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**Machinery for forestry — Portable  
chain-saw safety requirements and  
testing —**

**Part 2:  
Chain-saws for tree service**

*Matériel forestier — Exigences de sécurité et essais des scies à chaîne  
portatives —*

*Partie 2: Scies à chaîne pour l'élagage des arbres*

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 17, *Manually portable (hand-held) powered lawn and garden equipment and forest machinery*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 144, *Tractors and machinery for agriculture and forestry*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This fourth edition cancels and replaces the third edition (ISO 11681-2:2011), which has been technically revised. It also incorporates the Amendment ISO 11681-2:2011/Amd 1:2017.

The main changes compared to the previous edition are as follows:

- the normative references in [Clause 2](#) have been updated;
- requirements for kickback in [4.5.3.1](#) have been clarified;
- requirements and verification for throttle control system in [4.12](#) have been updated;
- a new subclause, [4.17.2.3](#) “Fuel feed line strength and accessibility”, has been added;
- [5.1.2](#) has been updated;
- in [5.1.3](#), information on safe starting procedure has been added.

A list of all parts in the ISO 11681 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

## Introduction

This document is a type-C standard as stated in ISO 12100:2010.

This document is of relevance, in particular, for the following stakeholder groups representing the market players with regard to machinery safety: players with regard to machinery safety:

- machine manufacturers (small, medium and large enterprises);
- health and safety bodies (regulators, accident prevention organizations, market surveillance, etc.).

Others can be affected by the level of machinery safety achieved with the means of the document by the above-mentioned stakeholder groups:

- machine users/employers (small, medium and large enterprises);
- machine users/employees (e.g. trade unions, organizations for people with special needs);
- service providers, e.g. for maintenance (small, medium and large enterprises);
- consumers (in case of machinery intended for use by consumers).

The above-mentioned stakeholder groups have been given the possibility to participate at the drafting process of this document.

The machinery concerned and the extent to which hazards, hazardous situations or hazardous events are covered are indicated in the scope of this document.

When requirements of this type-C standard are different from those which are stated in type-A or type-B standards, the requirements of this type-C standard take precedence over the requirements of the other standards for machines that have been designed and built according to the requirements of this type-C standard.

# Machinery for forestry — Portable chain-saw safety requirements and testing —

## Part 2: Chain-saws for tree service

### 1 Scope

This document specifies safety requirements and measures for verification for the design, construction, transporting and commissioning for tree service of portable, combustion-engine, hand-held chain-saws having a maximum mass of 4,3 kg (without the guide bar and saw-chain and with tanks empty).

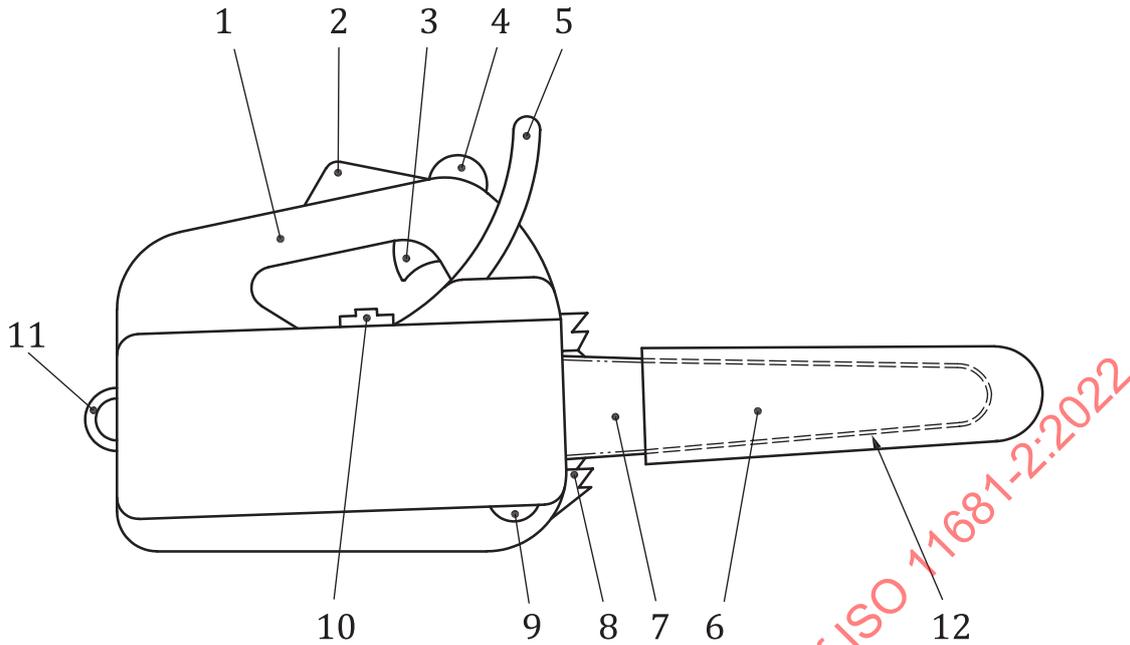
The chain-saws are intended to be used, with the right hand on the rear handle and left hand on the front handle, by a trained operator.

Dismantling and scrapping of the product is not covered by this document. Methods for the elimination or reduction of hazards arising from the use of these machines and the type of information on safe working practices to be provided by the manufacturer are specified.

This document deals with all significant hazards, hazardous situations and hazardous events relevant to these machines when they are used as intended and under conditions of misuse which are reasonably foreseeable by the manufacturer (see [Annex B](#)).

This document is applicable to chain-saws manufactured after its date of publication.

NOTE [Figure 1](#) shows an example of a chain-saw within the scope of this document.



**Key**

- |   |                           |    |                  |
|---|---------------------------|----|------------------|
| 1 | rear handle               | 7  | guide bar        |
| 2 | throttle trigger lock-out | 8  | spiked bumper    |
| 3 | throttle trigger          | 9  | chain catcher    |
| 4 | front handle              | 10 | stopping device  |
| 5 | front handguard           | 11 | attachment point |
| 6 | guide bar cover           | 12 | saw-chain        |

**Figure 1 — Example of chain-saw**

**2 Normative references**

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 6531:2017, *Machinery for forestry — Portable chain-saws — Vocabulary*

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 6534:2007/Amd 1:2012, *Forestry machinery — Portable chain-saw hand-guards — Mechanical strength — Amendment 1*

ISO 6535:2015, *Portable chain-saws — Chain brake performance*

ISO 7010:2019, *Graphical symbols — Safety colours and safety signs — Registered safety signs*

ISO 7293:1997, *Forestry machinery — Portable chain saws — Engine performance and fuel consumption*

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

ISO 7914:2002/Amd 1:2012, *Forestry machinery — Portable chain-saws — Minimum handle clearance and sizes — Amendment 1*

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

- ISO 8334:2007, *Forestry machinery — Portable chain-saws — Determination of balance and maximum holding moment*
- ISO 9518:2018, *Forestry machinery — Portable chain-saws — Kickback test*
- ISO 10726:2020, *Portable chain-saws — Chain catcher — Dimensions and mechanical strength*
- ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction*
- ISO 13772:2018, *Forestry machinery — Portable chain-saws — Non-manually actuated chain brake performance*
- ISO 13772:2018/Amd 1:2020, *Forestry machinery — Portable chain-saws — Non-manually actuated chain brake performance — Amendment 1*
- ISO 13849-1:2015, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*
- ISO 13849-2:2012, *Safety of machinery — Safety-related parts of control systems — Part 2: Validation*
- ISO 13857:2019, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs*
- ISO 14982:1998, *Agricultural and forestry machinery — Electromagnetic compatibility — Test methods and acceptance criteria*
- ISO 22867:2021, *Forestry and gardening machinery — Vibration test code for portable hand-held machines with internal combustion engine — Vibration at the handles*
- ISO 22868:2021, *Forestry and gardening machinery — Noise test code for portable hand-held machines with internal combustion engine — Engineering method (Grade 2 accuracy)*
- IEC 61032:1997, *Protection of persons and equipment by enclosure — Probes for verification*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 6531:2017, ISO 12100:2010 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

#### 3.1

##### **trained operator**

person who has competence and knowledge in:

- the use of, and particular hazards associated with using, a chain-saw (for tree service work) manufactured in accordance with the provisions of this document, and
- the precautions to be taken to limit these hazards, including the wearing of the recommended personal protective equipment (PPE).

## 4 Safety requirements and/or protective measures

### 4.1 General

Machines shall comply with the safety requirements and/or protective measures of this clause. In addition, the machine shall be designed according to the principles of ISO 12100:2010 for relevant but not significant hazards which are not dealt with by this document.

The safe operation of a chain-saw also depends on the safe environment associated with the use of personal protective equipment (PPE), such as gloves, slip-resistant footwear, and leg, eye, foot, hearing and head protective equipment, as well as safe working procedures (see [5.1](#)).

Except where otherwise specified in this document, the safety distances specified in ISO 13857:2019, 4.2.4.1 and 4.2.4.3, shall be met.

### 4.2 Handles

#### 4.2.1 Requirements

Chain-saws shall have a handle for each hand. These handles shall be designed such that

- they can be fully gripped by an operator wearing protective gloves,
- they provide the necessary sureness of grip by their shaping and surface,
- they conform to the dimensions and clearances given for tree-service chain-saws in ISO 7914:2002 (see also [4.12.1](#)), and
- their strength complies with ISO 7915:2021.

Chain-saws having a system for isolating machine vibration from the handles shall be designed so that the operator is able to stop the engine in a controlled manner with the engine stopping device (see [4.11](#)), even in the case of failure of the vibration isolation system.

#### 4.2.2 Verification

Dimensions shall be verified by measurement. Strength requirements shall be verified by testing in accordance with ISO 7915:2021. The possibility of stopping the chain-saw engine when a failure has occurred in the vibration isolation system shall be verified by inspection of the design and by functional testing.

### 4.3 Hand protection

#### 4.3.1 Protection at front handle

##### 4.3.1.1 Requirements

A hand-guard shall be fitted in the vicinity of the front handle to protect the operator's fingers and hand from injury through contact with the saw-chain.

The dimensions of this front hand-guard shall comply with ISO 6533:2020. Its strength shall comply with ISO 6534:2007.

##### 4.3.1.2 Verification

Dimensions shall be verified by measurement. Strength requirements shall be verified by testing in accordance with ISO 6534:2007.

## 4.3.2 Protection at rear handle

### 4.3.2.1 Requirements

A 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 with a broken saw-chain.

This hand-guard shall extend from the right edge of the handle for at least 30 mm on the guide bar side (see [Figure 2](#)) and at least 100 mm lengthwise from the inner rear part of the handle (see [Figure 2](#)).

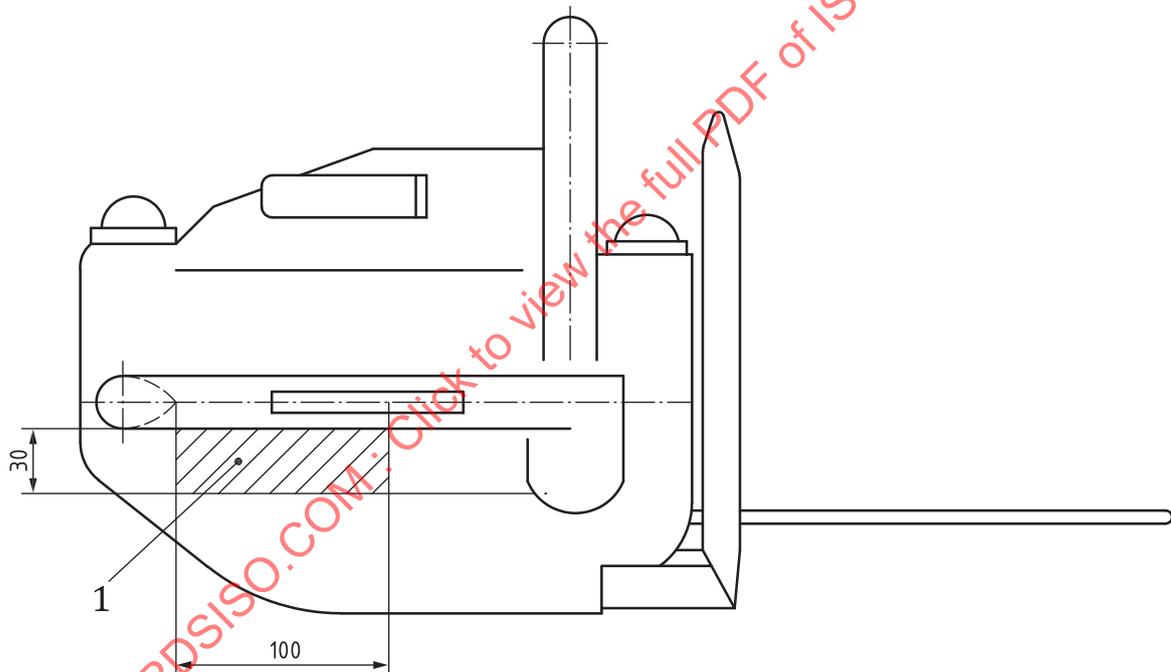
This requirement may also be fulfilled by parts of the machine.

The strength of the rear hand-guard shall comply with ISO 6534:2007.

### 4.3.2.2 Verification

Dimensions shall be verified by measurement. Strength requirements shall be verified by testing in accordance with ISO 6534:2007.

Dimensions in millimetres



#### Key

- 1 minimum area covered or guarded to protect hand from broken saw-chain

**Figure 2 — Minimum dimensions of protection at the rear handle**

## 4.4 Balance and holding moment

### 4.4.1 Requirements

Chain-saws shall be longitudinally balanced to within  $\pm 25^\circ$  between the centreline of the guide bar and the horizontal plane, and laterally balanced to within  $\pm 10^\circ$  between the guide bar plane and the vertical plane.

The maximum holding moment shall not exceed 6 N·m.

The limits shall be met by the shortest and longest applicable guide bars.

#### 4.4.2 Verification

The angles for longitudinal and lateral balance and the holding moment shall be verified by functional testing in accordance with ISO 8334:2007.

#### 4.5 Protection against injury by kickback

##### 4.5.1 Chain brake

###### 4.5.1.1 Requirements

The chain-saw shall be fitted with a chain brake that can be activated manually by means of the front hand-guard. The chain brake release force shall be between 20 N and 50 N and the direction of movement shall be away from the operator.

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

###### 4.5.1.2 Verification

The chain brake release force and stopping time shall be verified in accordance with ISO 6535:2015.

##### 4.5.2 Non-manual chain brake

###### 4.5.2.1 Requirements

There shall also be a non-manual chain brake system that operates the chain brake when kickback occurs. This system shall meet the requirements for tree-service chain-saws given in ISO 13772:2018.

###### 4.5.2.2 Verification

The non-manually activated chain brake system shall be verified by functional testing in accordance with ISO 13772:2018.

##### 4.5.3 Kickback and chain stop angles

###### 4.5.3.1 Requirements

At least one of the calculated kickback parameters shall be less than 25° ( $CKA_{wob}$  or  $CKA_{wb}$  or  $CKA_{cs} < 25^\circ$ ). This requirement shall be fulfilled for all guide bar and saw-chain combinations specified in the instructions. For the definitions of the kickback parameters, see ISO 9518:2018.

###### 4.5.3.2 Verification

$CKA_{wob}$ ,  $CKA_{wb}$ , and  $CKA_{cs}$  shall be verified by functional testing in accordance with ISO 9518:2018.

#### 4.6 Chain catcher

##### 4.6.1 Requirements

The chain-saw shall be fitted with a chain catcher located, and with dimensions and strength, in accordance with ISO 10726:2020. The chain catcher shall be replaceable.

#### 4.6.2 Verification

Dimensions shall be verified by measurement. Strength requirements shall be verified by testing in accordance with ISO 10726:2020. Means for replacing the chain catcher shall be verified by inspection.

### 4.7 Spiked bumper

#### 4.7.1 Requirements

The chain-saw shall have provision for mounting a spiked bumper (see [Figure 1](#)).

#### 4.7.2 Verification

The provision for mounting a spiked bumper shall be verified by inspection.

### 4.8 Chip discharge

#### 4.8.1 Requirements

The chain-saw shall be so designed that wood particles are directed below the underside of the chain-saw when it is in an upright (cross-cutting) position.

#### 4.8.2 Verification

The direction of the discharge of wood particles shall be verified by inspection during cross-cutting operations.

### 4.9 Guide bar cover

#### 4.9.1 Requirements

The chain-saw shall be provided with a guide bar cover (see [Figure 1](#)), so designed that it remains attached to the guide bar during transport and storage.

#### 4.9.2 Verification

The attachment of the guide bar cover to the guide bar shall be verified by inspection when holding the chain-saw in any direction.

### 4.10 Engine starting device

#### 4.10.1 Requirements

The engine starting device shall be a self-contained, battery-powered electric starter and/or a manual starter where the actuator is permanently attached to the machine.

Chain-saws with a manual starter shall have a recoil device for the rope.

Two or more separate and dissimilar actions shall be required to activate the electrical starting device.

#### 4.10.2 Verification

The means of starting the chain-saw shall be verified by inspection and functional testing.

## 4.11 Engine stopping device

### 4.11.1 Requirements

The chain-saw shall be fitted with an engine stopping device by means of which the engine can be brought to a final stop and which does not depend on sustained manual effort for its operation. The control for this device shall be so positioned that it can be operated using either hand when the chain-saw is held with one hand, and with the right hand when the chain-saw is held with both hands, whether or not the operator is wearing protective gloves. The colour of the control shall clearly contrast with the background.

### 4.11.2 Verification

The correct functioning of the engine stopping device shall be verified by inspection while the machine is being operated. The location and colour of the control shall also be verified by inspection.

## 4.12 Throttle control system

### 4.12.1 Dimensions

#### 4.12.1.1 Requirements

The throttle trigger shall be so positioned that it can be pressed and released with a gloved hand while the rear handle is held by meeting the dimensional requirements of ISO 7914:2002. See also [4.2.1](#).

#### 4.12.1.2 Verification

The position and dimensions shall be verified by measurement.

### 4.12.2 Operation

#### 4.12.2.1 Requirements

##### 4.12.2.1.1 Throttle trigger/throttle trigger lock-out

The chain-saw shall be provided with a throttle trigger that, when released, automatically reverts to the idling position. The throttle trigger shall be retained in the idling position by the automatic engagement of a throttle trigger lock-out.

When a force is applied to the throttle trigger, while the throttle trigger lock-out is engaged, engine speed shall not increase to a point where the clutch engages and continuous saw-chain movement begins.

NOTE When fitted to assist starting, a throttle control latch maintains an engine speed higher than idling speed until the throttle trigger is activated and released (see [4.12.3](#)).

After the starting procedure has been completed, activation of the throttle trigger to increase the engine speed to a point at which the saw-chain will start to move shall only be possible with the throttle trigger lock-out disengaged.

The starting procedure is considered to have been completed when the operator disengages the throttle lock and the engine returns to idling speed.

##### 4.12.2.1.2 Unintentional continuous movement of the saw-chain

Unintentional continuous movement of the saw-chain shall be prevented by a throttle-linkage so designed that when a force is applied to the rear handle while the throttle trigger lock-out is engaged,

engine speed will not increase to a point where the clutch engages, and continuous saw-chain movement begins.

#### 4.12.2.2 Verification

##### 4.12.2.2.1 Throttle trigger/throttle trigger lock-out

The throttle trigger and throttle trigger lock-out requirements shall be verified by inspection and the following test.

The throttle trigger lock-out function shall be verified by inspection and by applying a force equal to  $(50 \pm 5)$  N to the throttle trigger with the throttle trigger lock-out engaged. The force shall be applied gradually during approximately 1 s and then held for  $(5 \pm 1)$  s at a position  $(5 \pm 1)$  mm in front of the rear part of the throttle trigger. The force shall be applied in the direction of the throttle trigger movement. (Parallel to the path of the trigger for a trigger with linear travel and perpendicular to the arc segment for a trigger designed to rotate around a fixed point).

During the test the handle shall be fixed with means that do not interfere with the function of the throttle trigger lock-out.

##### 4.12.2.2.2 Unintentional continuous movement of the saw-chain

Unintentional continuous movement of the saw-chain shall be verified by the following test.

The machine shall be equipped with guide bar and saw-chain and the fuel and oil tanks shall be at least half full. Initially start and warm up the engine to steady-state conditions by applying load (cutting or by using a brake as described in ISO 22868:2021). Stop the engine and fix the machine by the guide bar using a vice. Restart the engine at idling speed.

Let the engine speed stabilize for 10 s and set the engine to the highest idling speed recommended by the manufacturer in the instructions.

Apply a load corresponding to three times the mass of the machine as defined in 5.1.2 a) to the rear handle. When load is applied in the most unfavourable direction, no continuous movement of the saw-chain shall be observed. Saw-chain movement is not considered continuous if the saw-chain movement includes interruptions in rotation.

#### 4.12.3 Throttle control latch

##### 4.12.3.1 Requirements

If a throttle control latch is provided to aid starting and its engagement results in movement of the saw-chain during starting, the throttle control latch shall be engaged manually and shall be automatically released when the throttle trigger is operated. In such cases, the activation device used to set the throttle control latch shall be located outside the gripping area of the handle and it shall require at least two independent motions to engage the throttle control latch.

The gripping area is defined as extending from 25 mm in front of, to 75 mm behind, the rear part of the throttle trigger.

The operational force on the throttle trigger for releasing the throttle control latch shall not exceed 25 N.

##### 4.12.3.2 Verification

The functionality of the throttle control latch shall be verified by inspection and measurement while operating the machine. The specified force for releasing the throttle control latch shall be applied within 1 s at a position  $5 \text{ mm} \pm 1 \text{ mm}$  in front of the rear part of the throttle trigger and in the direction of the trigger movement (perpendicular to the rotation radius of the trigger).

## 4.13 Drive sprocket guard

### 4.13.1 Requirements

Unintended contact with the drive sprocket shall be prevented. Covers for the drive sprocket that are provided to meet this requirement, whose only function is to guard against unintentional contact, shall be either a fixed guard (detachable by means of tools) or an interlocking movable guard (detachable without the use of tools).

Fixed guards shall be fixed by systems that can be opened or removed only with tools and that have their fixing system permanently attached to the guard and/or machine when the guard is removed.

Interlocking movable guards shall have a safety-related control system which complies with at least ISO 13849-1:2015, Category 1.

### 4.13.2 Verification

The design of fixed guards shall be verified by inspection.

The functionality of interlocking movable guards shall be checked by inspection, functional testing and to the principles specified in ISO 13849-2:2012.

## 4.14 Clutch

### 4.14.1 Requirements

The chain-saw's clutch shall be designed so that the saw-chain does not move continuously when the engine rotates at any speed less than 1,25 times the idling speed. Chain movement is not considered continuous if the chain movement includes interruptions in rotation.

### 4.14.2 Verification

Correct operation of the clutch shall be verified by inspection when the engine speed is increased from idling speed to 1,25 times the highest idling speed, in accordance with the instructions.

## 4.15 Protection against contact with parts under high voltage

### 4.15.1 Requirements

All high-voltage parts of the circuit, including spark-plug terminals, shall be located, insulated or guarded so that the operator cannot come into accidental contact with them.

Ignition interruption or short-circuiting shall be provided and shall be fitted on the low-voltage side.

### 4.15.2 Verification

The location and insulation of the parts under high voltage shall be verified by inspection, using a standard test finger, in accordance with IEC 61032:1997, Figure 2, Probe B. The ignition interruption or short-circuiting shall be verified by inspection.

## 4.16 Protection against contact with hot parts

### 4.16.1 Requirements

Hot parts, with the exclusion of the guide bar and saw-chain, shall be protected against unintentional contact during normal operation of the chain-saw. Normal operation of the machine in accordance with the manufacturer's recommendations shall not cause the operator to come into unintentional contact

with an area of greater than 10 cm<sup>2</sup> of any contiguous hot surface. The contiguous hot surface can be curved or irregular. Such a hot surface shall be guarded from unintentional contact if the tip or the conical surface of the test cone, shown in [Figure 3](#), can contact more than 10 cm<sup>2</sup> of the contiguous hot surface area.

Maintenance and adjustment procedures as described in the manufacturer's instructions are considered intentional acts and excluded from the provisions of this subclause

The temperature for these accessible parts of the machine, as given above and including guards or shields provided to prevent access to such hot surfaces, shall not be more than 80 °C for metallic surfaces or 94 °C for plastic surfaces.

NOTE For further information, see ISO 13732-1:2006, Annex E.

#### 4.16.2 Verification

The protection against contact shall be verified by determining the area accessible, as follows.

Conduct the temperature test in the shade and with a maximum wind speed of 3 m/s. Operate the engine by cycling for 5 s at idling speed and 5 s at racing speed until the surface temperatures stabilize.

Identify the hot surface area or areas. Determine temperatures using temperature-measuring equipment with an accuracy of ±2 °C.

If the test is conducted at an ambient temperature outside of the nominal (20 ± 3) °C, the recorded temperatures shall be corrected using [Formula \(1\)](#):

$$T_C = T_O - T_A + 20 \quad (1)$$

where

$T_C$  is the corrected temperature, in degrees Celsius (°C);

$T_O$  is the observed temperature, in degrees Celsius (°C);

$T_A$  is the ambient temperature, in degrees Celsius (°C).

Allow the power source to cool before using the cone. It is not necessary to test the accessibility of hot parts while they are hot.

Apply the test cone shown in [Figure 3](#) in any direction and with a maximum force of  $(10_{-1}^0)$  N. When moving the cone, determine whether there is any contact between the hot surface area(s) and the cone's tip or the conical surface. Neither tip nor conical surface shall come into contact with any hot surface area greater than 10 cm<sup>2</sup>. The cylindrical surface of the cone or the flat surface of the cone shall not be considered.

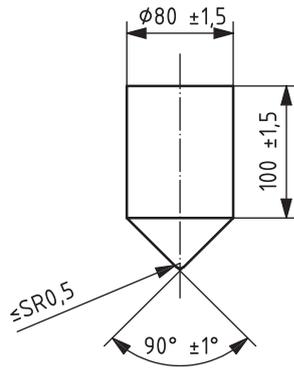


Figure 3 — Test cone

## 4.17 Fuel and oil systems

### 4.17.1 Requirements

The fuel cap shall have a retainer.

The fuel tank opening shall be at least 20 mm in diameter and the oil tank opening at least 19 mm in diameter. Each opening or cap shall be clearly marked to indicate the function of the tank; if only the caps are marked, they shall not be interchangeable between tanks.

The design of the fuel tank assembly shall be such that no leakage occurs while the chain-saw is at the normal operating temperature, with the chain-saw in all working positions and while being transported.

The filler openings shall be located so that the action of filling of the tanks is not obstructed by other components. It shall be possible to use a funnel.

Tanks and fuel lines shall be integrated in the chain-saw so that they will withstand, without any visible leakage, the shock occurring when the complete chain-saw is impacted to the ground in accordance with 4.17.2.2.

Fuel feed lines accessible by the probe defined in Figure 4, shall not break, crack, leak or become detached from their fittings or connections when tested in accordance with 4.17.2.3.

### 4.17.2 Verification

#### 4.17.2.1 General

The fuel cap retainer, opening dimensions and the possibility of using a funnel shall be verified by inspection. The tightness of the caps shall be verified by inspection while turning the chain-saw in any direction. Seepage from fuel tank ventilation systems is not regarded as leakage.

#### 4.17.2.2 Drop test

The chain-saw shall be impacted onto a concrete surface by dropping it once with the longest guide bar, as specified in the instructions, at  $(-25 \pm 2)$  °C.

Before the drop test, install the guide bar, together with the associated saw-chain, and half fill the fuel and oil tanks with a mixture by volume of 40 % glycol and 60 % water, then condition the chain-saw at the test temperature for at least 6 h.

Within 60 s of its emergence from the conditioning environment, drop the chain-saw onto a concrete surface. Do this with the chain-saw suspended by means of a string attached to the front handle so

that the guide bar plane is vertical and the lowest point of the front handle where it is suspended is  $(775 \pm 5)$  mm above the concrete surface.

Inspect for visible leakage while holding the chain-saw for  $(30 \pm 2)$  s in each of the positions b) to g) as specified in ISO 6531:2017, Figure A.1.

#### 4.17.2.3 Fuel feed lines strength and accessibility

Fuel feed line strength and accessibility shall be determined by the use of a 7 mm diameter  $\times$  200 mm length test probe made of PA6 plastic material without glass reinforcement (Figure 4). The test probe shall be mounted to a force meter. All guards and covers shall be installed for the test and the test shall be conducted at a temperature of  $(20 \pm 5)$  °C. The fuel feed lines and connections shall be preconditioned by completely filling the fuel tank and then running the engine for 5 min. Stop the engine and wait for 24 h prior to conducting the test.

The fuel feed lines and connections shall be tested by inserting the test probe into any opening which can be used to access the fuel feed lines. Fuel feed lines accessible with the tip of the test probe, shall be tested by applying an axial force of  $(40^{+0}_{-2})$  N. The force shall be applied to accessible fuel feed lines that the probe contacts.

Compliance is checked by visual inspection. For chain-saws incorporating pressurized fuel feed lines visual inspection shall be performed when the chain-saw engine is running and then after the engine is stopped.

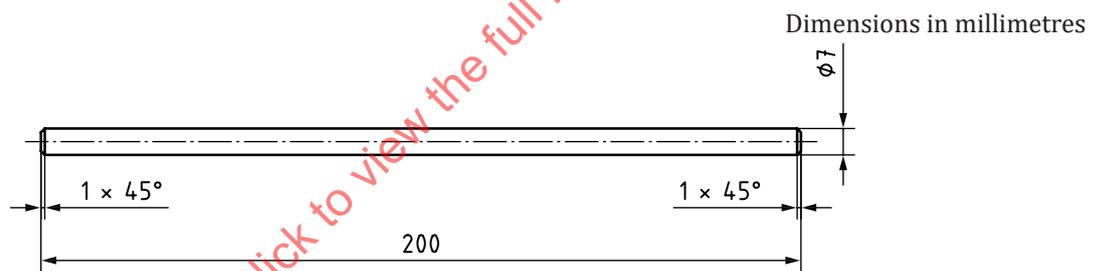


Figure 4 — Test probe for fuel feed line strength and accessibility

#### 4.18 Exhaust gases

##### 4.18.1 Requirements

The exhaust outlet shall be located so as to direct emissions away from the operator in normal working positions.

##### 4.18.2 Verification

The location and direction of the exhaust outlet shall be verified by inspection.

#### 4.19 Chain lubrication

##### 4.19.1 Requirements

The guide bar and saw-chain shall be automatically lubricated. If, additionally, a manual oiler is provided, it shall be located so that it can be operated by the right hand while holding the chain-saw.

#### 4.19.2 Verification

The functionality of the saw-chain oiling system shall be verified by inspection while operating the machine. The location of a manual oiler, if provided, shall be verified by inspection.

#### 4.20 Chain tensioning

##### 4.20.1 Requirements

Chain-saws shall be provided with a means for adjusting the saw-chain tension.

##### 4.20.2 Verification

Compliance is verified by inspection and functional testing.

#### 4.21 Attachment device

##### 4.21.1 Requirements

The chain-saw shall be equipped with an attachment device that enables the machine to be attached to a rope or tool strap, as appropriate. The diameter of the opening shall be at least 10 mm. The device shall be capable of carrying a mass of at least six times the total chain-saw mass, with full tanks, longest guide bar and saw-chain.

The attachment device shall be located so that the chain-saw will hang with the guide bar down.

Other supplementary attachment points are acceptable provided they have an opening with a diameter of at least 10 mm and are capable of carrying a mass of at least six times the total chain-saw mass, with full tanks, longest guide bar and saw-chain.

##### 4.21.2 Verification

Compliance is verified by inspection and measurements.

#### 4.22 Vibration

##### 4.22.1 Reduction by design at source and by protective measures

Vibration reduction shall be an integral part of the design process, thus specifically taking into account measures at source. The success of the applied vibration reduction measures is assessed on the basis of the actual vibration total values for each handle. The main sources causing and influencing vibration are generally the dynamic forces from engine, cutting means, unbalanced moving parts, impact in gear sprockets, bearings and other mechanisms, and the interaction between operator, machine and material being worked.

Besides measures to reduce vibration at source, technical measures such as isolators and resonating masses shall be used to isolate, when appropriate, the vibration source from the handles.

NOTE CR 1030-1 gives general technical information on widely recognized technical rules and means and provides guidelines for the design of reduced hand-arm vibration machines.

##### 4.22.2 Vibration measurement

The vibration shall be measured, and the equivalent vibration total value calculated for each handle in accordance with ISO 22867:2021.

## 4.23 Noise

### 4.23.1 Reduction by design at source and by protective measures

Noise reduction shall be an integral part of the design process, thus specifically taking into account measures at source. The success of the applied noise reduction measures is assessed on the basis of the actual noise emission values. The main sources causing and influencing noise are generally the air intake system, engine cooling system, engine exhaust system, cutting system and vibrating surfaces.

NOTE ISO/TR 11688-1:1995 gives general technical information and guidance for the design of low-noise machines.

Special care shall be taken in the acoustical design of chain-saws.

ISO/TR 11688-2:1998 gives useful information on noise generation mechanisms in machinery. ISO 14163:1998 provides guidelines for noise control by silencers. ISO 11691:2020 and ISO 11820:1996 address the testing of the silencer.

### 4.23.2 Noise measurement

The equivalent A-weighted emission sound pressure level at the operator's position and the A-weighted sound power level shall be measured and calculated in accordance with ISO 22868:2021.

## 4.24 Electromagnetic immunity

### 4.24.1 Requirements

All electronic components of the systems used to control the machine shall meet the acceptance criteria given in ISO 14982:1998, 6.3 and 6.6, concerning the electromagnetic immunity of the machine.

### 4.24.2 Verification

The electromagnetic immunity shall be verified by testing in accordance with ISO 14982:1998.

## 5 Information for use

### 5.1 Instructions

#### 5.1.1 General

For the information to be provided to the user, the following applies, together with ISO 12100:2010, 6.4.

#### 5.1.2 Technical data

The instructions shall give at least the following technical information for each chain-saw model.

a) Mass

Chain-saw without guide bar and saw-chain, empty tanks, in kg.

b) Cutting length

Usable cutting lengths, in cm or cm and inch

c) Saw-chain speed

Saw-chain speed in m/s as measured at maximum engine power speed according to ISO 7293:2021.

d) Approved saw-chains and guide bars

Recommended saw-chains and guide bars approved to meet the requirements of this document.

Type of chain(s) and guide bar(s).

e) Engine

Engine idling speed range,  $\text{min}^{-1}$ .

f) Values for A-weighted equivalent emission sound pressure level at the operator position, determined in accordance with ISO 22868:2021, together with the uncertainty of stated values, in dB.

g) Values for A-weighted equivalent sound power level, determined in accordance with ISO 22868:2021 (if required), together with the uncertainty of stated values, in dB.

h) Values for equivalent vibration total value (for each handle), determined in accordance with ISO 22867:2021, together with uncertainty of stated values, both in  $\text{m/s}^2$ .

### 5.1.3 Other information

The instructions shall contain, in accordance with ISO 12100:2010, 6.4.5, comprehensive instructions and information on all aspects of operator/user maintenance, and the safe use of the chain-saw, including type and use of PPE, suitable clothing and the need for training in all manual chain-saw operations.

Extensive use should be made of pictograms and/or diagrams.

The importance of reading the instructions thoroughly before using the chain-saw shall be stressed on the front of the instructions.

A warning shall also be given that the chain-saw is of a special type designed especially for tree service. It shall be stated that the chain-saw is only to be used by a trained operator using a carefully designed, safe work system, and it shall be emphasized that the chain-saw is only intended for tree service under these defined conditions. It shall also be stated that, generally, the chain-saw is intended to be used with two hands in the same way as a conventional chain-saw.

NOTE [Annex A](#) gives useful guidance on the use of the tree service chain-saw, including safe work system.

The terms used in all documentation shall be in accordance with ISO 6531:2017. Alternative wording may be used provided it is explained according to ISO 6531:2017.

The instructions shall at least cover information relating to the following:

a) transport, handling and storage of the chain-saw, including

- the use of a guide bar cover during transport and storage,
- cleaning and maintenance before storage, and
- instructions for securing the machine during transport to prevent loss of fuel, damage or injury;

b) commissioning of the chain-saw, including

- assembly instructions, initial adjustments and checks, and including a description of the method to install the saw-chain and guide bar,
- a list of recommended saw-chain and guide bar combinations, including a warning of possible consequences from using non-approved combinations, e.g. increased risk of kickback,
- chain tensioning and sharpening techniques, including the use of gloves,

- information regarding regular maintenance, pre-operating procedures and daily maintenance routines, as well as the consequences of improper maintenance,
  - guide bar and saw-chain adjustments with the engine stopped, including regular checking of the chain brake,
  - regular functional checks of the clutch (no saw-chain movement at idling speed) and information regarding the correct adjustment of the idling speed, and
  - filling of fuel and oil tanks, especially concerning fire precaution;
- c) the chain-saw itself, including
- a description, identification and the nomenclature of principal parts, including the safety devices of the chain-saw and an explanation of its function,
  - an explanation of symbols and safety signs,
  - the mounting of a spiked bumper,
  - information on specified replacement saw-chains and guide bars that have been approved to meet the kickback requirements of the document,
  - declared values of the A-weighted emission sound pressure level at the operator position and of the A-weighted sound power level, including a warning of the risks and the measures to be taken to minimize those risks, with a third octave band analysis to be supplied upon request to enable selection of the correct hearing protection,
  - equivalent vibration, including a warning of the risks and measures to be taken to minimize those risks (including an explanation of white finger risks and the means available to the users for protecting themselves);
- d) the use of the chain-saw, including
- a note alerting the user to possible national regulations that can restrict the use of the machine,
  - the need for daily inspection before use and after dropping or other impacts to identify significant damage or defects,
  - instructions regarding the safe starting procedure, which includes the instruction to always engage the chain brake before starting the engine and when the engine has started, to immediately disengage the throttle control latch and ensure that the engine speed has returned to idle before disengaging the chain brake,
  - instructions to only use the throttle control latch at starting procedure and a warning of using the machine with the throttle control latch engaged,
  - operating instructions and instructions for common cutting tasks, as well as the need for adequate training, including prohibited operations and a warning against the use of the unit when tired, ill or under the influence of alcohol or other drugs,
  - instructions for the selection and use of eye (visor or glasses), head, hand, leg and foot protection, including mentioning of the need to use slip-resistant foot protection,
  - instructions regarding exposure to noise, and the selection and use of hearing protection, including recommendations for limiting the duration of operation, if appropriate,
  - instructions regarding exposure to vibration, with an explanation of white finger risks and to seek medical attention if symptoms occur, and, if appropriate, recommendations for limiting the duration of operation,
  - instructions on the regular testing of the chain brake, with information about possible effects of normal use and maintenance on the kickback safety performance of the chain-saw,

- hazards which may be encountered while using the chain-saw, such as blockage of the saw-chain, and how to avoid them while performing typical tasks,
  - warning about the risk for bystanders and animals and the need to keep a safe distance during operation of the chain-saw,
  - an explanation of the kickback safety features that the chain-saw incorporates, including a description of the chain brake function and the influence of saw-chain and guide bar type on kickback magnitude. The user shall also be informed about the possible effects of use and maintenance of the chain brake system and other components such as the saw-chain and guide bar on the kickback safety performance of the machine,
  - an explanation of, and instructions in how to deal with, the phenomena of kickback, “skating” and “bouncing”, and dropping at the end of a cut,
  - a warning about the emission of exhaust gases, lubrication oil mist and saw dust,
  - an instruction that the chain-saw shall be held with the right hand on the rear handle and the left hand on the front handle, and
  - information regarding the appropriate use of a spiked bumper, e.g. the advantage of using a spiked bumper when cutting trees and thick branches;
- e) maintenance instructions, including
- servicing and replacement tasks for the user, including the need to keep the chain-saw in good working condition,
  - specifications of the spare parts affecting the health and safety of the operator, particularly the saw-chain and guide bar,
  - drawings or diagrams to allow user maintenance and fault-finding tasks,
  - the procedure for sharpening the saw-chain, with particular emphasis on the effects of kickback behaviour that may result if specifications are not followed, and
  - the provision of sufficient information to enable the user to maintain the safety system throughout the life of the product and to explain the consequences of improper maintenance, use of non-conforming replacement components, or the removal or modification of safety components;
- f) declaration of conformity
- any locally required conformity declarations, e.g. EC Declaration of Conformity.

## 5.2 Marking

All chain-saws shall be marked with the following minimum information:

- business name and full address of the manufacturer or, where applicable, the authorized representative — the address may be simplified, provided the manufacturer (or, where applicable, his authorized representative) can be identified, but in any event the address on the plaque shall be sufficient for mail to reach the company;
- designation of series or type;

Allowing the technical identification of the product. This may be achieved by a combination of letters and/or numbers and may be combined with the designation of the machinery.

- designation of the machinery;

Designation of the machinery may be achieved by a code that is any combination of letters, numbers or symbols, provided that this code is explained by giving the explicit designation, such as “chain-saw” etc., in the instructions-supplied with the machine.

NOTE An example of such a code is “A123-B”.

- year of construction, i.e. the year in which the manufacturing process was completed;
- serial number, if any;
- any marking that indicates compliance, e.g. the CE-mark.

The chain-saw shall also bear the following information:

- identification and method of operation — preferably according to ISO 3767-5 — of the controls for the engine stopping device, chain brake, manual oiler control, choke control, primer and heated handle switch (if provided);
- identification of carburettor and oil adjustments;
- identification of fuel and oil tank openings and/or caps.

If symbols are used, they shall be explained in the instructions, and, except if cast, embossed or stamped, shall be in contrast to their background. Embossed features shall be at least 0,3 mm in height above the surrounding surface. The information and/or instructions provided by the symbols shall be clearly legible when viewed from a distance of not less than 500 mm.

The markings shall be located in a readily visible position and shall resist the anticipated service conditions, e.g. the effects of temperature, moisture, petrol, oil, abrasion and weathering exposure.

If labels are used, they shall be tested in accordance with 5.4.

The labels shall be tested in accordance with 5.4.2 after which they shall undergo a visual inspection and be compared against an untested, new control specimen. No significant indications of indentation, separation, splitting, chalking, swelling, peeling, blistering, flaking, large scratches or cracking of the material, and/or no significant deterioration of print, shall be detected.

The labels shall also be tested in accordance with 5.4.3, after which the non-adhesion distance shall be a maximum of 1 mm from the specimen edge and the adhesive properties shall be at least  $0,09w$ , in newtons, where  $w$  is the test specimen width, in millimetres.

NOTE Labels tested and approved according to ANSI/UL 969:2018 supplemented by the gasoline exposure test can be used and considered to fulfil the requirements of 5.4.

### 5.3 Warnings

All chain-saws shall be marked, using text or pictorials, with an indication that

- head, hand, arm, leg and foot, and eye and hearing protection is necessary (examples of pictorials can be found in ISO 17080:2005, Figures A.3.4 and A.3.5),
- protective clothing is necessary, e.g. for feet, legs, hands and forearms, and
- by a warning sign:

**WARNING — THIS CHAIN-SAW IS FOR USE BY TRAINED TREE SERVICE OPERATORS ONLY. USE WITHOUT PROPER TRAINING CAN RESULT IN SEVERE INJURIES. SEE INSTRUCTIONS!**

The requirements specified in 5.3 and 5.4 are not applicable for this warning but see 5.5 for more detailed information related to this warning sign.

If safety signs are used, they shall be explained in the instructions.

The warnings shall be legible and located in a readily visible position on the machine and shall resist the anticipated service conditions, e.g. the effects of temperature, moisture, petrol, oil, abrasion and weather exposure.

When symbols are used, they shall, except if they are cast, embossed or stamped, be in contrast to their background. Embossed features shall be at least 0,3 mm in height above the surrounding surface. The information and/or instructions provided by the safety signs shall be clearly legible when viewed with normal vision from a distance of not less than 500 mm.

If labels are used, they shall be tested in accordance with 5.4.

The labels shall be tested in accordance with 5.4.2, after which they shall undergo a visual inspection and be compared against an untested, new control specimen. No significant indications of indentation, separation, splitting, chalking, swelling, peeling, blistering, flaking, large scratches or cracking of the material, and/or no significant deterioration of print, shall be detected.

The labels shall also be tested in accordance with 5.4.3, after which the non-adhesion distance shall be a maximum of 1 mm from the specimen edge and the adhesive properties shall be at least  $0,09w$ , in newtons, where  $w$  is the test specimen width, in millimetres.

## 5.4 Test of labels

### 5.4.1 Preparation of test specimens and control specimens

#### 5.4.1.1 General

New test specimens shall be prepared for each of the tests given in 5.4.2 and 5.4.3. New control specimens shall also be prepared for any test that involves a visual inspection.

#### 5.4.1.2 Test panels

Test panels shall be made with a surface and material equal to that on which the sign shall be mounted.

The test panels shall be carefully cleaned with an appropriate solvent in order to remove all traces of adhesive, grease, oil and water, and then dried for at least 2 h.

#### 5.4.1.3 Test specimens

The number of test specimens and control specimens prepared for each test shall be a minimum of three.

The test specimen/control specimen shall be the complete label wherever possible, except where the physical limitations of the test equipment do not allow for testing of an entire label or when the graphical content of the label has no effect on the results of the test. The minimum dimensions of the test specimen shall be 13 mm width and 25 mm length.

The backing layer protecting the adhesive side shall be completely removed for the wipe resistance test (see 5.4.2) and for the adhesion test (see 5.4.3) to a length of at least 15 mm, but leaving the protected end long enough to be attached to the pulling machine. The specimens shall then be applied to the test panel symmetrically. The applied specimens shall be rolled over five times using a steel roller with a rubber coating having a width at least 2 mm wider than the test specimen and a diameter of 30 mm to 60 mm; the roller shall be applied with a force of  $50 \text{ N} \pm 2 \text{ N}$  and a rolling speed of approximately 200 mm/s shall be maintained.

After being applied to the test panels, the test specimens shall be conditioned at a temperature of  $23 \text{ }^\circ\text{C} \pm 5 \text{ }^\circ\text{C}$  with a relative humidity of  $50 \% \pm 20 \%$  for at least 24 h prior to testing.

#### 5.4.2 Wipe resistance test

Three test specimens shall be mounted on test panels in accordance with 5.4.1 and then immersed in the test liquid for  $300 \text{ s} \pm 3 \text{ s}$ .

After having removed it from the test liquid, wipe the test specimen with a force of  $10 \text{ N} \pm 1 \text{ N}$  and 1 cycle/s, using an unbleached cotton cloth soaked in the test liquid for  $30 \text{ s} \pm 3 \text{ s}$ . After the wiping test has been completed, a visual inspection of the test specimen shall be carried out.

The test liquids shall be

- a) water, and
- b) a mixture by volume of 50 % isooctane and 50 % toluene.

#### 5.4.3 Adhesion test

Three test specimens shall be mounted on test panels in accordance with 5.4.1 and immersed in the test liquid (50 % isooctane and 50 % toluene) for  $30 \text{ min} \pm 1 \text{ min}$ .

After removing the test specimen from the test liquid, inspect and measure any non-adhesion distances from the specimen edge.

Then, attach the test panel to a holder and the free end of the test specimens, still covered by the backing layer protecting the adhesive side, to a pulling machine. Apply a pulling force upwards at an angle of  $90^\circ \pm 5^\circ$  to the test panel and at a speed of  $(60 \pm 6) \text{ mm/min}$ . Measure the tensile force required for this over a distance of at least 15 mm. The average value of the tensile force, expressed in newtons, shall be calculated and recorded. If the test distance of 15 mm is not achievable because the test specimens tear, the test specimens shall be reinforced with a second layer of the label being tested.

### 5.5 Warning to be provided at point of sale

The chain-saw shall be provided with a hangtag or a label affixed to the machine and the packaging carton shall incorporate a pre-printed text or an adhesive label providing the following verbatim text, in the official language of the country of sale, clearly visible to the potential purchaser of the chain-saw:

**WARNING — THIS CHAIN-SAW IS FOR USE BY TRAINED TREE SERVICE OPERATORS ONLY. USE WITHOUT PROPER TRAINING CAN RESULT IN SEVERE INJURIES.**

Where a label is affixed to the machine, it may be of a type that can be removed.

The word WARNING shall be in black capital letters on yellow or orange background and the letters used in the text after the word WARNING shall be black on white background.

Safety sign W001 of ISO 7010:2019 shall precede the warnings for each language.

The safety sign W001 of ISO 7010:2019 shall be black on yellow background.

When printed on the packaging carton, the safety sign and wording need not be in accordance with the above colour requirements, provided they are in contrast to the background and are incorporated on at least two faces of the carton, excluding the bottom face.

The safety sign shall have at least the same height as the word WARNING. As an alternative, one safety sign in common for all languages may be used. If so, the minimum height of the safety sign shall be 15 mm.

On hangtags or labels attached to the chain-saw, the minimum height of letters used in the word WARNING shall be 2,5 mm. The letters used in the text after the word WARNING shall have a minimum height of 2,0 mm.

When printed on the packaging carton or on a label affixed to the carton, the minimum height of letters used in the word WARNING shall be 3,0 mm. The letters used in the text after the word WARNING shall have a minimum height of 2,5 mm.

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## Annex A (informative)

### Working with tree service chain-saws from rope and harness

#### A.1 Overview

This annex presents suitable working practices for reducing the risk of injury from the use of tree service chain-saws when working at height from a rope and harness. While it may form the basis of guidance and training literature, it should not be regarded as a substitute for formal training. The guidance given in this annex is only an example of best working practice.

NOTE National or other regulations, which could be more stringent, can apply.

Presented are:

- general recommendations that should be followed before using a tree service chain-saw for work at height from a rope and harness,
- preparations for using a tree service chain-saw from a rope and harness, and
- how to use a tree service chain-saw for pruning and dismantling, including secure work positioning for two-handed use, starting the chain-saw, cutting with the chain-saw, restrictions on one-handed use and freeing a trapped chain-saw.

This annex does not deal with techniques for controlling sections of branches and stems cut by the chain-saw. Nor does it cover those aspects of safe use already dealt with in [5.1](#).

#### A.2 General recommendations

The operator of a tree service chain-saw working at height from a rope and harness should never work alone. A ground worker trained in appropriate emergency procedures should be present to assist.

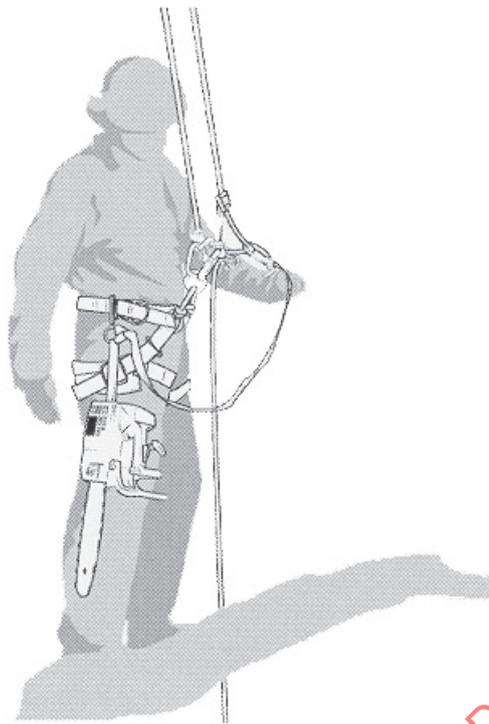
The operator should be trained in general safe climbing and work positioning techniques and should be properly equipped with harness, ropes, strops, carabiners and other equipment for maintaining secure and safe working positions for both himself and the chain-saw.

#### A.3 Preparing the chain-saw for use

The chain-saw should be checked, fuelled, started and warmed up by the ground worker and then switched off before being sent up to the operator in the tree.

The chain-saw should be fitted with a suitable strop for attachment to the operator's harness (see [Figure A.1](#)).

- a) Secure the strop around the attachment point on the rear of the chain-saw.
- b) Provide suitable carabiners to allow indirect (i.e. via the strop) and direct attachment (i.e. at the attachment point on the chain-saw) of the chain-saw to the operator's harness.
- c) Ensure the chain-saw is securely attached when sent up to the operator.
- d) Ensure the chain-saw is secured to the harness before disconnecting it from the means of ascent.



**Figure A.1 — Example of attachment of tree service chain-saw to operator's harness**

The ability to directly attach the chain-saw to the harness reduces the risk of damage to equipment when moving around the tree. The chain-saw should always be switched off when directly attached to the harness.

The chain-saw should only be attached to the recommended attachment points on the harness. These may be at mid-point (front or rear) or at the sides. Wherever possible, the chain-saw should be attached to the centre rear mid-point to keep it clear of climbing lines and to support its weight centrally down the operator's spine. See [Figure A.2](#).

When moving the chain-saw from any one attachment point to another, the operator should ensure that it is secured in the new position before releasing it from the previous attachment point.