permitted";
- "Cleaning with low-pressure water is permitted"; or
- "Immersion in water up to a depth of 1 m for cleaning is permitted".

NOTE 301 See Table K.301.

K.8.14 *Addition:*

An explanation of the symbols required by this document and used on machines, **detachable battery packs** or **separable battery packs** shall be provided in either the instruction manual or the safety instructions.

Where IP markings are used, their meaning in relation to the permissible class of exposure to water shall be explained.

K.8.14.1.1 Items 2) c) and 4) h) of Part 1 are not applicable.

K.8.14.1.101 Safety instructions for chain saws

Replacement of item 1) c):

c) **Hold the chain saw by insulated gripping surfaces only, because the saw chain may contact hidden wiring.** *Saw chains contacting a "live" wire may make exposed metal parts of the chain saw "live'" and could give the operator an electric shock.*

K.8.14.1.301 General chain saw safety warnings

a) **Follow all instructions when clearing jammed material, storing or servicing the chain saw. Make sure the switch is off and the battery pack is removed.** *Unexpected actuation of the chain saw while clearing jammed material or servicing may result in serious personal injury.*

NOTE 1 The above warning is used for machines with ~~separable batteries or detachable batteries~~ **separable battery packs** or **detachable battery packs**.

b) **Follow all instructions when clearing jammed material, storing or servicing the chain saw. Make sure the switch is off and the lock-off is in the locked position.** *Unexpected actuation of the chain saw while clearing jammed material or servicing may result in serious personal injury.*

NOTE 2 The above warning is used for machines with **integral batteries**.

c) **Do not expose the machine to rain or wet conditions**. *Water entering the machine will increase the risk of electric shock*.

NOTE 301 The warning in item c) above is omitted if the machine is classified as "Use in rain is permitted", "Cleaning with low-pressure water is permitted" or "Immersion in water to a depth of up to 1 m for cleaning is permitted" in accordance with K.7.2, including the case where there is no optional marking on the machine in accordance with Table K.301.

d) **Do not expose batteries to rain or wet conditions**. *Water entering a battery will increase the risk of electric shock and fire.*

NOTE 302 The warning in item d) above is omitted if the **battery** is classified as "Use in rain is permitted", "Cleaning with low-pressure water is permitted" or "Immersion in water to a depth of up to 1 m for cleaning is permitted" in accordance with K.7.301, including the case where there is no optional marking on the **battery** in accordance with Table K.302.

e) **Keep handles and grasping surfaces dry, clean and free from oil and grease**. *Slippery handles and grasping surfaces do not allow for safe handling and control of the machine in unexpected situations.*

NOTE 303 The text "dry," in item e) above is omitted if the machine is classified as "Use in rain is permitted" in accordance with K.7.2.

K.8.14.2 b) Items 101) and 102) in Part 4-1 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.

302) Information that the **chain saw**, **detachable battery pack**(**s**) or **separable battery pack**(**s**) is permitted to be used in rain

– if the **chain saw**, **detachable battery pack** or **separable battery pack** is classified as "Use in rain is permitted" in accordance with K.7.2 or K.7.301, as applicable; or

– if the **chain saw** is classified as "Use in rain permitted" in accordance with K.7.2 and the **detachable battery pack** or **separable battery pack** is classified as "Exposure to rain, cleaning with water and immersion in water are not permitted" in accordance with K.7.301, provided the requirements of K.14.2.302.6 are fulfilled;

303) If the **chain saw** and **battery** pack are intended for use in rain, instructions for safe use whilst operating the **chain saw** in the rain, such as wearing appropriate apparel, maintaining good visibility and taking extra caution to maintain footing and control of the **chain saw**;

304) Instruction indicating that a **detachable battery pack** or a **separable battery pack** should not be removed from the machine in the rain if the **detachable battery pack** or **separable battery pack** is classified as "Exposure to rain, cleaning with water and immersion in water are not permitted" in accordance with K.7.301;

305) For **chain saws** classified in K.7.2 as "Use in rain is permitted", instruction to only use appropriate **detachable battery packs** or **separable battery packs**, when using the **chain saw** in rain.

K.8.14.2 c) *Addition:*

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

302) For **chain saws**, **detachable battery packs** or **separable battery packs** classified as "Use in rain is permitted", "Cleaning with low-pressure water is permitted" or "immersion in water to a depth of up to 1 m for cleaning is permitted" in accordance with K.7.2 or K.7.301, as applicable, instructions on how to maintain and store the **chain saw**, **detachable battery pack** or **separable battery pack** after having been exposed to water;

303) For **chain saws**, **detachable battery packs** or **separable battery packs** classified as "Cleaning with low-pressure water is permitted" in accordance with K.7.2 or K.7.301, as applicable, information that cleaning the **chain saw**, **detachable battery pack** or **separable battery pack** with low-pressure water is permitted, including instructions on how to clean the **chain saw**, **detachable battery pack** or **separable battery pack** with low-pressure water;

304) For **chain saws**, **detachable battery packs** or **separable battery packs** classified as "Immersion in water to a depth of up to 1 m for cleaning is permitted" in accordance with K.7.2 or K.7.301, as applicable, information that immersing the **chain saw**, **detachable battery pack** or **separable battery pack** in water to a depth of up to 1 m for cleaning is permitted, including instructions on how to immerse the **chain saw**, **detachable battery pack** or **separable battery pack** in water for cleaning;

305) For **chain saws** classified in K.7.2 as "Cleaning with low-pressure water is permitted", instructions indicating the appropriate **battery** packs for use, such as by a catalogue number, series identification or the equivalent, when cleaning the **chain saw** with low-pressure water. This instruction may be omitted if the **battery** pack is intended to be removed before cleaning;

306) For **chain saws** classified in K.7.2 as "Immersion in water up to a depth of 1 m for cleaning is permitted", instructions indicating the appropriate **battery** packs for use, such as by a catalogue number, series identification or the equivalent, when immersing the **chain saw** in water up to a depth of 1 m for cleaning. This instruction may be omitted if the **battery** pack is intended to be removed before immersing the **chain saw** in water.

K.8.14.3 If information about the mass or weight of the machine is provided, it shall be the mass of the machine without the **saw chain, guide bar**, guide bar cover, oil, **battery** (except for **integral batteries**) and optional accessories.

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

K.9.3 *Replacement of Part 1:*

It shall not be possible to simultaneously access two conductive **accessible parts** with a **working voltage** between them that is a **hazardous voltage**, unless

– they are provided with **protective impedance**; or

– the conductive **accessible parts** are terminals and the contact area of each individual terminal of the machine, **detachable battery packs** or **separable battery packs** is not greater than the values specified in Table K.303 and the voltage between them does not exceed 60 V d.c.

NOTE 1 Terminals of the machine, **detachable battery packs** and **separable battery packs**, that are accessible while the **battery** is detached from the machine, have reduced likelihood for operator contact and are not exposed during machine operation. In addition, limited contact areas increase skin contact resistance.

For intermediate **working voltages** above 30 V d.c. and below 60 V d.c., the permissible contact areas specified in Table K.303 may be determined by linear interpolation.

NOTE 2 An example of linear interpolation is as follows. For a **working voltage** of 45 V d.c., the permissible contact area for terminals would be 114 + (164 − 114)/2 = 139 mm^2.

For terminals that are tabs with two accessible surfaces at opposite sides, the permissible contact area specified in Table K.303 applies to one side of the tab.

Table K.303 – Permissible contact area for terminals

DC working voltage V	Permissible contact area mm^2
30	244[a]
> 30 ≤ 40	164
> 40 ≤ 50	114
> 50 ≤ 60	86

[a] In wet conditions, 30 V or less is not a **hazardous voltage**, but the permissible contact area for a d.c. **working voltage** of 30 V is listed in this table in order to permit linear interpolation for values > 30 V and ≤ 40 V.

In the case of **protective impedance**, the short circuit current between the parts shall not exceed an average value of 2 mA d.c. or 0,7 mA peak when the peak-to-peak ripple exceeds 10 % of the average value, and there shall not be more than 0,1 µF capacitance directly between the parts.

Compliance is checked by inspection and by measurement.

Accessibility is checked by applying test probe B and test probe 18 of IEC 61032:1997 to each conductive part as specified below.

*For machines, **detachable battery packs** and **separable battery packs**, test probe B of IEC 61032:1997 is applied with a force not exceeding 5 N through openings to any depth that the test probe will permit, and it is rotated or angled before, during and after insertion to any position.*

If the opening does not allow the entry of test probe B of IEC 61032:1997, a rigid test probe with the dimensions of the test probe B of IEC 61032:1997, but without any articulation, is used, but the force on the probe is increased to 20 N and then the test with the articulated test probe B of IEC 61032:1997 is repeated.

*Contact with the test probe(s) is determined with all **detachable parts** removed and the machine operated in any possible position of **normal use**.*

*Lamps located behind detachable covers are not removed, provided the lamp may be de-energized by means of a user operable plug, **battery** pack disconnection or a switch.*

*In addition, for **detachable battery packs** or **separable battery packs**, test probe 18 of IEC 61032:1997 is applied with a force not exceeding 1 N to the **battery** pack, with the **battery** pack being in every possible position. The test probe is applied through openings to any depth that the test probe will permit and is rotated or angled before, during and after insertion to any position. If the opening does not allow the entry of the test probe, the force on the test probe in the straight position is increased to 10 N. If the test probe then enters the opening, the test is repeated with the test probe in the angled position. During the tests, the **detachable battery pack** or **separable battery pack** shall be fully assembled as in **normal use** without any parts removed.*

K.12.2.1 This subclause of Part 4-1 is not applicable.

K.14 Moisture resistance

~~This clause of Part 4-1 is not applicable, except as follows:~~

~~**K.14.301 Battery-powered chain saw moisture resistance**~~

~~**K.14.301.1** The enclosure of the machine shall provide the degree of protection against moisture in accordance with the classification of the machine. This does not apply to **saw chain** lubrication tanks and lubrication systems intended for use with oil as specified in 8.14.2.~~

~~*Compliance is checked by the appropriate treatment specified in K.14.301.3, with the machine conditions 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. The machine is switched off during the test.*~~

~~*The machine is placed in its normal rest position on a perforated turntable. The turntable is then turned continuously at approximately 1 rev/min during the test.*~~

~~*Electrical components, covers and other **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.*~~

~~**K.14.301.3** *Machines other than IPX0 are subjected to tests of IEC 60529 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.*~~

~~*Immediately after the appropriate treatment, the machine shall show that there is no trace of water on insulation which could result in a reduction of **creepage distances** and **clearances** which impairs compliance with K.28.1.*~~

K.14.1 This subclause is not applicable.

K.14.2 Moisture resistance testing

K.14.2.301 General

The construction of the **chain saw**, **detachable battery pack** or **separable battery pack** shall provide the degree of protection against moisture in accordance with the classification of

– the **chain saw** in accordance with K.7.2; and

– any **detachable battery pack** or **separable battery pack** in accordance with K.7.301.

Compliance is checked by the requirements of

– *K.14.2.302 for **chain saws**; and*
– *K.14.2.303 for **detachable battery packs** or **separable battery packs**.*

K.14.2.302 Chain saw moisture resistance

K.14.2.302.1 A combination of the **chain saw** and a **battery** shall be designed to limit risks due to ingress of water anticipated in accordance with the moisture resistance classification in K.7.2.

This requirement is not applicable for **chain saws** classified as "Exposure to rain, cleaning with water and immersion in water are not permitted" in accordance with K.7.2.

Compliance is checked by the tests of K.14.2.302.2 to K.14.2.302.6.

K.14.2.302.2 *The test is conducted with the machine configured for use in accordance with 8.14.2, except that the **saw chain** lubrication tank shall not be filled with oil.*

*The combination of the **chain saw** and **battery** is subjected to tests of IEC 60529:1989, IEC 60529:1989/AMD1:1999 and IEC 60529:1989/AMD2:2013 using water having a conductivity, σ, of (26,9 to 50) mS/m or a resistivity, ρ, of (37,1 to 20) Ωm as follows:*

– *__chain saws__ classified as "Use in rain is permitted" in accordance with K.7.2 are subjected to the test described in IEC 60529:1989, 14.2.4a), with the **saw chain** removed and with the **chain saw** operating at **maximum speed** when the **detachable battery pack** or **separable battery pack** is connected. For this test, the machine is placed and secured in its normal rest position on a perforated turntable. The turntable is then turned continuously at (1,0 ± 0,1) r/min during the test;*
– *__chain saws__ classified as "Cleaning with low-pressure water is permitted" in accordance with K.7.2 are subjected to the test described in IEC 60529:1989, 14.2.5, with the **chain saw** not operating. The **detachable battery pack** or **separable battery pack** is not connected to the **chain saw** if the **detachable battery pack** or **separable battery pack** is intended to be removed before cleaning in accordance with K.8.14.2 c) 303);*
– *__chain saws__ classified as "Immersion in water up to a depth of 1 m for cleaning is permitted" in accordance with K.7.2 are subjected to the test described in IEC 60529:1989, 14.2.7, with the **chain saw** not operating. The **detachable battery pack** or **separable battery pack** is not connected to the **chain saw** if the **detachable battery pack** or **separable battery pack** is intended to be removed before immersion in accordance with K.8.14.2 c) 304).*

K.14.2.302.3 *Except as specified below, prior to the conditioning of K.14.2.302.2, **detachable parts** are removed and subjected to the relevant treatment specified in K.14.2.302.2 with the **chain saw**, if this would result in a more unfavourable condition. Air filters are not removed. For **chain saws** classified as "Cleaning with low-pressure water is permitted" or "Immersion in water up to a depth of 1 m for cleaning is permitted" in accordance with K.7.2, **detachable parts** are not removed if they are required to be fitted in accordance with K.8.14.2 c) 305) or K.8.14.2 c) 306), as applicable. Movable covers that are non-**detachable parts** and are not self-restoring are placed in the most unfavourable position.*

*For **chain saws** classified as "Use in rain is permitted", "Cleaning with low-pressure water is permitted" or "Immersion in water to a depth of up to 1 m for cleaning is permitted", **detachable parts** are not removed and movable covers that are non-**detachable parts** are not opened if they are required to be fitted in accordance with K.8.14.2 b) 302), K.8.14.2 c) 303) or K.8.14.2 c) 304), as applicable, prior to the conditioning of K.14.2.302.2.*

*During the conditioning of K.14.2.302.2, the **chain saw** is first tested with any **detachable battery pack** or **separable battery pack** in accordance with Part 1, Subclause K.8.14.2 e) 2) connected, if applicable in accordance with K.14.2.302.2, and then again with the **detachable***

__battery__ pack or __separable battery pack__ removed. Any __detachable battery pack__ or __separable battery pack__ is not separately subjected to the conditioning of K.14.2.302.2.

For tests with the __detachable battery pack__ or __separable battery pack__ connected, after conditioning the __chain saw__ with the __detachable battery pack__ or __separable battery pack__, the __power switch__ shall still turn the __chain saw__ off and on. Afterwards, the test of K.14.2.302.5 is conducted, if applicable. Upon inspection, which shall be completed within 1 h after conditioning, the __chain saw__ and __detachable battery pack__ or __separable battery pack__ shall show there is no trace of water as specified in a) and b) below. Any water on

– *lacquered or enamelled windings; or*
– *external terminals or the insulation between them*

shall be ignored.

For tests with the __detachable battery pack__ or __separable battery pack__ not connected, after conditioning the __chain saw__, a __detachable battery pack__ or __separable battery pack__ is connected and the __power switch__ shall still turn the __chain saw__ on and off. Afterwards, the test of K.14.2.302.5 is conducted, if applicable. Upon inspection, which shall be completed within 1 h after conditioning, the __chain saw__ shall show there is no trace of water as specified in a) and b) below. Any water on

– *lacquered or enamelled windings; or*
– *external terminals or the insulation between them*

shall be ignored.

a) *On insulation or uninsulated current carrying parts which could result in a reduction of __clearances__ or __creepage distances__ between bare conductors below the values specified in Part 1, Clause K.28, where shorting of the conductors would result in the risk of fire or loss of an __SCF__. In order to evaluate the risk of fire due to traces of water on insulation, the test of Part 1, Subclause 18.6.1, item a), shall be applied between the bare conductors with a resistance not exceeding 10 mΩ. The test of Part 1, 18.6.1 item a), if applicable, is not required to be completed within 1 h after conditioning; and*
b) *On any __electronic components__ or __electronic circuits__ that can affect the correct functioning of any relevant __SCF__.*

K.14.2.302.4 *With respect to K.14.2.302.3 items a) and b), if water is present on insulating materials, encapsulation and coatings, those materials and coatings shall not be porous, or retain liquids, such as a fibrous or open cell material or be a material subject to decay, such as wood, cloth or natural rubber, taking into account the liquid to which the insulating material is exposed. Encapsulation with a minimum thickness of 0,5 mm, PVC, cross-linked polymers, thermoset materials, thermoplastic resins used for moulded plastic parts, closed cell foam materials and coatings complying with IEC 60664-3:2016 are considered to be acceptable for exposure to water.*

K.14.2.302.5 *After the conditioning of K.14.2.302.2, __chain saws__, __detachable battery packs__ or __separable battery packs__ containing a __working voltage(s)__ that is a __hazardous voltage__, where there is an __accessible part__ or surface connected to internal circuitry other than through __protective impedance__, shall comply with the test of Clause C.101.*

Prior to the test, excess water is drained from the machine and __battery__ by turning them in different orthogonal directions.

The machine is tested in operational condition with the __detachable battery pack__ fitted or the __separable battery pack__ connected, as applicable. The motor may be running or not running, whichever result is more unfavourable. If the __detachable battery pack__ or __separable battery pack__ has come into contact with water during the conditioning, the touch current is measured for the __battery__ separately.

K.14.2.302.6 *When a **detachable battery pack** or a **separable battery pack** is connected to the **chain saw** as required during the conditioning of K.14.2.302.2, then the **detachable battery pack** or **separable battery pack** shall be additionally evaluated as in a) and b) below, as applicable:*

*a) If a **detachable battery pack** is protected by the **chain saw** from exposure to water, then the **detachable battery pack** is considered to have fulfilled the requirement if there is no water within the space that could come in contact with the **detachable battery pack** at the conclusion of the conditioning of K.14.2.302.2.*

*b) If the **detachable battery pack** or **separable battery pack** has come in contact with water, then the **detachable battery pack** or **separable battery pack** is evaluated as follows.*

Water on the external contacts or the insulation between them shall be ignored, but there shall be no trace of water

- *which could result in a reduction of **clearances** or **creepage distances** between bare conductors below the values specified in Part 1, Clause K.28, where shorting of the conductors would result in the risk of **fire** or loss of an **SCF**. In order to evaluate the risk of **fire** due to traces of water on insulation, the test of Part 1, Subclause 18.6.1 a), shall be applied between the bare conductors with a resistance not exceeding 10 mΩ; and*
- *on any **electronic components** or **electronic circuits** that can affect the correct functioning of any relevant **SCF** or the integrity of the **charging system** as required in K.18.201.*

If water is present on insulating materials, encapsulation and coatings, those materials and coatings shall not be porous, or retain liquids, such as a fibrous or open cell foam material or be a material subject to decay, such as wood, cloth or natural rubber, taking into account the liquid to which the insulating material is exposed. Encapsulation with a minimum thickness of 0,5 mm, PVC, cross-linked polymers, thermoset materials, thermoplastic resins used for moulded plastic parts, closed cell foam materials and coatings complying with IEC 60664-3:2016 are considered to be acceptable for exposure to water.

*Additionally, if the **detachable battery pack** has come in contact with water, a separate **detachable battery pack** sample is conditioned in the **chain saw** in accordance with K.14.2.302.2 and then tested in accordance with K.14.2.304.1 or K.14.2.304.2, as applicable.*

K.14.2.303 Battery moisture resistance

K.14.2.303.1 A **detachable battery pack** or **separable battery pack** with a classification as indicated in K.7.301 shall be designed to limit the risks due to ingress of water anticipated in accordance with the moisture resistance classification.

This requirement is not applicable for **detachable battery packs** or **separable battery packs** classified as "Exposure to rain, cleaning with water and immersion in water are not permitted" in accordance with K.7.301.

Compliance is checked by the tests of K.14.2.303.2 and K.14.2.303.3.

*Prior to the test, **detachable parts** are removed and subjected to the relevant treatment with the **battery**, if this would result in a more unfavourable condition. Air filters are not removed. For batteries classified as "Cleaning with low-pressure water is permitted" or "Immersion in water up to a depth of 1 m for cleaning is permitted" in accordance with K.7.301, **detachable parts** are not removed if they are required to be fitted in accordance with K.8.14.2 c) 303) or K.8.14.2 c) 304), as applicable. Movable covers that are non-**detachable parts** and are not self-restoring are placed in the most unfavourable position.*

*The **detachable battery pack** or **separable battery pack** is then conditioned by subjecting it to the tests of IEC 60529:1989, IEC 60529:1989/AMD1:1999 and*

IEC 60529:1989/AMD2:2013, using water having a conductivity, σ, of (26,9 to 50) mS/m or a resistivity, ρ, of (37,1 to 20) Ωm as follows:

– ***batteries** classified as "Use in rain is permitted" in accordance with K.7.301 are subjected to the test described in 14.2.4a), except that;*

  - ***detachable battery packs** or **separable battery packs** are placed at the centre of a perforated turntable in their most unfavourable rest position; and*
  - *the turntable is then turned continuously at approximately 1 rev/min during the test;*

– ***batteries** classified as "Cleaning with low-pressure water is permitted" in accordance with K.7.301 are subjected to the test described in 14.2.5;*

– ***batteries** classified as "Immersion in water up to a depth of 1 m for cleaning is permitted" in accordance with K.7.301 are subjected to the test described in 14.2.7.*

K.14.2.303.2 *After conditioning the **detachable battery pack** or **separable battery pack** in accordance with K.14.2.303.1, water on the external terminals or the insulation between them shall be ignored, but there shall be no trace of water*

– *which could result in a reduction of **clearances** or **creepage distances** between bare conductors below the values specified in Part 1, Clause K.28, where shorting of the conductors would result in the risk of fire or loss of an **SCF**. In order to evaluate the risk of fire due to traces of water on insulation, the test of Part 1, Subclause 18.6.1 a) shall be applied between the bare conductors with a resistance not exceeding 10 mΩ; and*

– *on any **electronic components** or **electronic circuits** that can affect the correct functioning of any relevant **SCF** or the integrity of the **charging system** as required in K.18.201.*

If water is present on insulating materials, encapsulation and coatings, those materials and coatings shall not be porous, or retain liquids, such as a fibrous or open cell foam material or be a material subject to decay, such as wood, cloth or natural rubber, taking into account the liquid to which the insulating material is exposed. Encapsulation with a minimum thickness of 0,5 mm, PVC, cross-linked polymers, thermoset materials, thermoplastic resins used for moulded plastic parts, closed cell foam materials and coatings complying with IEC 60664-3:2016 are considered to be acceptable for exposure to water.

K.14.2.303.3 *After the conditioning of K.14.2.303.1, **detachable battery packs** or **separable battery packs** containing a **working voltage(s)** that is a **hazardous voltage**, where there is an **accessible part** or surface connected to internal circuitry other than through **protective impedance**, shall comply with the test of Clause C.101.*

*Prior to the test, excess water is drained from the **battery** by turning it in different orthogonal directions.*

K.14.2.304 Moisture resistance of battery/charger interface

K.14.2.304.1 Moisture resistance of battery/charger interface without drainage system

A **detachable battery pack** that is tested in accordance with K.14.2.303 or K.14.2.302.6 b) and is

– intended to be charged by a **charger** containing parts conductively coupled to the mains; and

– not designed to drain water that can be transferred from the **battery** to the **charger**

shall be designed so that it does not transfer water to the **charger** when installed for charging.

Compliance is checked by the following tests:

*Immediately following the conditioning specified in K.14.2.302.2 and K.14.2.303, as applicable, the **detachable battery pack** is detached from the **chain saw**, if applicable, and then positioned in its most unfavourable stable resting position with respect to draining for 10 min.*

*The **detachable battery pack** is then positioned such that the terminals intended to be connected to the **battery charger** are facing in a position as for normal charging in accordance with K.8.14.2 and placed on a container to collect any water that can drain out for 10 min. The container shall prevent the **detachable battery pack** from sitting in the collected pool of water.*

*The amount of water collected is to be weighed and shall not be more than 1 % by mass of the unconditioned **detachable battery pack**.*

K.14.2.304.2 Moisture resistance of battery/charger interface with drainage system

A **detachable battery pack** that is tested in accordance with K.14.2.303 or K.14.2.302.6 b) and its intended **charger**

– containing parts conductively coupled to the mains; and
– designed to drain water that can be transferred from the **battery** to the **charger**

shall be designed to prevent entry of water that would result in contact with **live parts** inside the **charger**.

Compliance is checked by the following test.

*For the test, the **charger** is not connected to the mains.*

*Immediately following the conditioning specified in K.14.2.302.2 and K.14.2.303, as applicable, the **detachable battery pack** is detached from the **chain saw**, if applicable, and then positioned in its most unfavourable stable resting position with respect to draining for 10 min.*

*The **detachable battery pack** is then connected to the **charger** in accordance with K.8.14.2. Any water that could be within the **detachable battery pack** enclosure is permitted to drain for 10 min. The **battery** is then removed and the **charger** is inspected for water that has come in contact with current-carrying parts inside the **charger**, other than terminals used for external connections.*

*No water shall be in contact with current-carrying parts inside the **charger**, other than terminals used for external connections, unless they are insulated in accordance with K.14.2.302.4.*

K.14.2.305 Gaskets, o-rings, seals, and tubing used for moisture resistance

Gaskets, o-rings, seals, tubing and sealing materials applied in a liquid form employed in **chain saws**, **detachable battery packs** and **separable battery packs**, that are relied upon to fulfil the requirements of K.14.2.302, K.14.2.303 and K.14.2.304 shall be constructed of a durable material composition.

NOTE 301 Examples of sealing materials applied in a liquid form include those that are adhesive or urethane resin.

Compliance is checked by the test specified in Annex EE.

K.17.2 This subclause of Part 4-1 is not applicable.

K.18.3 This subclause of Part 4-1 is not applicable.

K.18.5 This subclause of Part 4-1 is not applicable.

K.19.107.4 *Addition:*

The weight of different optional **batteries** shall be taken into consideration when conducting the test in order to identify the worst case.

K.19.111 *Replacement:*

Chain saws shall be in longitudinal balance.

Compliance is checked by the following test.

*The **chain saw** shall be fitted with the most unfavourable combination of **guide bar**, **saw chain** and **detachable battery pack** as specified in 8.14.2 and K.8.14.2. If the **chain saw** is supplied by means of a **separable battery pack**, the cord shall be removed at its point of exit from the **chain saw** or, if supplied with a cord guard or adapter, at its point of exit from the cord guard or adapter. The lubrication tank shall be half full. The **spiked bumper**, if any, shall be fitted. The **guide bar** cover shall not be fitted.*

*The **chain saw** shall be supported on the **front handle**, positioned so that the **guide bar** plane is vertical. This support shall produce the lowest possible friction to allow **chain saw** rotation. A segment of a suitable size of ball bearing may be used to achieve the low friction. See Figure 109.*

*The angle α between the centreline of the **guide bar** and the horizontal plane as shown in Figure 109 shall not exceed $\pm$ 30°.*

K.20.1 This subclause of Part 1 is applicable, except as follows:

Addition:

*Damage to the **guide bar**, **saw chain** and **chain catcher** are ignored.*

*There shall be no leakage of lubrication through cracks in lubrication tanks and tank caps while the **chain saw** is being held in each of the six orthogonal directions for 30 s. Seepage through ventilation systems is not considered a failure.*

K.20.3.1 ~~The **chain saw**, fully assembled in accordance with 8.14.2 and with the lubrication tank empty, *with any* **detachable battery pack** *attached is dropped three times in total on a concrete surface from a height of 1 m. For these three drops, the sample is tested in the three most unfavourable positions the lowest point of the tool being 1 m above the concrete surface.* Secondary impacts shall be avoided. *For the test, separable* **accessories** *are not mounted.*~~

*The **chain saw**,*

- *equipped with the longest **guide bar** in accordance with 8.3; and*
- *with the lubrication tank, if any, empty; and*
- *with the most unfavourable **detachable battery** pack, in accordance with IEC 62841-1:2014, K.8.14.2 e) 2), attached*

is dropped three times in total on a concrete surface from a height of 1 m. For these three drops, the sample is tested in the three most unfavourable positions the lowest point of the machine being 1 m above 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 **battery** pack attached to the machine. New samples may be used for each series of three drops. For the test, separable **accessories** are not mounted.*

*In addition for **detachable battery packs** or **separable battery packs**, the test is repeated three more times on the **battery** packs separately.*

*If **attachments** other than **guide bars** are provided as specified and mounted in accordance with K.8.14.2, the test is repeated with each attachment or combination of **attachments** mounted to a separate machine sample with a **detachable battery pack** ~~or **separable battery pack**~~ installed.*

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.

After the test, the lubrication tank is filled to the maximum level in accordance with 8.14.2.

*It is not necessary for the **chain saw** to be operable after the test. If it is operable after the test, then immediately following this test it shall be run at **maximum speed** at no-load for 30 s.*

K.21.18 *Addition:*

NOTE In Europe (EN 62841-4-1), the following additional subclause applies:

K.21.18.Z101 Isolation and disabling device

Machines with an **integral battery** shall either be equipped

– with an isolation device to prevent the risk of injury from mechanical hazards during servicing or **user maintenance**; or

– with a disabling device that prevents unintentional starting of the machine.

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 21.18.102. The other examples in NOTE 1 achieve this by the necessary actions for reconnection.

A disabling device may be achieved by any of the following:

– a self-restoring or non-self-restoring lock-off device where two separate and dissimilar actions are necessary before the motor is switched on (e.g. a **power switch** which has to be pushed in before it can be moved laterally to close the contacts to start the motor). It shall not be possible to achieve these two actions with a single grasping motion or a straight line motion;

– a removable disabling device provided with the machine where it shall not be possible for the machine to be operated when either applied or removed.

Compliance is checked by inspection and by manual test.

K.21.21 Machines with **detachable battery packs** or **separable battery packs** with a **hazardous voltage** shall be so designed that there is no risk of electric shock from charged capacitors when touching the accessible **battery** contacts of the machine after removal of a **detachable battery pack** or a **separable battery pack**. Capacitors having a rated capacitance less than or equal to 0,1 µF are not considered to entail a risk of electric shock even if connected to the supply side of the switch.

Compliance is checked by the following test.

The machine is operated at no-load for (10 ± 5) s.

*The **power switch** is then moved to the "off" position and the machine is disconnected from the **detachable battery pack** or a **separable battery pack**.*

*Ten seconds after disconnection, the accessible **battery** contacts of the machine shall comply with K.9.3.*

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.

The release mechanism shall only allow separation by deliberate action of the operator.

*Compliance is checked by inspection and by functional test using the heaviest **separable battery pack(s)** identified in K.8.14.2 e).*

K.23.1.10.1 This subclause of Part 4-1 is not applicable.

K.23.1.10.2 This subclause of Part 4-1 is not applicable.

K.23.301 Auxiliary switches, if any, associated with the **chain brake** are considered to be switches other than **power switches**. They shall, however, meet the requirements of K.23.1.10 and K.23.1. 201.

Compliance is checked by the relevant tests.

K.24 Supply connection and external flexible cords

This clause of Part 4-1 is not applicable, except as follows:

K.24.301 For **battery** machines with **separable battery packs**, the external flexible cable or cord shall have anchorages such that the conductors are relieved from strain, including twisting, where they are connected within the machine, and protected from abrasion.

Compliance is checked by inspection.

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 use of a tool during **normal use.**

Compliance is checked by inspection.

K.28 Creepage distances, clearances and distances through insulation

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 K.1 are equal or larger than the values required by IEC 60664-1, when

– 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 of Part 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 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 of Part 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 4-1 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 4-1 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 4-1 unless otherwise specified.

L.1 Scope

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

Addition:

This standard applies to **chain saws** for cutting wood and designed for use by one person. This standard does not cover **chain saws** designed for use in conjunction with a guide-plate and riving knife or in any other way such as with a support or as a stationary or transportable machine.

This standard does not apply to

– **chain saws** for tree service as defined in ISO 11681-2; or

– pole-mounted pruners.

NOTE 101 Pole-mounted pruners will be covered by a future part of IEC 62841.

NOTE 102 In Europe (EN 62841-4-1), this annex does not apply to **chain saws** equipped with **integral batteries** and with a **maximum speed** of the **saw chain** exceeding 5 m/s.

The **chain saws** covered by this standard are designed only to be operated with the right hand on the **rear handle** and the left hand on the **front handle.**

L.8.14.1.101 Safety instructions for chain saws

Replacement of item 1) c):

c) **Hold the chain saw by insulated gripping surfaces only, because the saw chain may contact hidden wiring.** *Saw chains contacting a "live" wire may make exposed metal parts of the chain saw "live" and could give the operator an electric shock.*

L.8.14.1.301 General chain saw safety warnings

a) **Follow all instructions when clearing jammed material, storing or servicing the chain saw. Make sure the switch is off and the battery pack is removed.** *Unexpected actuation of the chain saw while clearing jammed material or servicing may result in serious personal injury.*

NOTE 1 The above warning is used for machines with separable batteries or detachable batteries.

b) **Follow all instructions when clearing jammed material, storing or servicing the chain saw. Make sure the switch is off and the lock-off is in the locked position.** *Unexpected actuation of the chain saw while clearing jammed material or servicing may result in serious personal injury.*

NOTE 2 The above warning is used for machines with **integral batteries**.

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.8.14.3 If information about the mass or weight of the machine is provided, it shall be the mass of the machine without the **saw chain, guide bar,** guide bar cover, oil, **battery** (except for **integral batteries**) and optional accessories.

L.19.107.4 *Addition:*

The weight of different optional **batteries**, if applicable, shall be taken into consideration when conducting the test in order to identify the worst case.

L.19.111 *Replacement:*

Chain saws shall be in longitudinal balance.

Compliance is checked by the following test.

*The **chain saw** shall be fitted with the most unfavourable combination of **guide bar, saw chain** and **detachable battery pack** as specified in 8.14.2 and L.8.14.2. If the **chain saw** is supplied by means of a **separable battery pack**, the cord shall be removed at its point of exit from the **chain saw** or, if supplied with a cord guard or adapter, at its point of exit from the cord guard or adapter The lubrication tank shall be half full. The **spiked bumper**, if any, shall be fitted. The **guide bar** cover shall not be fitted.*

*The **chain saw** shall be supported on the **front handle**, positioned so that the **guide bar** plane is vertical. This support shall produce the lowest possible friction to allow **chain saw** rotation. A segment of a suitable size of ball bearing may be used to achieve the low friction. See Figure 109.*

*The angle α between the centreline of the **guide bar** and the horizontal plane as shown in Figure 109 shall not exceed $\pm$ 30°.*

L.20.1 This subclause of Part 1 is applicable, except as follows:

Addition:

*Damage to the **guide bar**, **saw chain** and **chain catcher** are ignored.*

*There shall be no leakage of lubrication through cracks in lubrication tanks and tank caps while the **chain saw** is being held in each of the six orthogonal directions for 30 s. Seepage through ventilation systems is not considered a failure.*

L.20.201 *Addition:*

*Following the test, t*here shall be no leakage of lubrication through cracks in lubrication tanks and tank caps while the **chain saw** is being held in each of the six orthogonal directions for 30 s. Seepage through ventilation systems is not considered a failure.

L.20.202 *For **chain saws**, L.20.301 applies.*

L.20.301 The **chain saw**, while not directly connected to the mains or to a **non-isolated source**, fully assembled in accordance with 8.14.2 and with the lubrication tank empty, *with any* **detachable battery pack** *attached is dropped three times in total on a concrete surface from a height of 1 m. For these three drops, the sample is tested in the three most unfavourable positions the lowest point of the tool being 1 m above the concrete surface.* Secondary impacts shall be avoided. *For the test, separable **accessories** are not mounted.*

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 **battery** pack attached to the machine. New samples may be used for each series of three drops. For the test, separable **accessories** are not mounted.*

*In addition for **detachable battery packs** or **separable battery packs**, the test is repeated three more times on the **battery** packs separately.*

*If **attachments** are provided as specified and mounted in accordance with 8.14.2, the test is repeated with each **attachment** or combination of **attachments** mounted to a separate machine sample with a **detachable battery pack** or **separable battery pack** installed.*

After the test, the lubrication tank is filled to the maximum level in accordance with 8.14.2.

L.21.18 *Addition:*

NOTE In Europe (EN 62841-4-1), the following additional subclause applies:

L.21.18.Z101 Isolation and disabling device

Machines with an **integral battery** shall either be equipped

– with an isolation device to prevent the risk of injury from mechanical hazards during servicing or **user maintenance**; or
– with a disabling device that prevents unintentional starting of the machine.

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 21.18.102. The other examples in NOTE 1 achieve this by the necessary actions for reconnection.

A disabling device may be achieved by any of the following:

– a self-restoring or non-self-restoring lock-off device where two separate and dissimilar actions are necessary before the motor is switched on (e.g. a **power switch** which has to be pushed in before it can be moved laterally to close the contacts to start the motor). It shall not be possible to achieve these two actions with a single grasping motion or a straight line motion;
– a removable disabling device provided with the machine where it shall not be possible for the machine to be operated when either applied or removed.

Compliance is checked by inspection and by manual test.

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.

The release mechanism shall only allow separation by deliberate action of the operator.

*Compliance is checked by inspection and by functional test using the heaviest **separable battery pack(s)** identified in L.8.14.2 e).*

L.24.1 *Modification:*

This subclause also applies to a flexible cord between a **non-isolated source** and the machine.

L.24.4 *Modification:*

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 use of a tool during **normal use.**

Compliance is checked by inspection.

Annex AA
(normative)

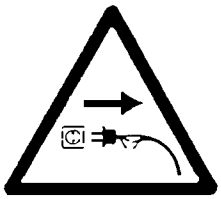
Safety signs

1) Do not expose to rain.

(Source: IEC 60745-2-13:2009, Annex AA)

2) Remove plug from the mains immediately if the cable is damaged or cut.

(Source: IEC 60745-2-13:2009, Annex AA)



3) Wear eye protection.

(Source: IEC 60745-2-13:2009, Annex AA)

4) Alternative for wear eye protection:

5) Wear ear protection.

(Source: IEC 60745-2-13:2009, Annex AA)

6) Optional symbol for "wear eye protection and wear ear protection".

7) Optional symbol for "wear eye and head protection".

8) Optional symbol for "wear eye, ear and head protection".

Annex BB
(informative)

Examples of instructions concerning the proper techniques for basic felling, limbing, and cross-cutting

BB.1 Felling a tree

When cross-cutting/bucking and felling operations are being performed by two or more persons at the same time, the felling operations should be separated from the cross-cutting/bucking operation by a distance of at least twice the height of the tree being felled. Trees should not be felled in a manner that would endanger any person, strike any utility line or cause any property damage. If the tree does make contact with any utility line, the company should be notified immediately.

The **chain saw** operator should keep on the uphill side of the terrain as the tree is likely to roll or slide downhill after it is felled.

An escape path should be planned and cleared as necessary before cuts are started. The escape path should extend back and diagonally to the rear of the expected line of fall as illustrated in Figure BB.101.

Before felling is started, consider the natural lean of the tree, the location of larger branches and the wind direction to judge which way the tree will fall.

Remove dirt, stones, loose bark, nails, staples and wire from the tree.

BB.2 Notching undercut

Make the notch 1/3 the diameter of the tree, perpendicular to the direction of falls as illustrated in Figure BB.102. Make the lower horizontal notching cut first. This will help to avoid pinching either the saw chain or the guide bar when the second notch is being made.

BB.3 Felling back cut

Make the felling back cut at least 50 mm higher than the horizontal notching cut as illustrated in Figure BB.102. Keep the felling back cut parallel to the horizontal notching cut. Make the felling back cut so enough wood is left to act as a hinge. The hinge wood keeps the tree from twisting and falling in the wrong direction. Do not cut through the hinge.

As the felling gets close to the hinge, the tree should begin to fall. If there is any chance that the tree may not fall in desired direction or it may rock back and bind the **saw chain**, stop cutting before the felling back cut is complete and use wedges of wood, plastic or aluminium to open the cut and drop the tree along the desired line of fall.

When the tree begins to fall, remove the **chain saw** from the cut, stop the motor, put the **chain saw** down, then use the retreat path planned. Be alert for overhead limbs falling and watch your footing.

BB.4 Limbing a tree

Limbing is removing the branches from a fallen tree. When limbing leave larger lower limbs to support the log off the ground. Remove the small limbs in one cut as illustrated in

Figure BB.103. Branches under tension should be cut from the bottom up to avoid binding the **chain saw**.

BB.5 Cross-cutting/bucking a log

Cross-cutting/bucking is cutting a log into lengths. It is important to make sure your footing is firm and your weight is evenly distributed on both feet. When possible, the log should be raised and supported by the use of limbs, logs or chocks. Follow the simple directions for easy cutting.

When the log is supported along its entire length as illustrated in Figure BB.104, it is cut from the top (overbuck).

When the log is supported on one end, as illustrated in Figure BB.105, cut 1/3 the diameter from the underside (underbuck). Then make the finished cut by overbucking to meet the first cut.

When the log is supported on both ends, as illustrated in Figure BB.106, cut 1/3 the diameter from the top (overbuck). Then make the finished cut by underbucking the lower 2/3 to meet the first cut.

When cross-cutting/bucking on a slope always stand on the uphill side of the log, as illustrated in Figure BB.107. When “cutting through”, to maintain complete control, release the cutting pressure near the end of the cut without relaxing your grip on the **chain saw** handles. Don’t let the chain contact the ground. After completing the cut, wait for the **saw chain** to stop before you move the **chain saw**. Always stop the motor before moving from tree to tree.

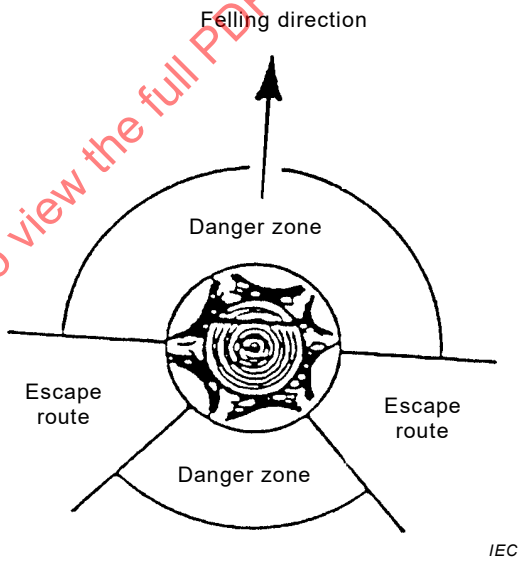


Figure BB.101 – Description of felling: escape routes

Dimensions in millimetres

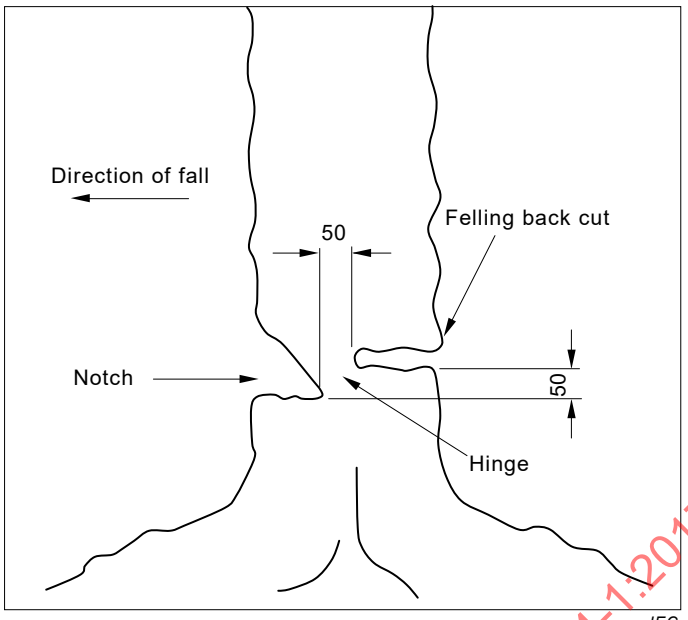


Figure BB.102 – Description of felling: undercutting

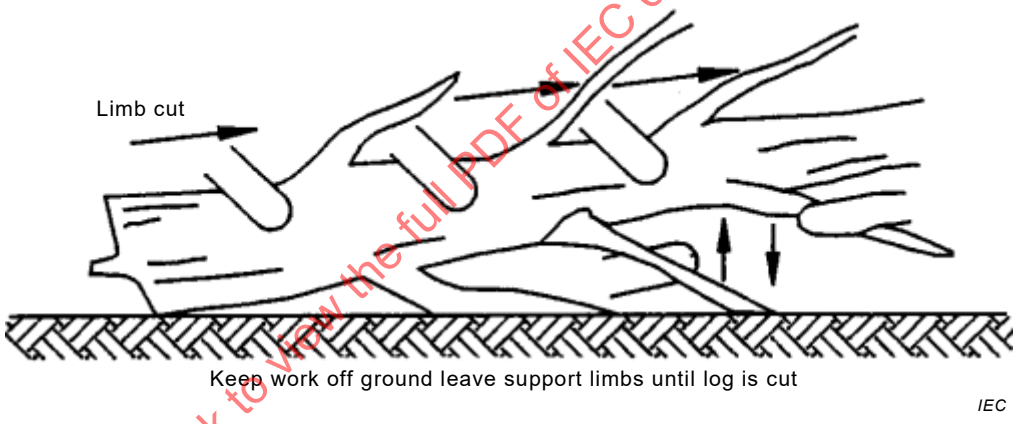


Figure BB.103 – Tree limbing

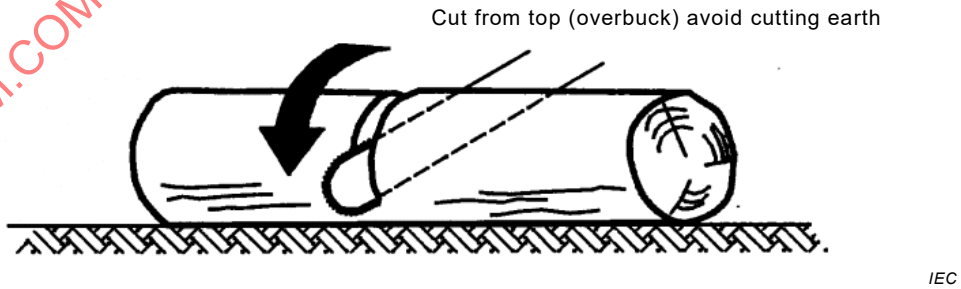


Figure BB.104 – Log supported along the entire length

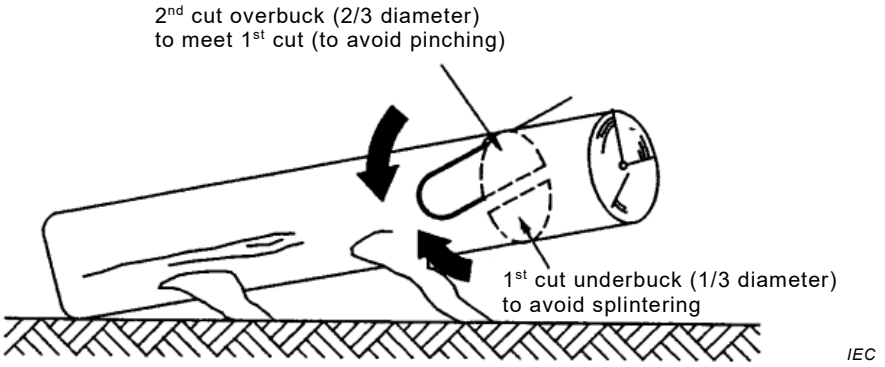


Figure BB.105 – Log supported one end

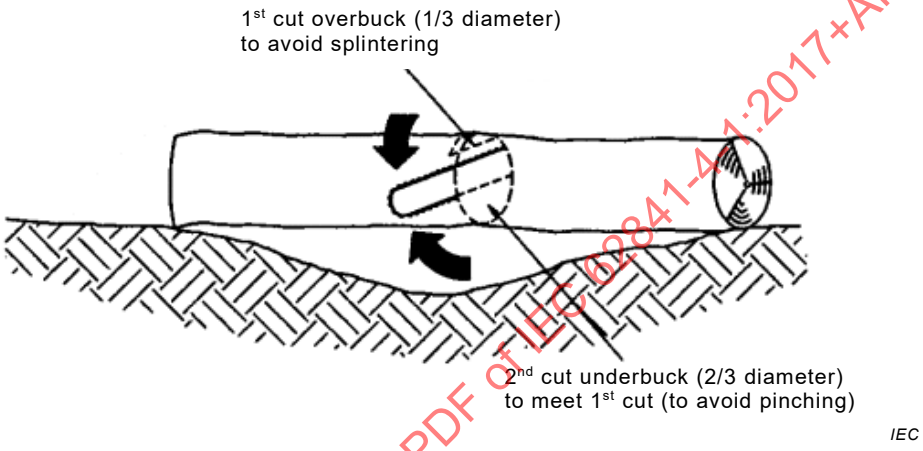


Figure BB.106 – Log supported both ends

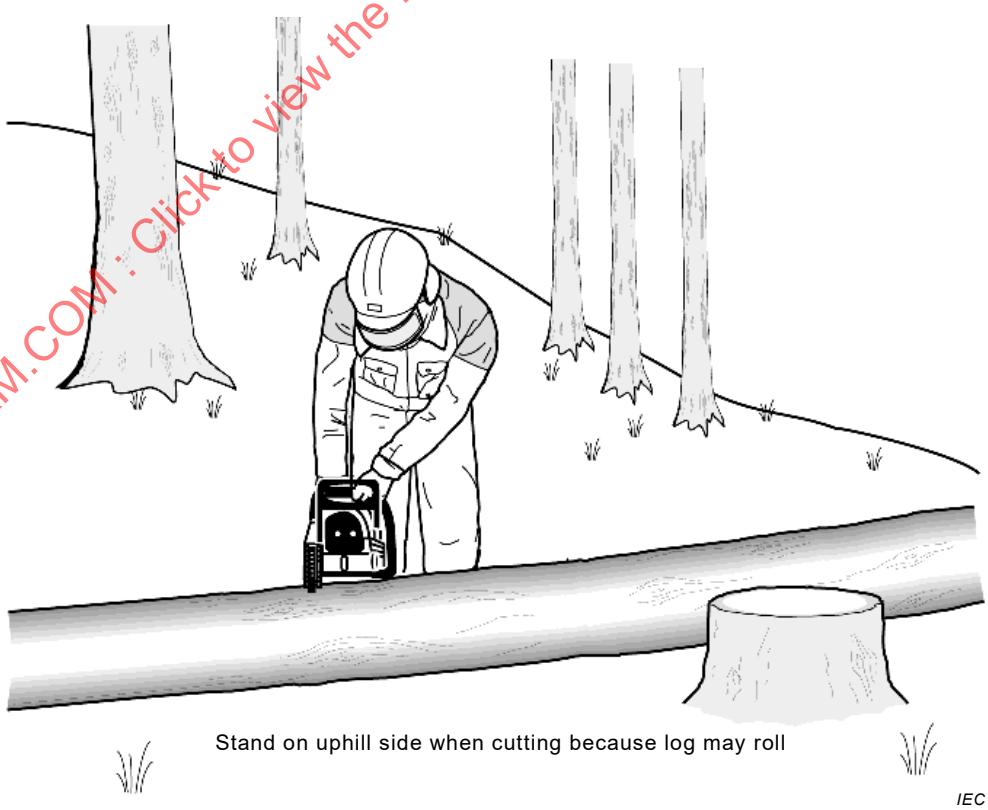


Figure BB.107 – Cross-cutting/bucking a log

Annex CC
(informative)

Example of a material and construction for fulfilling the requirements for an artificial surface

CC.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.

CC.2 Construction

As is shown in Figure CC.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 of the construction as shown in Figure CC.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 aluminum section, 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, aluminum T-sections 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 cut to size.

The felt flooring of the joint planes which are neither stood on nor driven over (type A surface in Figure CC.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 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.

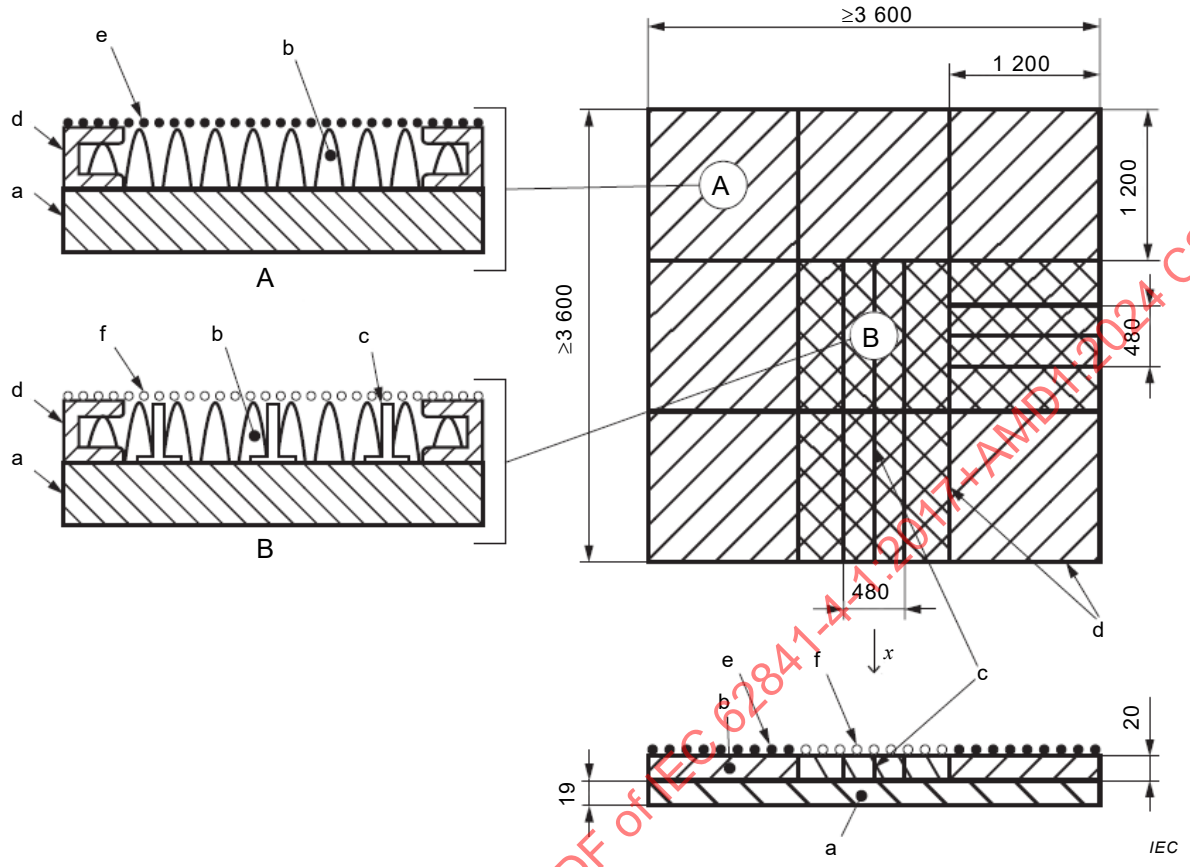
Protection by simple wire mesh is not, however, sufficient in the area subjected to traffic (type B surface in Figure CC.1). For these surfaces, the use of wire grating of corrugated steel wire with a diameter of 3,1 mm and a mesh width of 30 mm has proved to be suitable.

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



Key

"A" this surface not suitable to carry weight. Do not stand on or drive over.

"B" this surface 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 CC.1 – Sketch of the measurement surface covered with an artificial surface (not to scale)

Annex DD
(normative)

Other machine and battery signs

1) OK to use in rain.

Annex EE
(normative)

Ageing test for gaskets, o-rings, seals and tubing used for moisture resistance

EE.1 *Three samples of a gasket, o-ring, seal or tubing, as applicable, forming a part that is depended upon to protect the **chain saw**, **detachable battery pack(s)** or **separable battery pack(s)** against ingress of moisture as identified in K.14.2.305 are subjected to the elongation and tensile strength tests of ISO 37:2017 in the as-received condition and after the oven conditioning, based on the external enclosure surface temperature closest to the component measured during the test of Part 1, Subclause K.12.1, as specified in Table EE.1. As a result of the tests, the parts shall have a minimum percentage of the unaged values for tensile strength and elongation as specified in Table EE.1, after ageing.*

Table EE.1 – Accelerated ageing test

External enclosure surface temperature closest to the component	Oven conditioning parameters	Minimum acceptable percentage of unaged value for samples	
°C		Tensile strength	Elongation
≤ 60	Air oven ageing for 70 hours at (100 ± 5) °C	60	60
> 60 and ≤ 75	Air oven ageing for 168 hours at (100 ± 5) °C	50	50
> 75 and ≤ 90	Air oven ageing for 168 hours at (121 ± 5) °C	50	50
> 90 to ≤ 105	Air oven ageing for 168 hours at (136 ± 5) °C	50	50

EE.2 *As an alternative to the test specified in Clause EE.1, a gasket, o-ring, seal, tubing or sealing material applied in a liquid form employed to comply with the requirements for moisture resistance is tested as follows. With the gasket, o-rings, seal, tubing or sealing material in place, the **chain saw**, **detachable battery pack** or **separable battery pack** is conditioned in a circulating air oven for 240 h at (20 ± 5) K above the temperature measured on the external enclosure surface closest to the component during the test of Part 1, Subclause K.12.1. After the conditioning, the **chain saw**, **detachable battery pack** or **separable battery pack** is subjected to the tests in K.14.2.302, K.14.2.303 and K.14.2.304, as applicable. Additionally, after the test, a visual inspection shall show no damage to the gasket, o-ring, seal, tubing or sealing material.*

NOTE 101 In Canada and the United States of America, the requirements of this Annex are considered to be fulfilled if the relevant gasket, o-ring, seal or tubing is certified to UL 157.

Bibliography

The bibliography of Part 1 is applicable, except as follows.

Addition:

UL 157, *Standard for Gaskets and Seals*

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

Part 4-1: Particular requirements for chain saws

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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9) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at https://patents.iec.ch. IEC shall not be held responsible for identifying any or all such patent rights.

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

IEC 62841-4-1 edition 1.1 contains the first edition (2017-10) [documents 116/339/FDIS and 116/344/RVD] and its amendment 1 (2024-10) [documents 116/816/FDIS and 116/837/RVD].

This Final version does not show where the technical content is modified by amendment 1. A separate Redline version with all changes highlighted is available in this publication.

International Standard IEC 62841-4-1 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 4-1 is to be used in conjunction with the first edition of IEC 62841-1 (2014).

This Part 4-1 supplements or modifies the corresponding clauses in IEC 62841-1, so as to convert it into the IEC Standard: Particular requirements for chain saws.

Where a particular subclause of Part 1 is not mentioned in this Part 4-1, that subclause applies as far as relevant. 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;
– **terms defined in Clause 3: in bold typeface.**

Subclauses, notes, tables and figures which are additional to those in 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 4-1 as well as Annex K and Annex L of Part 1 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 publication 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.

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

Part 4-1: Particular requirements for chain saws

1 Scope

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

Addition:

This standard applies to **chain saws** for cutting wood and designed for use by one person. This standard does not cover **chain saws** designed for use in conjunction with a guide-plate and riving knife or in any other way such as with a support or as a stationary or transportable machine.

This standard does not apply to

– **chain saws** for tree service as defined in ISO 11681-2; or
– pole-mounted pruners.

NOTE 101 Pole-mounted pruners will be covered by a future part of IEC 62841.

The **chain saws** covered by this standard are designed only to be operated with the right hand on the **rear handle** and the left hand on the **front handle**.

2 Normative references

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

Addition:

IEC 60664-3:2016, *Insulation coordination for equipment within low-voltage systems – Part 3: Use of coating, potting or moulding for protection against pollution*

IEC 61672-1, *Electroacoustics – Sound level meters – Part 1: Specifications*

ISO 37:2017, *Rubber, vulcanized or thermoplastic – Determination of tensile stress-strain properties*

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

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*

ISO 6533:2020, *Forestry machinery – Portable chain-saw front hand-guard – Dimensions and clearances*

ISO 6534:2007, *Forestry machinery – Portable chain-saw hand-guards – Mechanical strength*

ISO 7914:2002, *Forestry machinery – Portable chain-saws – Minimum handle clearance and sizes*

ISO 7915:2021, *Forestry machinery – Portable chain-saws – Determination of handle strength*

ISO 9518:2018, *Forestry machinery – Portable chain-saws – Kickback test*

ISO 10726:1992, *Portable chain-saws – Chain catcher – Dimensions and mechanical strength*

ISO 11681-2:2011, *Machinery for forestry – Portable chain-saw safety requirements and testing – Part 2: Chain-saws for tree service*

ISO 13772:2009, *Forestry machinery – Portable chain saws – Non-manually actuated chain brake performance*

ISO 17080:2005, *Manually portable agricultural and forestry machines and powered lawn and garden equipment – Design principles for single-panel product safety labels*

ISO 22868:2011, *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:

3.101
bar tip guard
shield that prevents contact with the **saw chain** at the tip of the **guide bar**

3.102
chain brake
function or device for stopping the **saw chain** activated manually or non-manually when **kickback** occurs

3.102.1
manually activated chain brake
braking function triggered by the hand of the operator

3.102.2
non-manually activated chain brake
braking function triggered by **kickback** motion independent of operator activation

3.103
chain catcher
device for restraining the **saw chain** if it breaks or derails (see Figure 101)

3.104
chain saw
machine designed to cut wood with a **saw chain** and consisting of an integrated unit of handles, motor, **guide bar** and **saw chain**, designed to be supported with two hands (see Figure 101)

3.105
cutting length
approximate effective length of cut of the **chain saw**

Note 1 to entry: The method for determining **cutting length** is specified in 21.101.

3.106
drive sprocket
chain drive wheel with teeth

3.107
front hand guard
guard between the **front handle** and the **saw chain** for protecting the hand from injuries if the hand slips off the handle (see Figure 101)

3.108
front handle
support handle located at or towards the front of the machine (see Figure 101)

3.109
guide bar
attachment that supports and guides the **saw chain** (see Figure 101)

3.110
kickback
rapid upward and/or backward motion of the **chain saw** which can occur when the moving **saw chain** contacts an object such as a log or branch near the tip of the **guide bar** or when the wood closes in and pinches the moving **saw chain**

3.111
maximum speed
highest steady-state **saw chain** speed attainable under all conditions of **normal use**, including no-load, when adjusted in accordance with the manufacturer's specifications and/or instructions

Note 101 to entry: The steady-state **saw chain** speed excludes transients such as overshoot that can occur before attaining a steady-state condition.

3.112
operator presence sensor
device to detect the presence of an operator's hand

3.113
rear hand guard
extension on the lower part of the **rear handle** for protecting the hand from the **saw chain** if it breaks or derails (see Figure 101)

3.114
rear handle
support handle located towards the rear of the machine (see Figure 101)

3.115
saw chain
attachment, serving as a cutting tool, consisting of drive links and cutters (see Figure 101 and Figure 108)

3.116
spiked bumper
device, fitted in front of the **guide bar** mounting point, acting as a pivot when in contact with a tree or log (see Figure 101 and Figure 102)

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:

5.15 *Addition:*

*For tests carried out at any percentage of **rated input** or **rated current**, except for no-load, the **saw chain** and the **guide bar** may be removed and the **chain saw** loaded by means of a brake.*

5.17 *Addition:*

*The mass of the machine includes the heaviest **guide bar** and **saw chain** combination in accordance with 8.14.2 c) 101) as well as the lubrication tank, if any, filled to the maximum specified level, but excludes the **guide bar** cover.*

5.101 *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:

7.2 *Replacement:*

Chain saws shall not be classified with a degree of protection against harmful ingress of water higher than IPX0 according to IEC 60529:1989, IEC 60529:1989/AMD1:1999 and IEC 60529:1989/AMD2:2013.

Compliance is checked by inspection.

8 Marking and instructions

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

8.1 *Replacement:*

Chain saws shall be marked with rating information as follows:

– **rated voltage**(**s**) or **rated voltage range**, in volts. Machines for star-delta connection shall be clearly marked with the two **rated voltages** (for example 230 Δ/ 400 Y). A machine that complies with this standard for a voltage range, may also be marked with any single voltage or smaller voltage range within that range;

– symbol for nature of supply, unless the **rated frequency**(**ies**) or **rated frequency range** is marked. The symbol for nature of supply shall be placed next to the marking for **rated voltage**;

– **rated input**, in watts or **rated current**, in amperes. The **rated input** or **rated current** to be marked on the machine is the total maximum input or current that can be drawn from external circuit at the same time. If a machine has alternative components which can be selected by a **control device**, the **rated input** or **rated current** is that corresponding to the highest loading possible;

– symbol for **class II construction**, for **class II tools** (machines) only.

8.1.101 Chain saws shall not be marked with an IP rating for the degree of protection against harmful ingress of water higher than IPX0 in accordance with IEC 60529:1989, IEC 60529:1989/AMD1:1999 and IEC 60529:1989/AMD2:2013. **Chain saws** may be marked with an IP rating for the degree of protection against solid foreign objects and access to hazardous parts in accordance with IEC 60529:1989, IEC 60529:1989/AMD1:1999 and IEC 60529:1989/AMD2:2013.

Compliance is checked by inspection.

8.2 *Addition:*

Chain saws shall be marked with safety information which shall be written in one of the official languages of the country in which the machine is to be sold or marked with the appropriate symbol:

– "Wear eye protection" or a relevant safety sign of ISO 7010 or the safety sign specified in Annex AA;

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

A combination of ISO safety signs, such as eye, ear, dust and head protection, is allowed. In addition, a combination of safety signs as specified in Annex AA is allowed.

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

– "Beware of chain saw kickback and avoid contact with bar tip", or A.1.3 of ISO 17080:2005.

– "Always use chain saw two-handed" or A.3.1 of ISO 17080:2005.

For mains supplied machines:

"Remove plug from the mains immediately if the cable is damaged or cut" or the safety sign specified in Annex AA.

8.3 *Addition:*

Chain saws shall be marked with the following:

– specified nominal **guide bar** size or size range;

NOTE 101 The nominal **guide bar** size is not necessarily the same as the **cutting length**.

– identification of the direction of rotation of the **saw chain** by a legible and durable mark on the body of the machine. This may be located under the **drive sprocket** cover.

8.14.1 *Addition:*

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

8.14.1.101 Safety instructions for chain saws

1) **General chain saw safety warnings:**

a) **Keep all parts of the body away from the saw chain when the chain saw is operating. Before you start the chain saw, make sure the saw chain is not contacting anything.** *A moment of inattention while operating chain saws may cause entanglement of your clothing or body with the saw chain.*

b) **Always hold the chain saw with your right hand on the rear handle and your left hand on the front handle.** *Holding the chain saw with a reversed hand configuration increases the risk of personal injury and should never be done.*

c) **Hold the chain saw by insulated gripping surfaces only, because the saw chain may contact hidden wiring or its own cord.** *Saw chains contacting a "live" wire may make exposed metal parts of the chain saw "live" and could give the operator an electric shock.*

d) **Wear eye protection. Further protective equipment for hearing, head, hands, legs and feet is recommended.** *Adequate protective equipment will reduce personal injury from flying debris or accidental contact with the saw chain.*

e) **Do not operate a chain saw in a tree, on a ladder, from a rooftop, or any unstable support.** *Operation of a chain saw in this manner could result in serious personal injury.*

f) **Always keep proper footing and operate the chain saw only when standing on fixed, secure and level surface.** *Slippery or unstable surfaces may cause a loss of balance or control of the chain saw.*

g) **When cutting a limb that is under tension, be alert for spring back.** *When the tension in the wood fibres is released, the spring loaded limb may strike the operator and/or throw the chain saw out of control.*

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

i) **Carry the chain saw by the front handle with the chain saw switched off and away from your body. When transporting or storing the chain saw, always fit the guide bar cover**. *Proper handling of the chain saw will reduce the likelihood of accidental contact with the moving saw chain.*

j) **Follow instructions for lubricating, chain tensioning and changing the bar and chain.** *Improperly tensioned or lubricated chain may either break or increase the chance for kickback.*

k) **Cut wood only. Do not use chain saw for purposes not intended. For example: do not use chain saw for cutting metal, plastic, masonry or non-wood building materials.** *Use of the chain saw for operations different than intended could result in a hazardous situation.*

l) **Do not attempt to fell a tree until you have an understanding of the risks and how to avoid them.** *Serious injury could occur to the operator or bystanders while felling a tree.*

NOTE The above warning is omitted for **chain saws** that are not suitable for tree felling as specified by the manufacturer. See 8.14.2 b) 104).

m) **This chain saw is not intended for tree felling.** *Use of the chain saw for operations different than intended could result in serious injury to the operator or bystanders.*

NOTE The above warning is omitted for **chain saws** that are suitable for tree felling.

2) **Causes and operator prevention of kickback:**

Kickback may occur when the nose or tip of the guide bar touches an object, or when the wood closes in and pinches the saw chain in the cut.

Tip contact in some cases may cause a sudden reverse reaction, kicking the guide bar up and back towards the operator.

Pinching the saw chain along the top of the guide bar may push the guide bar rapidly back towards the operator.

Either of these reactions may cause you to lose control of the saw which could result in serious personal injury. Do not rely exclusively upon the safety devices built into your saw.

As a chain saw user, you should take several steps to keep your cutting jobs free from accident or injury.

Kickback is the result of chain saw misuse and/or incorrect operating procedures or conditions and can be avoided by taking proper precautions as given below:

a) **Maintain a firm grip, with thumbs and fingers encircling the chain saw handles, with both hands on the saw and position your body and arm to allow you to resist kickback forces.** *Kickback forces can be controlled by the operator, if proper precautions are taken. Do not let go of the chain saw.*

NOTE Figure 103 may be used as an illustration in the instruction manual for holding the machine properly.

b) **Do not overreach and do not cut above shoulder height.** *This helps prevent unintended tip contact and enables better control of the chain saw in unexpected situations.*

c) **Only use replacement guide bars and saw chains specified by the manufacturer.** *Incorrect replacement guide bars and saw chains may cause chain breakage and/or kickback.*

d) **Follow the manufacturer's sharpening and maintenance instructions for the saw chain.** *Decreasing the depth gauge height can lead to increased kickback.*

8.14.2 a) *Addition:*

101) Explanation of **chain saw** safety devices;

102) Instructions for properly installing and adjusting the **guide bar** and **saw chain**;

103) Instruction for selection and use of protective equipment for eyes, ears, head, hands, legs and feet, as applicable.

8.14.2 b) *Addition:*

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

102) Statement to position the cord so that it will not be caught on branches and the like, during cutting;

103) Recommendation that the first-time user should, as a minimum, practise cutting logs on a saw-horse or cradle;

104) Information that the **chain saw** is not suitable for tree felling, if applicable;

105) Instructions to explain the proper techniques for basic felling, limbing, and cross-cutting. Examples for the required instructions are given in Clause BB.1 to BB.5. If the **chain saw** is not suitable for tree felling as specified by the manufacturer, then instructions for felling techniques may be omitted;

106) If applicable, instruction on the use of a manual lubrication control;

107) If applicable, instruction not to operate the **chain saw** without lubrication and to replenish it in due time before the container is empty;

108) Instruction to use only recommended lubricants;

109) Information on the **maximum speed** of the **saw chain**, or if the **maximum speed** of the **saw chain** is less than 20 m/s, this may be stated.

8.14.2 c) *Addition:*

101) Information on recommended **guide bar** and **saw chain** combination(s) that can be used and that maintains compliance with this standard;

102) Instructions on sharpening and maintenance of the **saw chain** and/or a recommendation to have sharpening and maintenance of the **saw chain** performed by authorised service centres.

8.14.3 *Replacement:*

If information about the mass or weight of the machine is provided, it shall be the mass of the machine without the **saw chain, guide bar**, **guide bar** cover, oil and optional **accessories**.

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.

12 Heating

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

12.2.1 *Replacement:*

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

The machine is operated with a torque load applied such that rated input or rated current is drawn. The machine is operated for 30 min. During this period, the torque load is adjusted as necessary to maintain rated input or rated current.

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:

Addition:

NOTE 101 **Saw chain** lubrication tanks and lubrication systems intended for use with oil as specified in 8.14.2 are not considered to be **liquid systems**.

14.2 This subclause of Part 1 is not applicable.

14.2.1 This subclause of Part 1 is not applicable.

14.2.2 This subclause of Part 1 is not applicable.

14.3 to 14.5 These subclauses of Part 1 are not applicable for **saw chain** lubrication tanks and lubrication systems intended for use with oil as specified in 8.14.2.

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 *Modification:*

This subclause is applicable as for **hand-held tools**. The **saw chain** is removed for the endurance test.

18 Abnormal operation

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

18.3 *Replacement:*

*Machines incorporating a series motor are operated without the **saw chain** at a voltage equal to 1,3 times* **rated voltage** *for 1 min at no-load.*

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 *Modification:*

The requirements for tools other than **lawn and garden machinery** are applicable.

18.6.1 *Addition:*

*Components intended to discharge capacitors to comply with 21.21 and K.21.21 are only subjected to the fault conditions a) to f) whilst connected to the mains or **battery**, as applicable, and no evaluation for compliance is conducted whilst disconnected from the mains or **battery**, as applicable.*

18.8.1 *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	c
Power switch – provide desired switch-off	c
Provide desired direction of rotation for **cutting lengths** ≤ 300 mm	a
Provide desired direction of rotation for **cutting lengths** > 300 mm	b
Starting current limitation as in 10.2	Not an **SCF**
Prevent exceeding thermal limits as in 18.4 and 18.5.3	a
Manually activated chain brake function if required in 19.107.1 for **chain saws**	b
Prevent **saw chain** speed from exceeding 6 m/s for **chain saws** with no chain brake if such overspeed would cause non-compliance with 19.107.1	a
Prevent exceeding the required average braking time and the maximum braking time in 19.107.1.2 by more than 0,03 s	a
Overspeed prevention for **chain saws** without a **non-manually activated chain brake** to prevent **saw chain** speed above 18 m/s as in 19.107.2	a
Non-manually activated chain brake function as in 19.107.2	b
Overspeed prevention if such overspeed would cause non-compliance with 19.107.4	a
Provide automatic lubrication of the **saw chain** as in 19.110	Not an **SCF**
Prevent exceeding the maximum run-down time in 19.112 by more than 1 s	a
Operator presence sensor as in 21.18.102	a
Lock-off function as required by 21.18.102	b
Visual or audible indicator as referenced in 21.18.102	Not an **SCF**
Function to fulfil the requirements of 21.21 or K.21.21	Not an **SCF**
Prevent self-resetting as required in 23.3	a

19 Mechanical hazards

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

19.1 *Modification:*

The requirements of this subclause do not apply to those moving parts and **guards** which are separately covered by 19.102, 19.103 and 19.104.

19.6 This subclause of Part 1 is not applicable.

19.7 This subclause of Part 1 is not applicable.

19.8 This subclause of Part 1 is not applicable.

19.9 *Replacement:*

If, in accordance with 8.14.2, the user is instructed to remove a **drive sprocket** cover, such as for maintenance, to change the **saw chain** or **guide bar**, then the fastenings shall remain attached to the **drive sprocket** cover or to the machinery, unless the **drive sprocket** cover fastenings are the only means for retaining the **guide bar**. If a fastening is not removed for removing the **drive sprocket** cover, it is considered as still attached.

Compliance is checked by inspection and by manual test.

19.101 Handles

Chain saws shall be fitted with at least two handles to provide safe control. The length of the grip area of the **front handle** shall be at least 100 mm. The handle surfaces shall be so designed and shaped that firm grip may be applied. Minimum clearances and sizes of the handles shall be in accordance with ISO 7914 for forest work **chain saws**, except for the determination of dimension *D*. Dimension *D* shall be the straight line distance from the rear side of the **power switch** to a point on the axis of the **front handle**, 50 mm to the left of X_0, where X_0 is determined in accordance with ISO 6533. For **chain saws** with a **maximum speed** of the **saw chain** not exceeding 8 m/s and a maximum **cutting length** not exceeding 300 mm, however, the dimension *D* in Table 1 of ISO 7914:2002 may be reduced to a minimum of 125 mm.

Compliance is checked by inspection and by measurement.

19.102 Front hand guard

A guard shall be fitted in the vicinity of the **front handle** to protect the operator's fingers from injury by contact with the **saw chain**. The dimensions and clearances of this **front hand guard** and the prevention of access from the **front handle** to the **saw chain** shall comply with ISO 6533.

Compliance is checked by inspection and by measurement.

19.103 Rear hand guard

A **rear hand guard** shall be provided along the length of the right side of the bottom of the **rear handle** to protect the operator's hand from contact in case the **saw chain** breaks or derails.

The **rear hand guard** shall extend from the right edge of the **rear handle** for at least 30 mm on the **guide bar** side (see Figure 104) and

– at least 100 mm lengthwise from the inner rear part of the **chain saw** body (see Figure 104); or
– at least three times the diameter of 25 mm behind the **power switch**, as defined by three cylinders pressed against the **rear handle** and the **power switch**;

whichever of these options is further back.

This requirement may also be fulfilled by parts of the machine.

Compliance is checked by inspection and by measurement.

19.104 Drive sprocket cover

The **drive sprocket** and **saw chain** shall be covered to provide protection against personal injury. This cover shall not be removable without the aid of a tool unless the **drive sprocket** cover fastenings are the only means for retaining the **guide bar**.

The **chain saw** shall comply with ISO 6533:2020, 7.3.

There may be openings at the front, the front upper section and the bottom section to allow the ejection of wood chips and to allow passage of the **guide bar** and **saw chain**.

Compliance is checked by inspection, by measurement and by the following test:

*With the **drive sprocket** cover, **guide bar** and **saw chain** fitted, it shall not be possible to touch the **drive sprocket** with the straight test probe (see Figure 105) introduced with a force not exceeding 5 N from the top, the rear and the sides of the **drive sprocket** cover.*

19.105 Chain catcher

The **chain saw** shall be fitted with a **chain catcher** device placed under the **saw chain** as far to the front as practicable. The **chain catcher** shall extend sideways at least 5 mm from the centre-plane of the **guide bar**.

Compliance is checked by inspection and by measurement.

19.106 Void

19.107 Protection against injury by kickback

Chain saws shall be designed to minimize the risk of injury due to the effect of **kickback**.

19.107.1 Chain saws shall be equipped with a **manually activated chain brake,** operated by the **front hand guard** in a direction away from the operator, that stops movement of the **saw chain.**

A **manually activated chain brake** is not required if the **chain saw** is fitted with a **non-manually activated chain brake** that meets the requirements of 19.107.2 or provided the following requirements are fulfilled:

– the **maximum speed** of the **saw chain** does not exceed 5 m/s; and
– the **cutting length** without **bar tip guard** does not exceed 300 mm.

*Compliance is checked by inspection and by measurement with the **chain saw** fitted with a **saw chain** and **guide bar** as specified in 8.14.2.*

NOTE In New Zealand, the following conditions apply:

All **chain saws** shall be fitted with a **manually activated chain brake**.

19.107.1.1 The **manually activated chain brake** shall be designed so that the static activation force required is not more than 60 N and not less than 20 N.

Compliance is checked by the following test.

*With the **power switch** in the "on" position and the **chain saw** disconnected from the power source, the force on the **front hand guard** needed to activate the brake shall be measured at the centre of the top (horizontal) part of the **front hand guard** and in the direction of 45° forward and downward in relation to the **guide bar** centreline, see Figure 106.*

The force shall be applied at a uniform rate.

19.107.1.2 The average braking time shall not exceed 0,12 s and the maximum braking time shall not exceed 0,15 s.

Compliance is checked by the following test.

*The **chain saw** and **saw chain** tension shall be adjusted as for **normal use**, as specified in 8.14.2. The **chain saw** shall be run in before starting the test by performing 10 on"/"off" cycles with the **power switch**. One cycle consists of 30 s running and 30 s rest. After the run-in, the **saw chain** tension shall be adjusted according to the manufacturer's recommendations. If no recommendations are provided, the **saw chain** tension shall generally be adjusted so that, when a (0,9 ± 0,1) kg mass is hanging from the centre of the **cutting length** along the lower*

*portion of the **saw chain,** the gap between the **saw chain** side link and the **guide bar** is (0,020 ± 0,003) mm per millimetre of **guide bar** length.*

*With the **saw chain** lubricated as in **normal use,** and operated at **rated voltage** and **maximum speed**, the **front hand guard** is set in motion by the impact of a pendulum. This pendulum shall have a mass of 0,70 kg, a hammer with a flat strike face of 50 mm diameter and an arm of 700 mm length. The pendulum drop height shall be 200 mm. Any special hardware and/or software used to achieve **maximum speed** in accordance with 5.101 shall not influence the braking performance provided by the chain brake. The time for the **saw chain** to stop shall be measured from the moment of impact with the **front hand guard** (see Figure 107).*

*The **chain brake** shall be operated a total of 25 times. The maximum stopping time and the average stopping time of the **saw chain** shall be determined at the first five and the last five braking operations.*

*The **saw chain** is considered to be stopped when the time taken for two successive drive links (see dimension a in Figure 108) to pass a fixed point exceeds 5 ms.*

*The tests shall be done in 2 min intervals, comprising a no-load running period of 1 min prior to each impact of the pendulum. Immediately after the operation of the **chain brake** and the **saw chain** has stopped, the **chain saw** shall be switched off for the remainder of the interval. The **chain brake** actuation mechanism shall be reset during this off period.*

19.107.2 **Chain saws** with a **maximum speed** of the **saw chain** above 15 m/s shall be equipped with a **non-manually activated chain brake** that is sufficiently sensitive to operate when **kickback** occurs.

*Compliance is checked by inspection and by the test of ISO 13772:2009, with the **power switch** in the "on" position and the **chain saw** disconnected from the power source. For **chain saws** with the longest nominal **guide bar** size in accordance with 8.3 less than 500 mm, the threshold level of **chain saws** for forest service with ≤ 40 cm^3 engine displacement shall apply. For **chain saws** with the longest nominal **guide bar** size in accordance with 8.3 of 500 mm or greater, the threshold level of **chain saws** for forest service with > 40 cm^3 engine displacement shall apply. Measurements shall not be carried out on **guide bars** longer than 500 mm nominal length, except if no **guide bar** below 500 mm is specified in accordance with 8.3, measurements shall be carried out with the shortest specified **guide bar** only.*

19.107.2.1 If the actuation of the **non–manually activated chain brake** is independent of the **front hand guard,** the stopping time requirements shall apply as specified in 19.107.1.2.

*Compliance is checked by the test described by 19.107.1.2. The pendulum, however, is replaced by any arrangement suitable to measure the time from the moment the simulated **kickback** is detected by the **non-manually activated chain brake** until the **saw chain** has stopped.*

NOTE Examples of suitable test arrangements include the use of timing devices, sensors, high speed video, etc.

19.107.2.2 If the **non-manually activated chain brake** functions through the activation of the **front hand guard**, then the stopping time requirements in 19.107.1.2 shall apply.

*Compliance is checked by test described by 19.107.1.2. If this test was already performed for a **manually activated chain brake**, this test need not be repeated.*

19.107.3 After activation of a **chain brake**, if any, the motion of the **saw chain** shall stop and operation of the **chain saw** shall not resume without deliberate operator action of either:

– deactivation and reactivation of the **power switch**; or

– resetting of the **front hand guard**, if the operational state of the **chain brake** is recognizable by position or other means.

Compliance is checked by inspection and by manual test.

19.107.4 The computed kickback angle or the chain stop angle, whichever is lower, shall be determined for the most unfavourable **guide bar** and **saw chain** combination specified in 8.14.2. The angle shall not exceed 45°.

NOTE The most unfavourable combination can be determined by testing for the worst case **saw chain** on a single **guide bar** and independently testing for the worst case **guide bar** using the worst case **saw chain**.

This requirement does not apply to **guide bars** with a nominal **cutting length** of more than 630 mm.

NOTE 101 ISO 9518:2018 is not intended for testing **chain saws** with a **cutting length** in excess of 630 mm.

If the **chain saw** is provided with a **guide bar** incorporating a **bar tip guard**, whether removable or permanently attached, this shall be removed prior to testing.

The medium-density fibreboard (MDF) samples shall be as specified in ISO 9518:2018.

*Compliance is checked by determination of the computed kickback angle or the chain stop angle in accordance with ISO 9518:2018, except that the speed of the **drive sprocket** shall be in accordance with ISO 9518:2018, Table 1 or ISO 9518:2018, Table 2. For **chain saws** that exceed the speeds of ISO 9518:2018, Table 1 or ISO 9518:2018, Table 2, and where it is not possible to control the speed, the test shall be done at the nearest speed exceeding the values of ISO 9518:2018, Table 1 or ISO 9518:2018, Table 2.*

19.108 Guide bar cover

A protective cover shall be provided with the **chain saw** to cover the **guide bar** in order to prevent injuries during transportation.

The **guide bar** cover shall not be displaced by more than 50 mm when the **guide bar** is in a vertical downward position.

When the **guide bar** is adjusted to its maximum length and the **guide bar** cover is fully engaged on the **guide bar**, no more than 50 mm of the **saw chain** on the top or bottom of the **guide bar** shall remain exposed.

Compliance is checked by inspection and by measurement.

19.109 Saw chain tension

Chain saws shall be provided with means of tensioning the **saw chain**.

Compliance is checked by inspection.

19.110 Saw chain lubrication

Chain saws with a **maximum speed** of the **saw chain** of 5 m/s and above shall be equipped with a provision for lubricating the **saw chain**.

If the **chain saw** is fitted with a manual lubrication control, it shall be so located that it can be operated while holding the **chain saw** with both hands in a normal operating position.

Compliance is checked by inspection.

19.111 Balance

Chain saws shall be in longitudinal balance.

Compliance is checked by the following test.

*The **chain saw** shall be fitted with the most unfavourable **guide bar** and **saw chain** as specified in 8.14.2. The lubrication tank, if any, shall be half full. The **spiked bumper**, if any, shall be fitted. The **supply cord** is removed at its point of exit from the **chain saw** or, if supplied with a cord guard, at its point of exit from the cord guard. If the **chain saw** is fitted with an appliance inlet, then no connection shall be made at the appliance inlet. The **chain saw guide bar** cover shall not be fitted.*

*The **chain saw** shall be supported on the **front handle**, positioned so that the **guide bar** plane is vertical. This support shall produce the lowest possible friction to allow **chain saw** rotation. A segment of a suitable size of ball bearing may be used to achieve the low friction. See Figure 109.*

*The angle α between the centreline of the **guide bar** and the horizontal plane as shown in Figure 109 shall not exceed $\pm$ 30°.*

19.112 Run down time

The run down time of **chain saws** shall be limited.

Compliance is checked by the following test.

*The **chain saw** and **saw chain** tension shall be adjusted as for **normal use**, as specified in 8.14.2. The **chain saw** shall be run in before starting the test by performing 10 "on"/"off" cycles with the **power switch**. One cycle consists of 30 s running and 30 s rest. After the run-in, the **saw chain** tension shall be adjusted according to the manufacturer's recommendations. If no recommendations are provided, the **saw chain** tension shall generally be adjusted so that, when a (0,9 ± 0,1) kg mass is hanging from the centre of the **cutting length** along the lower portion of the chain, the gap between the **saw chain** side link and the **guide bar** is (0,020 ± 0,003) mm per millimetre of **guide bar** length.*

The test is made under no-load. The test sequence shall consist of a total of 2 500 cycles.

*The run down time of the **saw chain** shall not exceed 2 s for the first 6 cycles of operation and shall not exceed 3 s for the final 6 cycles of the test sequence.*

*The stop time is measured from the moment of release of the **power switch** actuator until the **saw chain** is stopped. The **saw chain** is considered to be stopped when the time taken for two successive drive links (see dimension a in Figure 108) to pass a fixed point exceeds 5 ms.*

20 Mechanical strength

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

20.1 *Addition:*

*Damage to the **guide bar**, **saw chain** and **chain catcher** are ignored.*

*Prior to performing the electric strength test, there shall be no leakage of lubrication through cracks in lubrication tanks and tank caps while the **chain saw** is being held in each of the six orthogonal directions for 30 s. Seepage through ventilation systems is not considered a failure.*

20.3.1 *Replacement:*

*The **chain saw**, equipped with the longest **guide bar** in accordance with 8.3 and with the lubrication tank empty, is dropped three times in total on a concrete surface from a height of 1 m. For these three drops, the sample is tested in the three most unfavourable positions with the lowest point of the machine being 1 m above the concrete surface. Secondary impacts shall be avoided.*

NOTE A method for avoiding secondary impacts is tethering.

*If **attachments** other than **guide bars** are provided as specified and mounted in accordance with 8.14.2, the test is repeated with each **attachment** or combination of **attachments** mounted to a separate machine sample.*

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.

After the test, the lubrication tank is filled to the maximum level in accordance with 8.14.2.

*It is not necessary for the **chain saw** to be operable after the test. If it is operable after the test, then immediately following this test it shall be run at **maximum speed** at no-load for 30 s.*

20.101 Handles

The handles shall be of durable construction and capable of withstanding stress sustained under normal working conditions.

*Compliance is checked by the handle strength test of ISO 7915:2021, the test forces for a **chain saw** for forest service with an electric motor shall apply.*

20.102 Front and rear hand guard

The **front hand guard** and **rear hand guard** shall be of durable construction and capable of withstanding impacts sustained in normal working conditions.

Compliance is checked by applying the dynamic and durability tests of ISO 6534. In 5.2 of ISO 6534:2007, a temperature of (–10 ± 3) °C shall apply.

20.103 The **chain catcher** shall have sufficient mechanical strength.

Compliance is checked by inspection and by the strength test of Clauses 3 and 4 of ISO 10726:1992. In 4.1 of ISO 10726:1992, a temperature of (–10 ± 3) °C shall apply.

21 Construction

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

21.18 *Replacement:*

Additional requirements for **power switches** for **chain saws** are given in 21.18.101 and 21.18.102.

21.18.101 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) or grasping surface(s) required by 19.101.

When the lock-off function as specified in 21.18.102 is in the unlocked state, the **chain saw** shall operate within 1 s after actuation of the **power switch**.

The **chain saw** shall only operate when the **chain brake**, if any, is deactivated.

Compliance is checked by inspection and by manual test.

21.18.102 The machine 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 **saw chain** 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 b) 6).

The lock-off device shall be actuated before the **power switch** can enable drive to the **saw chain**.

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** is activated;

or

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

NOTE 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 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 a lock-off device located within any grasping surface identified in accordance with 8.14.2 b) 6), in order to determine if it is possible to actuate the **power switch** 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, 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 111; and*
– *then applied in the direction perpendicular to the handle axis, see Figure 112*

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.

21.35 This subclause of Part 1 is not applicable.

21.101 Determination of cutting length

The **cutting length** *L* shall be measured with the **guide bar** adjusted to its midway point. The measurement shall be made along the centreline of the **guide bar** in accordance with a) – d) below.

a) For **chain saws** without a **bar tip guard** and where no **spiked bumper** is provided or the **spiked bumper** is removable, the **cutting length** *L* is determined as $L = L_1 + L_3$ as shown in Figure 102 a), where
   - L_1 is the distance from the **chain saw** body (*A*), to the tip end of the **guide bar** (not including the bar tip sprocket, if any); and
   - L_3 is 6 mm, which is an approximation for the height of the **saw chain** cutter.

b) For **chain saws** without a **bar tip guard** and where the **spiked bumper** is permanently attached to the **chain saw**, the **cutting length** *L* is determined as $L = L_2 + L_3$ as shown in Figure 102 a), where
   - L_2 is the distance from root of the spike nearest the centreline of the **guide bar** on the **spiked bumper** (*B*); and
   - L_3 is 6 mm, which is an approximation for the height of the **saw chain** cutter.

c) For **chain saws** with a **bar tip guard** and where no **spiked bumper** is provided or the **spiked bumper** is removable, the cutting length *L* is determined as $L = L_1$ as shown in Figure 102 b), where L_1 is the distance from the **chain saw** body (*A*) and the inside part of the **bar tip guard.**

d) For **chain saws** with a **bar tip guard** and where the **spiked bumper** is permanently attached to the **chain saw**, the **cutting length** *L* is determined as $L = L_2$ as shown in Figure 102 b), where L_2 is the distance from the root of the spike nearest the centreline of the **guide bar** on the **spiked bumper** (*B*) and the inside part of the **bar tip guard.**

21.102 Operator presence sensor

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

It is not required that the **operator presence sensor** is capable of distinguishing between an operator's hand and other objects.

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

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

Compliance is checked by inspection.

21.103 Spiked bumper

Chain saws with a nominal **guide bar** size or size range in accordance with 8.3 exceeding 400 mm shall

- be equipped with a **spiked bumper** (see Figure 101); or
- have provision for mounting one.

Compliance is checked by inspection.

21.104 Bar tip guard

Chain saws may be equipped with a **bar tip guard** (see Figure 102 b)).

NOTE A **bar tip guard**, if provided, influences the determination of **cutting length** in 21.101.

Compliance is checked by inspection.

22 Internal wiring

This clause of Part 1 is applicable.

23 Components

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

23.1.10.1 *Modification of the sixth paragraph:*

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

power switches for **chain saws** – for 50 000 cycles.

Addition:

Auxiliary switches, if any, associated with the **chain brake** are considered to be switches other than **power switches** and shall be classified as follows with respect to endurance – for 10 000 cycles.

23.1.10.2 *Modification of the third paragraph:*

Power switches for **chain saws** are tested for 50 000 cycles.

23.3 *Addition:*

Protection devices (e.g. overload or over-temperature protection devices) or circuits that switch off the **chain saw** shall be of the non-self-resetting type.

24 Supply connection and external flexible cords

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

24.1 *Replacement:*

Machines 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 inlets shall be suitable for the ratings of the machine.

Compliance is checked by inspection and by measurement.

The cord is measured from where it exits the machine to where it enters the plug or connector. 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 101 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 110 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.

24.4 *Modification:*

Supply cords shall not be lighter than heavy polychloroprene sheathed flexible cable (code designation 60245 IEC 66) or equivalent.

Compliance is checked by inspection.

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.

25 Terminals for external conductors

This clause of Part 1 is applicable.

26 Provision for earthing

This clause of Part 1 is applicable.

27 Screws and connections

This clause of Part 1 is applicable.

28 Creepage distances, clearances and distances through insulation

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

28.1 *Replacement:*

Creepage distances and **clearances** shall not be less than the values in millimetres shown in Table 12. The values specified in the table 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

– 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 or larger than the values required by IEC 60664-3.

28.2 Depending on the w**orking voltage**, the distance through insulation shall be sufficient:

– 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**.

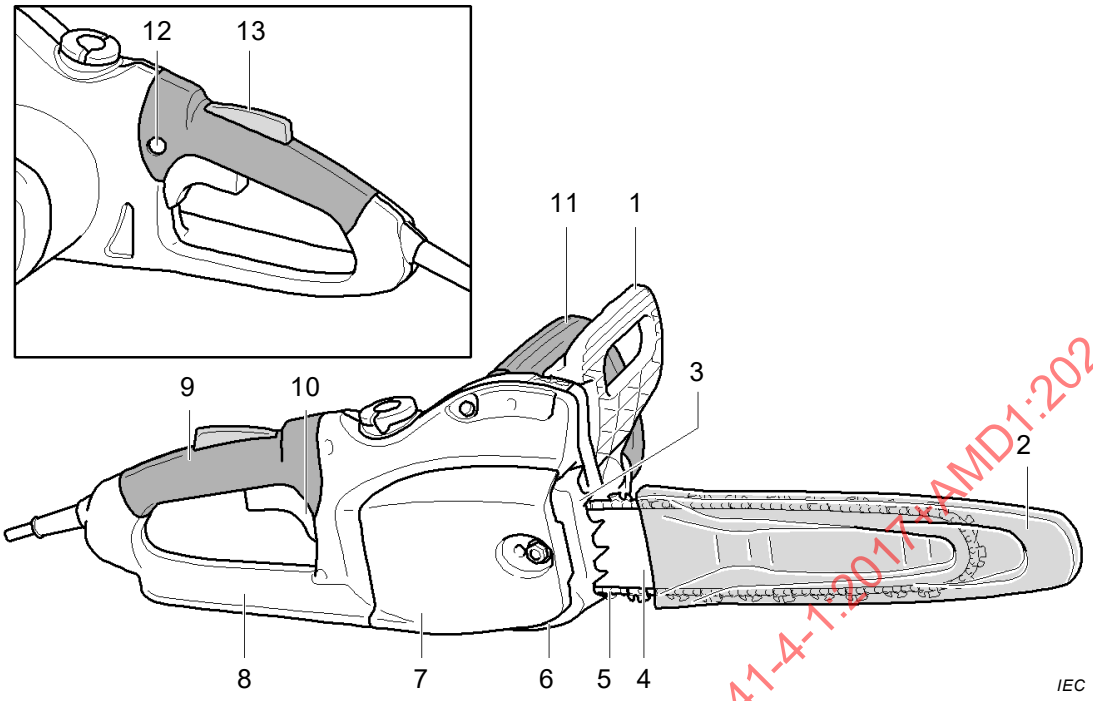
   The test voltage is applied between the outer surfaces of the layer, or of the two layers, as applicable.

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.

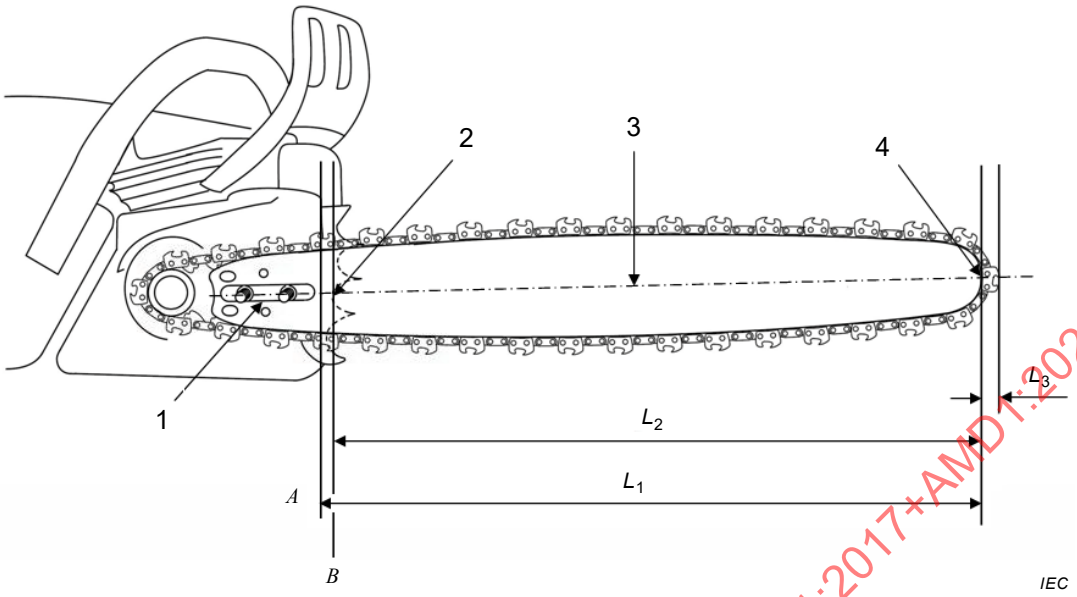
For optocouplers, the conditioning procedure is carried out at a temperature of 50 K in excess of the maximum temperature rise measured on the optocoupler during the tests of Clause 12 and Clause 18, the optocoupler being operated under the most onerous conditions which occur during these tests.



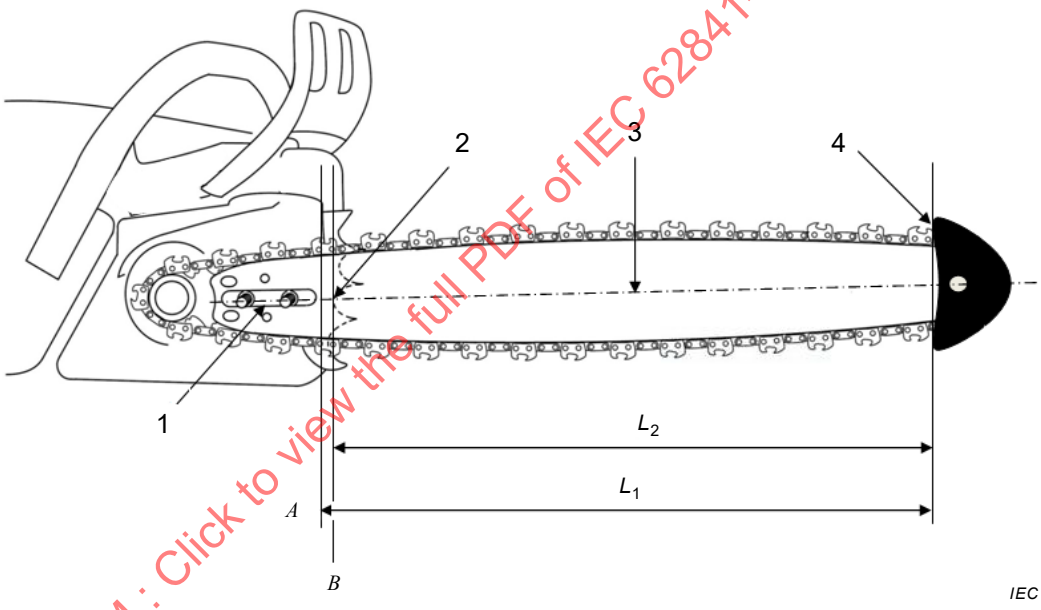
Key

1 **front hand guard**
2 **guide bar** cover
3 **spiked bumper**
4 **guide bar**
5 **saw chain**
6 **chain catcher**
7 **drive sprocket** cover
8 **rear hand guard**
9 **rear handle**
10 **power switch**
11 **front handle**
12 lock-off device
13 **operator presence sensor**

Figure 101 – Chain saw nomenclature



a) Chain saw without a bar tip guard



b) Chain saw with a bar tip guard

Key

1 **guide bar**

2 **spiked bumper**

3 centreline of **guide bar**

4 **bar tip guard**

A **chain saw** body

B root of the spike nearest the centreline of the **guide bar** on the **spiked bumper**

L_1 distance from *A* to the tip end of the **guide bar** (for **chain saws** with no **bar tip guard**) or the distance from *A* to the inside part of the **bar tip guard**

L_2 distance from *B* to the tip end of the **guide bar** (for **chain saws** with no **bar tip guard**) or the distance from *B* to the inside part of the **bar tip guard**

L_3 6 mm (approximation for the height of the **saw chain** cutter)

Figure 102 – Cutting length

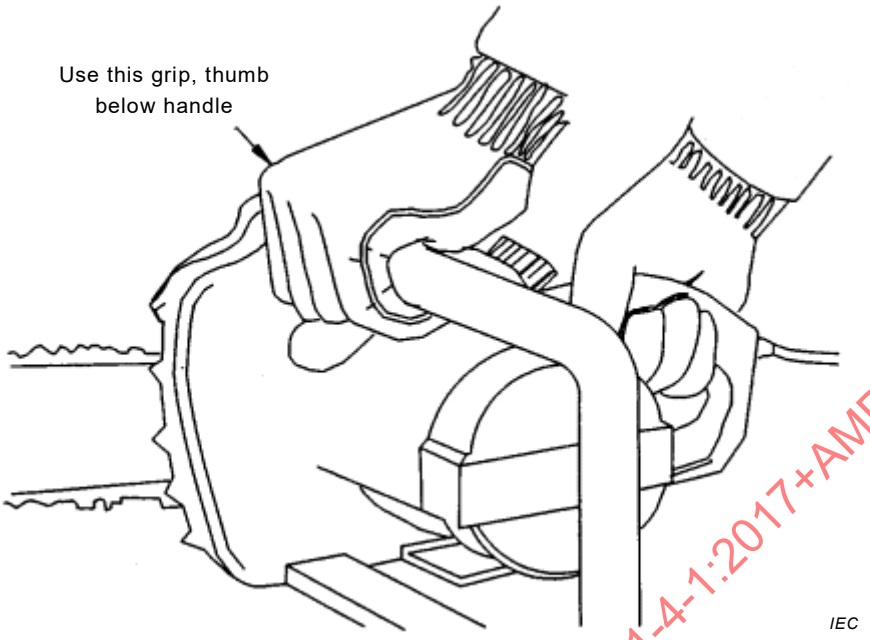


Figure 103 – Holding the chain saw

Dimensions in millimetres

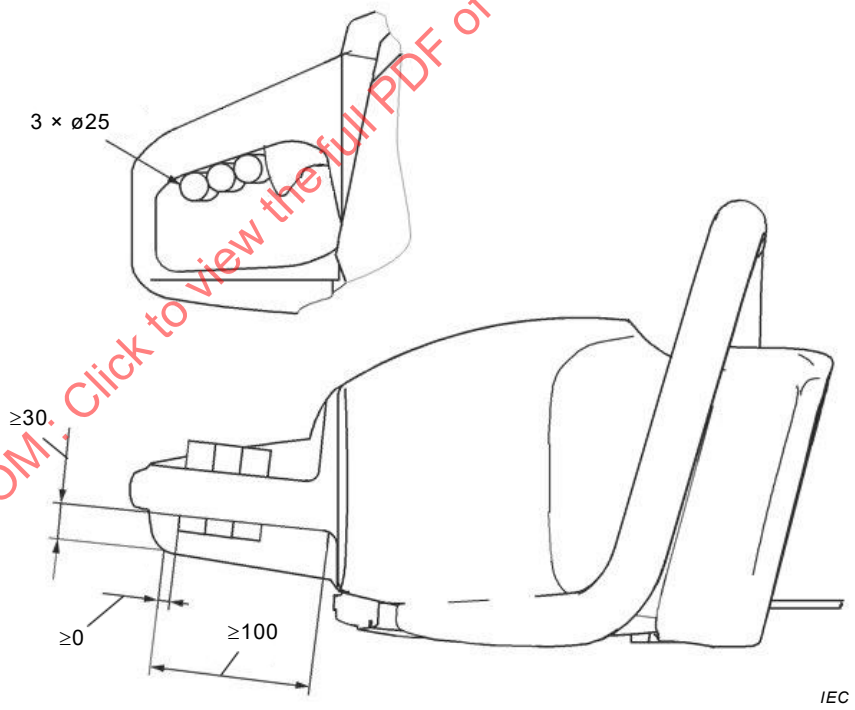
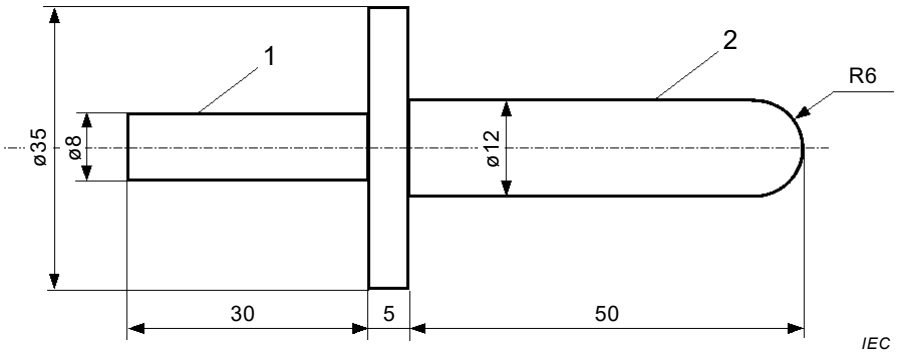


Figure 104 – Minimum rear hand guard dimensions

Dimensions in millimetres



Key

1 handle section

2 test section

Figure 105 – Straight test probe

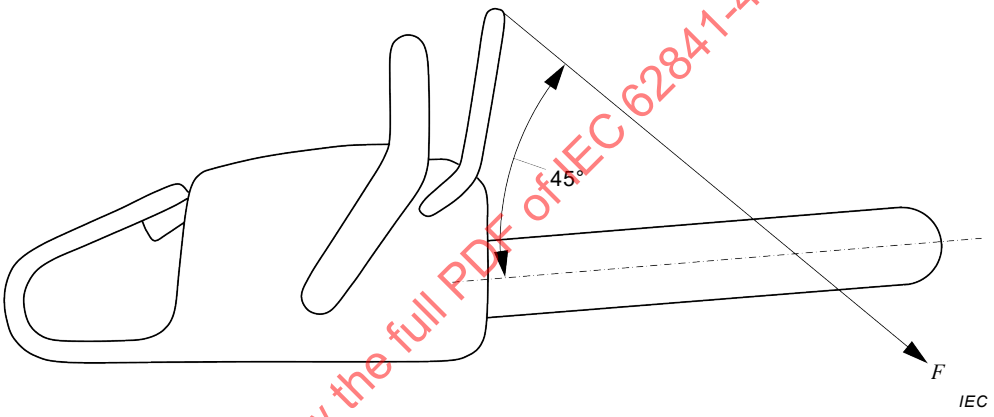
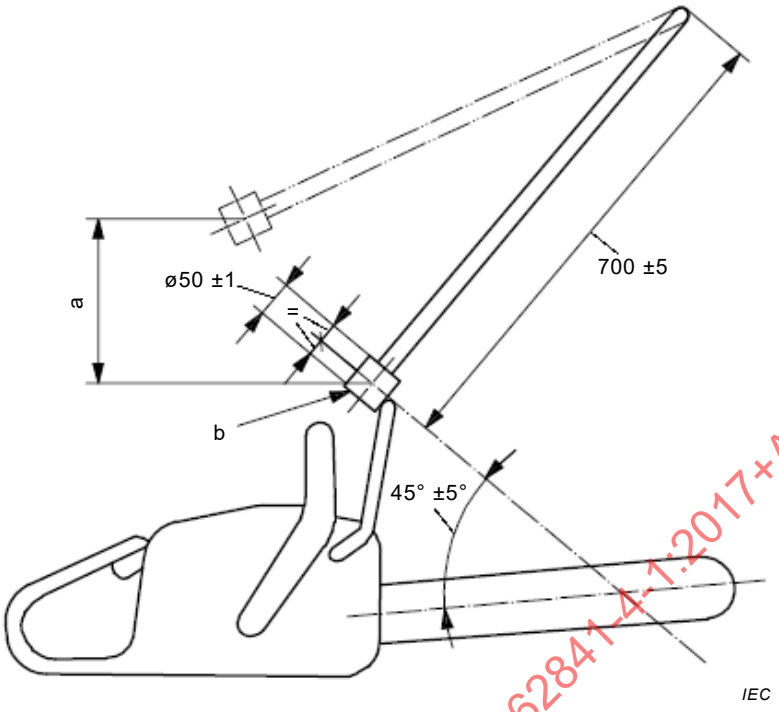


Figure 106 – Measuring direction of static activation force *F*

Dimensions in millimetres

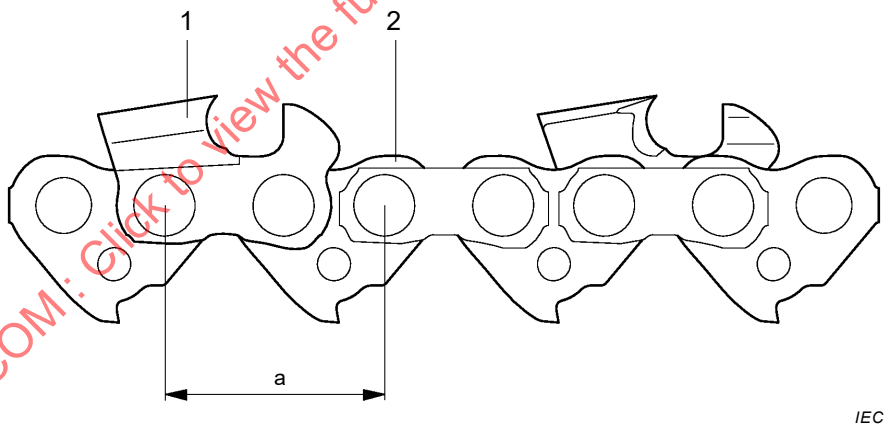


Key

a pendulum drop height

b sharp edges shall be chamfered

Figure 107 – Impact direction and pendulum



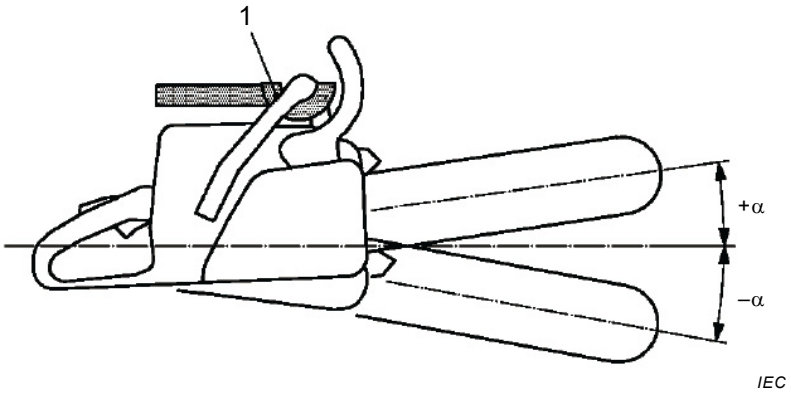
Key

1 cutter

2 drive link

a distance between drive links

Figure 108 – Saw chain drive link spacing

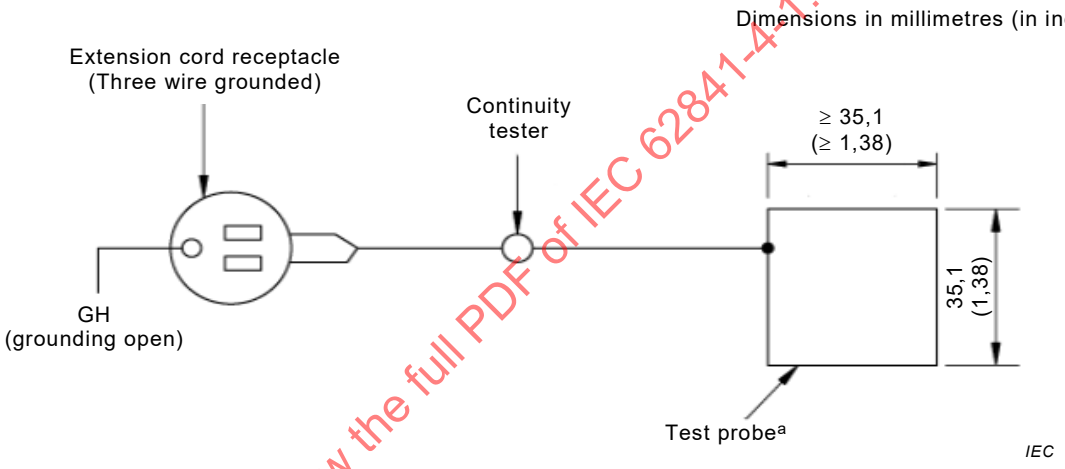


Key

1 segment of a ball bearing or equivalent

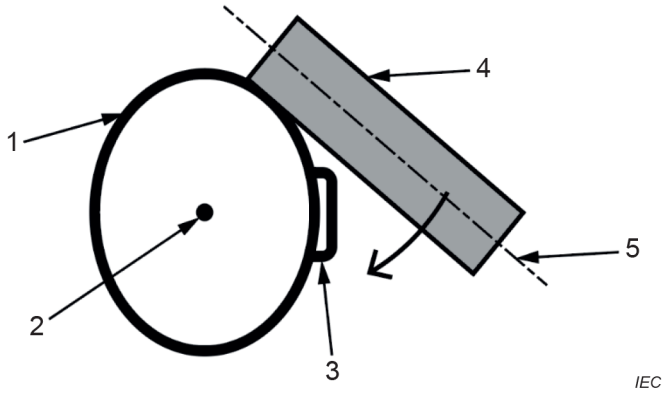
α angle between the centreline of the **guide bar** and the horizontal plane

Figure 109 – Chain saw balance



[a] Test probe shall be made of 1,5 mm (0,006 inch)thick metal

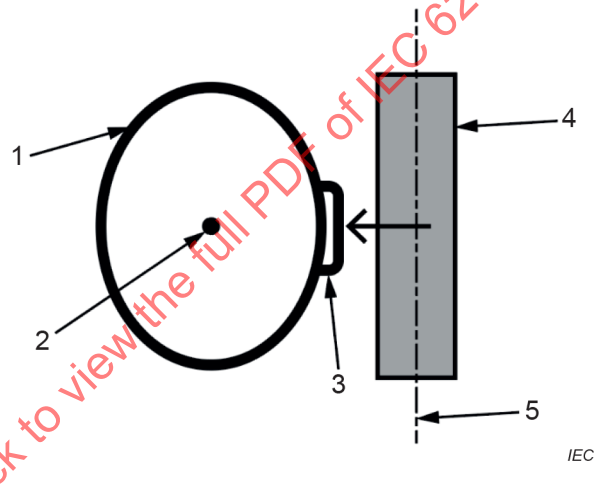
Figure 110 – Test assembly for accessibility of attachment plug blades



Key

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

Figure 111 – Application of steel rod when rotated around the rear handle



Key

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

Figure 112 – Application of steel rod when applied in the direction perpendicular to the rear handle axis

Annexes

The annexes of Part 1 are applicable except as follows:

Annex C
(normative)

Leakage current

Addition:

C.101 Measurement of insulation touch current for battery-operated machines

*The **insulation touch current** is measured for machines with a **working voltage** that is a **hazardous voltage**, where there is an **accessible part** or surface conductively connected to internal circuitry, other than through **protective impedance**.*

The network used for measurement as shown in Figure C.3 of Part 1 is modified such that the value of R_s is decreased to 375 Ω.

The test is conducted by using two foil probes connected to the inputs of the modified network of Figure C.3 of Part 1, each of 25 mm diameter consisting of metal foil backed by foam or other compliant medium such that the probe conforms to the contour of the surfaces being checked. The probes are positioned where a large potential difference is likely.

*In addition, the foil probing test shall be conducted between handles and grasping surfaces as identified in 8.14.2 b) 6) of Part 1 even if there are no **accessible parts** or surfaces connected to internal circuitry.*

*When probing **batteries**, the test is not conducted on terminals of **detachable battery packs** or **separable battery packs** that comply with the contact surface and voltage limitation in accordance with K.9.3.*

The measurement circuit of Figure C.3 of Part 1 shall have a measurement accuracy of 5 %, evaluated at d.c., 100 Hz, 1 kHz and 10 kHz.

*The **insulation touch current** limit (I_{limit}) in mA shall be calculated dependent on the value of the conductivity or resistivity of the water used for testing, as applicable.*

If the water conductivity is measured,

$I_{limit} = 1/25 \times \sigma$

with σ being the conductivity of the water in mS/m.

If the water resistivity is measured,

$I_{limit} = 40 / \rho$

with ρ being the resistivity of the water in Ωm.

NOTE 101 The value of I_{limit} is 2,0 mA if water with the highest conductivity or lowest resistivity is used for the test. Water with lower conductivity or higher resistivity will result in lower values of I_{limit}.

Annex I
(informative)

Measurement of noise and vibration emissions

NOTE In Europe (EN 62841-4-1), Annex I is normative.

I.2 Noise test code (grade 2)

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

I.2.2.1 General

Replacement:

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

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.

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 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;
– 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 –10 °C to 30 °C and the wind speed shall be less than 8 m/s and preferably 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 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;

– measurements shall be made using an integrating-averaging sound level meter as defined in IEC 61672-1; alternatively, instruments with the time-weighting characteristics “slow”, as defined in IEC 61672-1, may be used.

The A-weighted sound power level, L_{WA}, shall be calculated in accordance with 8.6 of ISO 3744:2010, as follows:

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

with $\overline{L_{pfA}}$ determined from

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

where

$\overline{L_{pfA}}$ is the A-weighted surface sound pressure level according to ISO 3744;

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

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

K_{2A} is the environmental correction, A-weighted;

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:

$$S = 2\pi r^2, \text{ in m}^2.$$

where the radius of the hemisphere, r = 4 m

so, from equation (I.101)

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

Table I.101 – Co-ordinates of microphone positions

Position No.	*x*	*y*	*z*
1	+ 0,65 *r*	+ 0,65 *r*	0,38 *r*
2	– 0,65 *r*	+ 0,65 *r*	0,38 *r*
3	– 0,65 *r*	– 0,65 *r*	0,38 *r*
4	+ 0,65 *r*	– 0,65 *r*	0,38 *r*
5	– 0,28 *r*	+ 0,65 *r*	0,71 *r*
6	+ 0,28 *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.

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 See Annex CC 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 ground at the centre of the test site shall be flat and have good sound-absorbing properties. The surface shall be either forest ground or grass, with the grass or other organic material having a height of (50 ± 20) mm.

I.2.3 Emission sound pressure level determination

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

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

I.2.3.3 *Replacement:*

The emission sound pressure for the **chain saw** shall be determined in accordance with I.2.3.1.

NOTE A **chain saw** is used in a similar way to hand-held tools, without a uniquely defined work station. The sound pressure at a distance of 1 m from the machine is applicable.

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

Replacement:

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

The machine under test shall be new and equipped with **attachments** which affect the acoustic properties, as specified in 8.14.2. Prior to commencing testing, the machine (including any required ancillary equipment) shall be set up in a stable condition as specified in 8.14.2.

The installation and mounting conditions for A-weighted sound power level measurement shall be in accordance with A.1 and A.2 of ISO 22868:2011, as far as applicable to electric **chain saws**.

The operator, if any, shall not be positioned directly between any microphone position and the machine.

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

I.2.5 Operating conditions

Replacement:

I.2.5.1 General

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

Measurements shall be carried out on a new machine.

Before starting the test, the machine shall be operated under the conditions of I.2.5.2 or I.2.5.3 for a period of at least 15 min.

Care shall be taken that the location of the test timber on its support does not adversely affect the result of the test.

I.2.5.2 Mains powered **chain saws** shall be tested at **rated voltage** using a **saw chain** and the longest **guide bar** as specified in 8.14.2 c) 101), under both of the following conditions:

– no-load speed, with the highest setting of the speed control, if any, without altering any hardware or software; and

– **rated input** or **rated current** using a water brake (or equivalent) as specified in A.2.1 of ISO 22868:2011.

Four consecutive sound power level tests at no-load speed and four at **rated input** or **rated current** shall be carried out. The resulting sound power level L_{WA} is calculated by:

$$L_{WA} = 10 \lg \frac{1}{2} \left[10^{0,1 L_{W1}} + 10^{0,1 L_{W2}} \right] \text{dB}$$

where

L_{W1} is the arithmetic mean, rounded to the nearest decibel, of the four sound power level tests performed at no-load speed; and

L_{W2} is the arithmetic mean, rounded to the nearest decibel, of the four sound power level tests performed at **rated input** or **rated current**.

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.2.5.3 Battery powered **chain saws** shall be tested with a fully charged battery using a **saw chain** and the longest **guide bar** combination(s) as specified in 8.14.2 c) 101), under both of the following conditions:

– no-load speed, with the highest setting of the speed control, if any, without altering any hardware or software; and

– **maximum speed** at no-load, in accordance with 5.101.

NOTE A water brake (or equivalent) as specified in A.2.1 of ISO 22868:2011 is not used for the test of I.2.5.3.

Four consecutive sound power level tests at no-load speed and four at **maximum speed** at no-load shall be carried out. The resulting sound power level L_{WA} is calculated by:

$$L_{WA} = 10 \lg \frac{1}{2} \left[10^{0,1 L_{W1}} + 10^{0,1 L_{W2}} \right] \text{dB}$$

where

L_{W1} is the arithmetic mean, rounded to the nearest decibel, of the four sound power level tests performed at no-load speed; and

L_{W2} is the arithmetic mean, rounded to the nearest decibel, of the four sound power level tests performed at **maximum speed** at no-load.

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:

Figure I.102 shows the positions of the transducers for **chain saws**.

I.3.5.3 Operating conditions

Addition:

Chain saws are tested under load observing the conditions shown in Table I.103.

Table I.103 – Test conditions

Material	Sound timber taken from freshly felled hardwood log, not seasoned or frozen. Width of the log to be trimmed to 75 % of the usable **cutting length** of the **guide bar**.
Orientation of workpiece	Log to be rigidly clamped horizontally so that the centre line of the log is at (800 ± 100) mm from the ground
Orientation of the **attachment**	The **chain saw** shall be held with the **guide bar** centreline horizontal and the **guide bar** plane vertical
Cutting **attachment**	The most unfavourable combination of a **saw chain** and the longest **guide bar** as specified in 8.14.2 c) 101)
Feed force	For mains powered **chain saws**, sufficient force to achieve **rated input** ± 10 %. For battery powered **chain saws**, sufficient force to achieve the fastest cut possible without overloading the machine.
Test cycle	Perform the measurements during crosscutting in a part substantially free of knots. The vibration measurements shall be taken in the middle third through the log with the complete **guide bar** tip free outside the log. There shall be no contact between the test timber and the motor part of the machine or the **spiked bumper**, if any. Only the **guide bar** and the **saw chain** shall come into contact with the test timber.

I.3.6.1 *Addition:*

The vibration data for each test shall be obtained from at least four measurements with a duration of at least 2 s each, totalling to at least 20 s. After each measurement, the **chain saw** shall be switched off.

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.

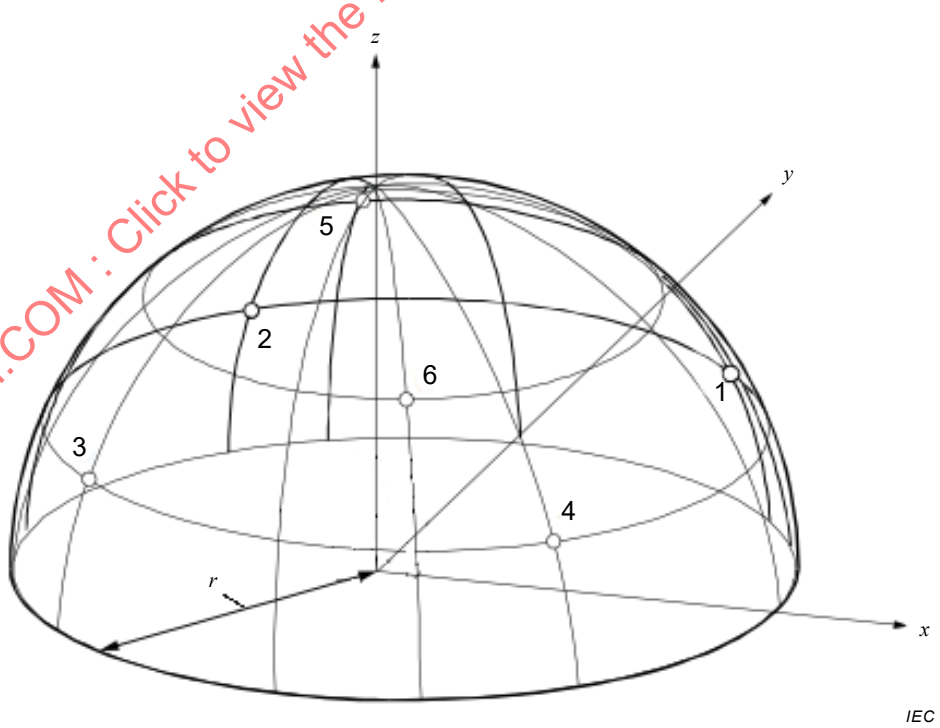


Figure I.101 – Microphone positions on the hemisphere (see Table I.101)

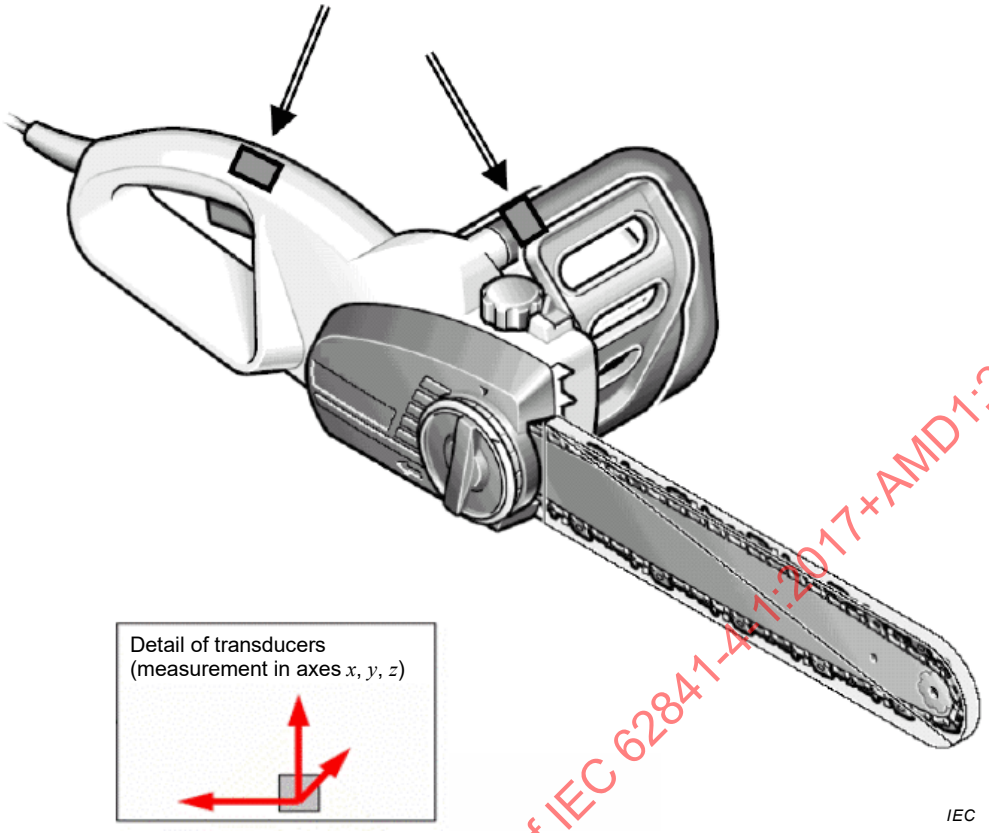


Figure I.102 – Positions of transducers for chain saws

Annex K
(normative)

Battery tools and battery packs

All clauses of the main body of this Part 4-1 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 4-1 unless otherwise specified.

K.1 Scope

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

Addition:

This standard applies to **chain saws** for cutting wood and designed for use by one person. This standard does not cover **chain saws** designed for use in conjunction with a guide-plate and riving knife or in any other way such as with a support or as a stationary or transportable machine.

This standard does not apply to

– **chain saws** for tree service as defined in ISO 11681-2; or
– pole-mounted pruners.

NOTE 101 Pole-mounted pruners will be covered by a future part of IEC 62841.

NOTE 102 In Europe (EN 62841-4-1), this annex does not apply to **chain saws** equipped with **integral batteries** and with a **maximum speed** of the **saw chain** exceeding 5 m/s.

The **chain saws** covered by this standard are designed only to be operated with the right hand on the **rear handle** and the left hand on the **front handle.**

K.3 Terms and definitions

Replacement of Definition 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 machine is supplied by (a) **fully charged battery**(**ies**) and operating at no-load, or with the machine in the "off" condition, whichever is greater

Replacement of Definition K.3.211 of Part 1:

K.3.211
hazardous voltage
voltage between parts

– for machines where use in rain, cleaning with low-pressure water and immersion in water to a depth of up to 1 m for cleaning is permitted, having
  - an average value exceeding 30 V d.c.; or
  - a peak value exceeding 21,2 V when the peak-to-peak ripple exceeds 10 % of the average value; or
– for other machines, having

- an average value exceeding 60 V d.c.; or
- a peak value exceeding 42,4 V when the peak-to-peak ripple exceeds 10 % of the average value

Note 301 to entry: For machines classified in accordance with K.7.2 as "Use in rain is permitted", "Cleaning with low-pressure water is permitted" or "Immersion in water to a depth of up to 1 m for cleaning is permitted", it is assumed that the operator's hands are wet during machine handling.

Add the following new definitions:

K.3.301
insulation touch current
current which flows through a person upon contact with **accessible parts** of a **battery-operated** machine with a **working voltage** that is a **hazardous voltage**

K.3.302
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.7.2 Chain saws shall be classified in accordance with the following categories with respect to moisture resistance:

– exposure to rain, cleaning with water and immersion in water are not permitted; or
– one or more of the following categories:
  - "Use in rain is permitted"; or
  - "Cleaning with low-pressure water is permitted"; or
  - "Immersion in water to a depth of up to 1 m for cleaning is permitted".

Compliance is checked by inspection and by the relevant tests, as applicable.

K.7.301 Detachable battery packs and **separable battery packs** shall be of one of the following categories with respect to moisture resistance:

– exposure to rain, cleaning with water and immersion in water are not permitted; or
– one or more of the following categories:
  - "Use in rain is permitted"; or
  - "Cleaning with low pressure water is permitted"; or
  - "Immersion in water to a depth of up to 1 m for cleaning is permitted".

Compliance is checked by inspection and by the relevant tests, as applicable.

K.8.1 This subclause of Part 4-1 is not applicable.

K.8.1.101 Chain saws, **detachable battery packs** and **separable battery packs** shall not be marked with an IPX1, IPX2, IPX3, IPX6, IPX8 or IPX9 rating.

Compliance is checked by inspection.

K.8.1.301 Chain saws shall be marked in accordance with their classification in K.7.2 as indicated in Table K.301.

Compliance is checked by inspection.

Table K.301 – Chain saw moisture resistance classification and marking

Moisture resistance classification	Required marking	Additional optional marking
Exposure to rain, cleaning with water and immersion in water are not permitted	In accordance with K.8.2	Markings prohibiting exposure to rain, cleaning with water or immersion in water are permitted. No additional markings related to moisture resistance classification, including IP markings, are permitted.
Use in rain is permitted	None	"OK to use in rain", the sign shown in Annex DD, "IPX4M", or any combination thereof. See NOTE 301 below.
Cleaning with low-pressure water is permitted	"May wash with water as indicated in instruction manual" or a symbol that is described in the instruction manual See NOTE 302 below.	IPX5S
Immersion in water up to a depth of 1 m for cleaning is permitted	"May immerse in water to a depth of up to 1 m for cleaning" or a symbol that is described in the instruction manual See NOTE 303 below.	IPX7S

NOTE 301 In Canada and the United States of America, for machines that are classified as "Use in rain is permitted" and where it is possible to fit a manufacturer-recommended **detachable battery pack** or a **separable battery pack** to the machine that does not fulfil the requirements of K.14.2.302.6, the additional optional marking on the machine must be one of the following:

– "OK to use in rain only when used with battery _____", where "_____" is replaced by an indication of the appropriate **battery** pack(s) for use, such as by a catalog number, series identification or the equivalent; or

– "OK to use in rain only when used with a battery marked "OK to use in rain"; or

– "OK to use in rain only when used with a battery marked  "; or

– "OK to use in rain only when used with a battery marked "IPX4".

The text "OK to use in rain" in the markings above can be replaced by "IPX4M" or "  ".

In Canada, the equivalent French wording of the above warnings is as follows:

– "OK à utiliser sous la pluie uniquement lorsqu'il est utilisé avec la batterie _____", où "_____" est remplacé par une indication du ou des blocs-batteries appropriés à utiliser, comme par un numéro de catalogue, une identification de série ou l'équivalent; or

– "OK pour une utilisation sous la pluie uniquement lorsqu'il est utilisé avec une batterie marquée "OK pour une utilisation sous la pluie"; or

– "OK à utiliser sous la pluie uniquement lorsqu'il est utilisé avec une batterie marquée  "; or

– "OK à utiliser sous la pluie uniquement lorsqu'il est utilisé avec une batterie marquée "IPX4".

"OK à utiliser sous la pluie" dans les marquages ci-dessus peut être remplacé par "IPX4M" or "  ".

NOTE 302 In Canada and the United States of America, for machines

– that are classified as "Cleaning with low-pressure water is permitted"; and

– where the manufacturer recommends cleaning the machine with the **battery** pack fitted; and

– where it is possible to fit a manufacturer-recommended **detachable battery pack** or a **separable battery pack** to the machine that does not fulfil the requirements of K.14.2.302.6,

the additional optional marking on the machine must be one of the following:

– "May wash with water as indicated in instruction manual only when used with battery _____", where "_____" is replaced by an indication of the appropriate **battery** pack(s) for use, such as by a catalog number, series identification or the equivalent; or

– "May wash with water as indicated in instruction manual only when used with a battery marked "May wash with water as indicated in instruction manual"; or

– "May wash with water as indicated in instruction manual only when used with a battery marked _____", where "_____" is replaced by a symbol that is described in the instruction manual.

In Canada, the equivalent French wording of the additional optional marking on the machine is as follows:

– "Peut être lavé à l'eau comme indiqué dans le manuel d'instructions uniquement lorsqu'il est utilisé avec la batterie _____", où "_____" est remplacé par une indication du ou des blocs-batteries appropriés à utiliser, par exemple par un numéro de catalogue, une identification de série ou l'équivalent; or

– "Peut se laver à l'eau comme indiqué dans le manuel d'instructions uniquement lorsqu'il est utilisé avec une batterie marquée "Peut se laver avec de l'eau comme indiqué dans le manuel d'instructions"; or

– "Peut être lavé à l'eau comme indiqué dans le manuel d'instructions uniquement lorsqu'il est utilisé avec une batterie marquée _____", où "_____" est remplacé par un symbole décrit dans le manuel d'instructions.

NOTE 303 In Canada and the United States of America, for machines

– that are classified as "Immersion in water up to a depth of 1 m for cleaning is permitted"; and

– where the manufacturer recommends immersing the machine with the **battery** pack fitted; and

– where it is possible to fit a manufacturer-recommended **detachable battery pack** or a **separable battery pack** to the machine that does not fulfil the requirements of K.14.2.302.6,

the additional optional marking on the machine must be one of the following:

– "May immerse in water to a depth of up to 1 m for cleaning only when used with battery _____", where "_____" is replaced by an indication of the appropriate **battery** pack(s) for use, such as by a catalog number, series identification or the equivalent; or

– "May immerse in water to a depth of up to 1 m for cleaning only when used with a battery marked "May immerse in water to a depth of up to 1 m for cleaning"; or

– "May immerse in water to a depth of up to 1 m for cleaning only when used with a battery marked _____", where "_____" is replaced by a symbol that is described in the instruction manual.

In Canada, the equivalent French wording of the additional optional marking on the machine is as follows:

– "Peut être immergé dans l'eau jusqu'à une profondeur de 1 m pour le nettoyage uniquement lorsqu'il est utilisé avec la batterie _____", où "_____" est remplacé par une indication du ou des blocs-batteries appropriés à utiliser, par exemple par un numéro de catalogue, une identification de série ou l'équivalent; or

– "Peut être immergé dans l'eau jusqu'à une profondeur de 1 m pour le nettoyage uniquement lorsqu'il est utilisé avec une batterie marquée "Peut être immergé dans l'eau jusqu'à une profondeur de 1 m pour le nettoyage"; or

– "Peut être immergé dans l'eau jusqu'à une profondeur de 1 m pour le nettoyage uniquement lorsqu'il est utilisé avec une batterie marquée _____", où "_____" est remplacé par un symbole décrit dans le manuel d'instructions.