INTERNATIONAL STANDARD

ISO 11806-1

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Agricultural and forestry machinery — Safety requirements and testing for portable, hand-held, powered brush-cutters and grass-trimmers —

Part 1: Machines fitted with an integral combustion engine

Matériel agricole et forestier — Exigences de sécurité et essais pour débroussailleuses et coupe-herbe portatifs à moteur —

Partie 1: Machines équipées d'un moteur à combustion interne intégré

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 11806-1 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 17, *Manually portable forest machinery*.

This first edition of ISO 11806-1 cancels and replaces ISO 11806:1997, of which it is also a technical revision.

ISO 11806 consists of the following parts, under the general title *Agricultural and forestry machinery — Safety requirements and testing for portable, hand-held, powered brush-cutters and grass-trimmers*:

— *Part 1: Machines fitted with an integral combustion engine*

— *Part 2: Machines for use with back-pack power unit*

Introduction

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

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.

Agricultural and forestry machinery — Safety requirements and testing for portable, hand-held, powered brush-cutters and grass-trimmers —

Part 1: Machines fitted with an integral combustion engine

1 Scope

This part of ISO 11806 gives safety requirements and measures for their verification for the design and construction of portable hand-held, powered brush-cutters and grass-trimmers (hereafter called machines) having an integral combustion engine as their power unit and mechanical power transmission between the power source and the cutting attachment. 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 part of ISO 11806 deals with all significant hazards, hazardous situations and hazardous events relevant to these machines, as well as when they are used as intended and under conditions of misuse which are reasonably foreseeable by the manufacturer.

This part of ISO 11806 is not applicable to machines equipped with metallic cutting attachments consisting of more than one piece, e.g. pivoting chains or flail blades.

NOTE See Annex C for a list of significant hazards.

This part of ISO 11806 is applicable to portable, hand-held, powered brush-cutters and grass-trimmers manufactured after its date of publication.

2 Normative references

The following referenced documents are indispensable for the application 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 683-9:1988, *Heat-treatable steel, alloy steels and free-cutting steels — Part 9: Wrought free-cutting steels*

ISO 7112, *Machinery for forestry — Portable brush-cutters and grass-trimmers — Vocabulary*

ISO 7113:1999, *Portable hand-held forestry machines — Cutting attachments for brush cutters — Single-piece metal blades*

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

ISO 8380, *Forestry machinery — Portable brush-cutters and grass-trimmers — Cutting attachment guard strength*

ISO 8893, *Forestry machinery — Portable brush-cutters and grass-trimmers — Engine performance and fuel consumption*

ISO/TR 11688-1, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 1: Planning*

ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction*

ISO 13857:2008, *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, *Forestry and gardening machinery — Vibration test code for portable hand-held machines with internal combustion engine — Vibration at the handles*

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

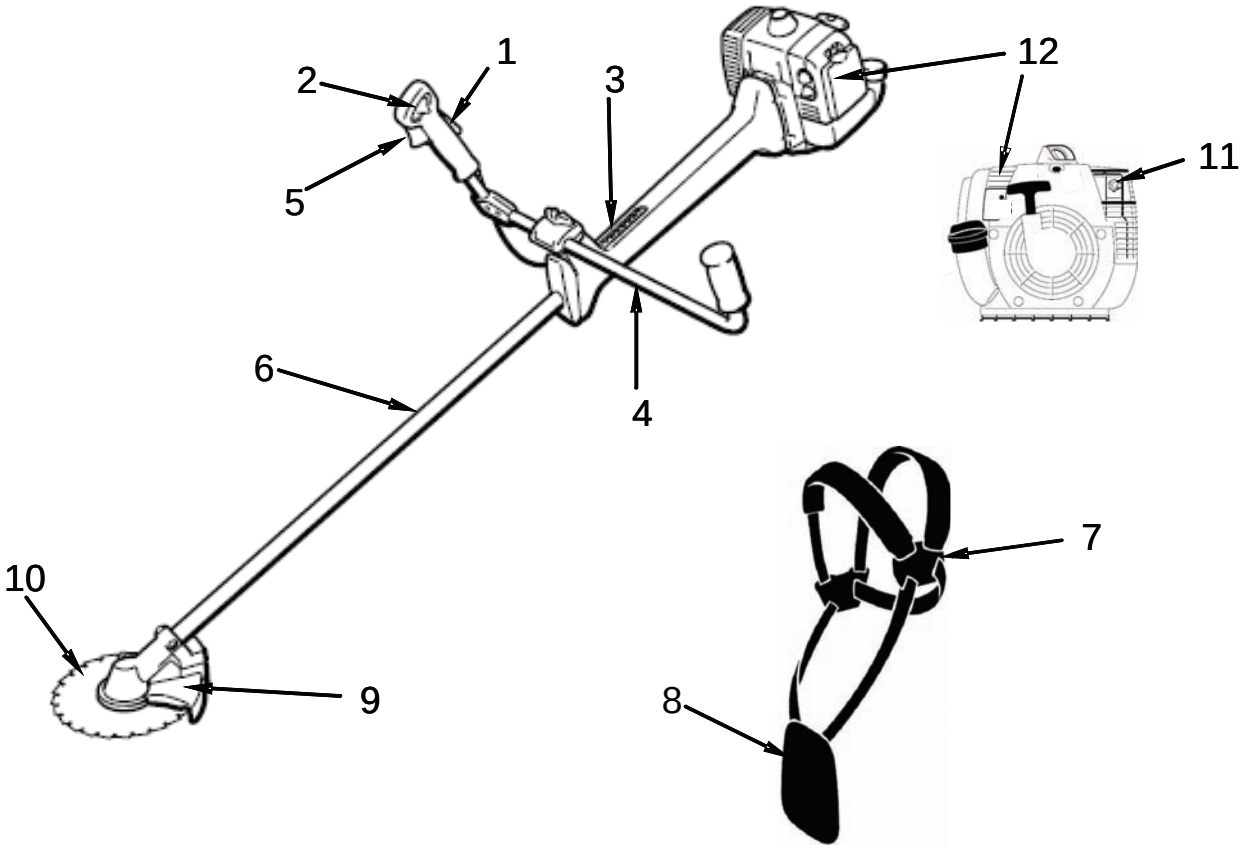
IEC 60745-1:2006, *Hand-held motor-operated electric tools — Safety — Part 1: General requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 7112, ISO 12100 and the following apply.

NOTE Figure 1 provides an example of a brush-cutter and Figure 2 of a grass-trimmer within the scope of this part of ISO 11806.

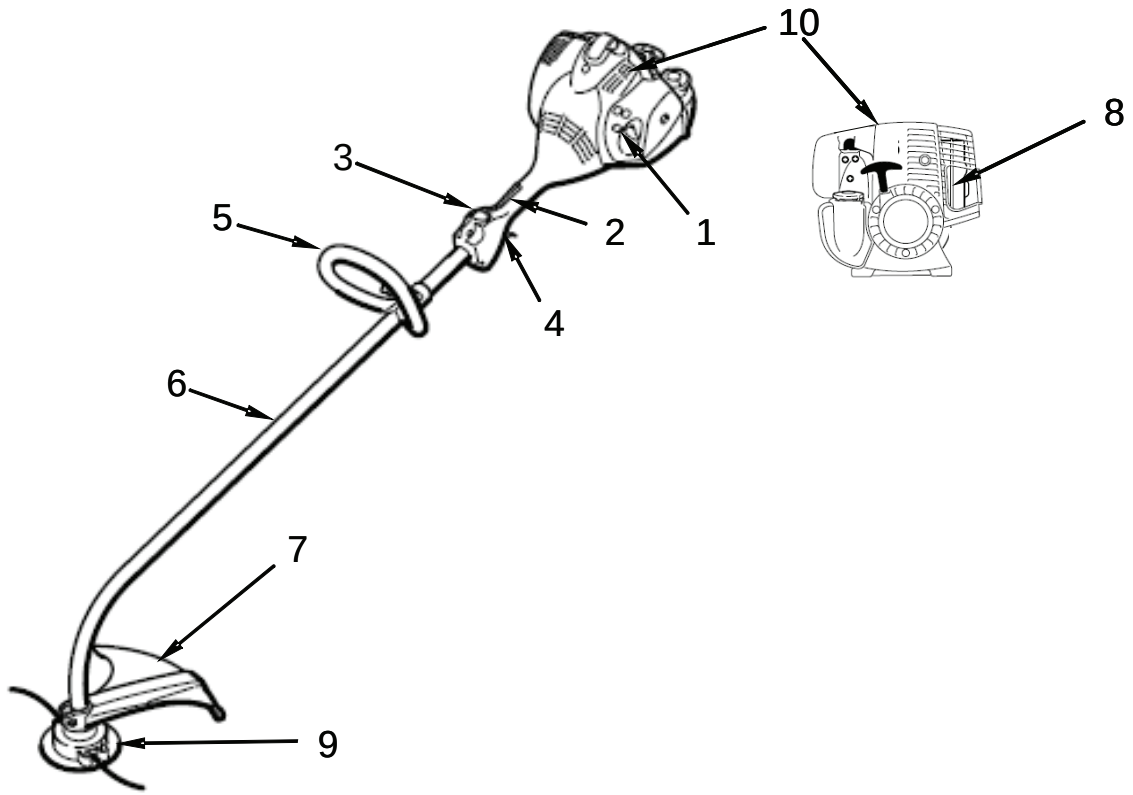
3.1
machine
complete brush-cutter (or grass-trimmer) including power unit, drive shaft tube, cutting attachment and guard, but excluding the harness



Key

1 throttle trigger lockout
2 stop switch
3 suspension point
4 handle
5 throttle trigger
6 drive shaft tube
7 harness, quick-release mechanism
8 harness, hip pad
9 cutting-attachment guard
10 cutting attachment, e.g. saw blade
11 muffler
12 power unit

Figure 1 — Brush-cutter with integral power source



Key

1 choke
2 rear handle
3 stop switch
4 throttle trigger
5 front handle
6 drive shaft tube
7 cutting-attachment guard
8 muffler
9 cutting attachment, e.g string trimmer head
10 power unit

Figure 2 — Grass-trimmer with integral power source

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 for relevant but not significant hazards which are not dealt with by this part of ISO 11806. The machine shall also be marked according to 5.2 and carry warnings according to 5.3.

The safe operation of a brush-cutter and a grass-trimmer depends on both the safety requirements given in this clause and the safe working conditions associated with the use of adequate personal protection equipment (PPE), such as gloves, slip-resistant footwear, and leg, eye and hearing protection equipment, as well as safe working procedures (see 5.1).

The instruction handbook to be provided with the machine shall comply with 5.1.

If a grass-trimmer can be converted to a brush-cutter then the converted machine shall comply with requirements for a brush-cutter and vice versa.

The overall safety of the separate cutting attachment has to be verified as a part of the complete machine.

Except where otherwise specified in this part of ISO 11806, the safety distances specified in ISO 13857:2008, 4.2.4.1 and 4.2.4.3, shall be met.

If a special tool is required to replace a cutting attachment, it shall be supplied with the machine.

4.2 Handles

4.2.1 Requirements

The machine shall have a handle for each hand. These handles shall be designed such that:

— they can be fully gripped by an operator when wearing gloves;

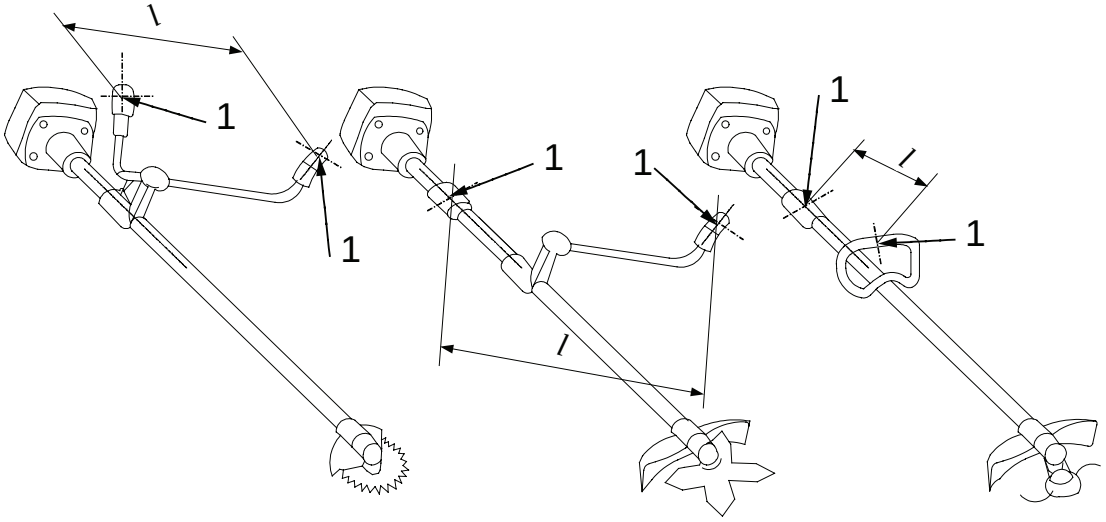
— they provide the necessary sureness of grip by their shaping and surface;

— they have a length of at least 100 mm;

— the distance *l* (see Figure 3) between the centre of the handles is at least 500 mm for those machines which can be equipped with metal saw blades, and at least 250 mm for all others;

— they are adjustable so that a suitable ergonomic working position can be achieved. An adjustment below the minimum distance *l* shall be prevented by design.

NOTE The position of the operator relative to the cutting attachment is defined by the suspension point (see 4.5 and 4.6) and the barrier (see 4.3).



Key

1 centre of gripping area

Figure 3 — Examples for handle distance *l*

4.2.2 Verification

The design, adjustment and dimensions shall be verified by inspection and measurements and function test.

4.3 Barrier and distance to cutting attachment for brush-cutters

4.3.1 Requirements

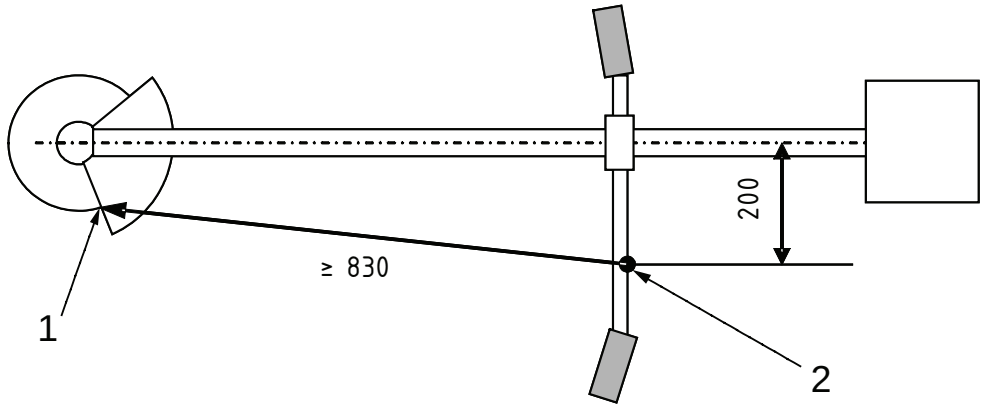
Brush-cutters shall be equipped with a barrier to prevent an unintentional contact with the cutting attachment during operation.

The barrier shall project at least 200 mm horizontally and perpendicularly from the centre-line of the drive shaft tube. This function can also be performed by the handle assembly. See Figure 4.

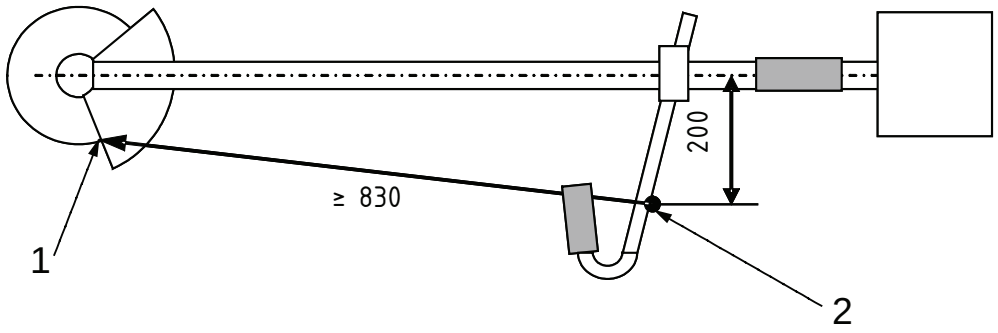
The minimum straight line distance from the rear of the barrier (2) at a width of 200 mm (2) to the nearest unguarded point of the cutting attachment (1) shall be at least 830 mm, where the unguarded point of the cutting attachment is the intersection between the plane perpendicular to the cutting path and the side-edge of the cutting-attachment guard. See Figure 4.

Barriers that are to be removed as a part of maintenance procedures, described in the instruction handbook, shall be fixed by systems that can be opened or removed only with tools. The fixing system for barriers which are independent from the handle assembly shall be permanently attached to the barrier and/or the machine when the barrier is removed.

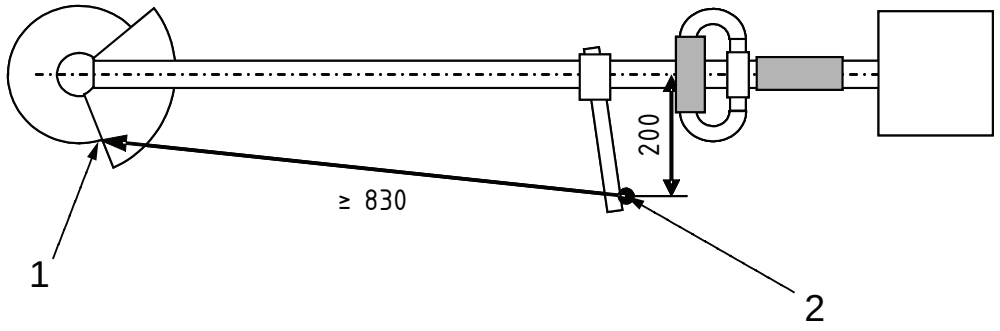
Dimensions in millimetres



a) Bicycle-type handle serving as a barrier



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



c) Front and rear handle with separate barrier

Key

1 unguarded point of the cutting attachment

2 rear of the handle bar/barrier

Figure 4 — Example of machines with different handle configurations, barrier and distance to cutting attachment

4.3.2 Verification

The design, adjustment and dimensions shall be verified by inspection and measurements.

4.4 Harness

4.4.1 Requirements

A double shoulder harness shall be provided for all machines exceeding a dry weight of 7,5 kg and for all brush saws.

Brush-cutters other than brush saws having a dry weight of 7,5 kg or less and grass-trimmers having a dry weight of 6 kg to 7,5 kg shall at least be provided with a single shoulder harness. For a grass-trimmer with a dry weight below 6 kg, no harness is required.

The double shoulder harness shall be designed so that pressure is evenly distributed on both shoulders of the operator. The design of the double shoulder harness shall prevent slipping in any direction and be supplied with a hip pad.

All double shoulder harnesses shall be equipped with a quick-release mechanism positioned either at the connection between the machine and harness or between the harness and operator. Either the design of the harness or the use of the quick-release mechanism shall ensure that the machine can be released quickly from the operator in the event of emergency.

The harness shall be adjustable to the size of the operator.

If a quick-release mechanism is provided, it shall be possible to open it under load and release the machine using only one hand.

4.4.2 Verification

The type of harness and its adjustment shall be verified by inspection. The quick-release mechanism(s) shall be checked by a function test carried out by a person wearing the harness and with a vertical load of three times the dry weight of the machine acting on the suspension point.

4.5 Balance

4.5.1 Requirements

4.5.1.1 All machines requiring a harness, except those described in 4.5.1.2, shall have the suspension point (see Figure 3) adjustable so that the machine is balanced when it is suspended on this point.

Such a balanced machine, with the suspension point at a minimum vertical distance of 750 mm above the ground, shall have:

— for brush-cutters: a distance from the ground to the nearest point of the blade of 200 mm ± 100 mm;

— for grass-trimmers: a distance from the ground to the nearest point of the cutting attachment of $200 \begin{smallmatrix} +100 \\ -200 \end{smallmatrix}$ mm.

The requirements shall be met with tanks that are half filled and for recommended cutting attachments.

4.5.1.2 Machines suspended with a harness, and designed to be supported by the ground shall have the suspension point adjustable so that the ground contact force is not greater than 20 N, with tanks that are half filled and for recommended cutting attachments.

4.5.2 Verification

The requirements of 4.5.1 shall be verified by inspection and measurement using the lightest and heaviest recommended cutting attachments.

4.6 Cutting-attachment strength

4.6.1 Requirements

The cutting attachment, excluding flexible cutting lines, shall not break or crack when impacted once against a steel rod of diameter 25 mm ± 1 mm.

The same cutting attachment shall then, without any adjustments, not break or crack when operated at an over-speed.

An exception from this second requirement is made for a single-piece metal blade. Such blades shall instead meet the material requirements in ISO 7113:1999, Clause 5.

These requirements are applicable to all recommended cutting attachments.

4.6.2 Verification

Impact strength shall be verified by a test according to Annex A and the same cutting attachment shall then be run for 5 min at 1,33 times racing speed (over-speed), as defined in ISO 7112. The final verification for cracks shall be done by visual inspection.

Single-piece metal blades shall be verified by testing in accordance with ISO 7113:1999, Clause 5.

4.7 Cutting-attachment retention

4.7.1 Requirements

Metallic cutting attachments shall be secured to prevent relative motion between the cutting attachment and the retainer, or between the metallic cutting attachment and the shaft on which it is mounted.

The method for securing the metallic cutting attachment shall also prevent loosening of the cutting attachment during use.

These requirements are applicable to all metallic cutting attachments recommended in the instruction handbook.

4.7.2 Verifications

The method of attachment shall be verified by inspection and by using the following test procedure.

a) Install the cutting attachment in accordance with the instruction handbook.

b) Lock the power transmission shaft.

c) Apply to the cutting attachment a rotational torque, *M*, in newton metres (N · m):

$$M = 0{,}4 \times V \times k$$

where

V is the engine displacement, in cubic centimetres (cm^3);

k is the gear ratio (engine/cutting-attachment rotational frequency).

Conduct the test five times in the direction of normal rotation, then five times in the opposite direction.

4.8 Cutting-attachment guards

4.8.1 Requirements

The guard dimensions shall comply with ISO 7918.

The guard location shall comply with ISO 7918, for all possible adjustments.

The guard strength shall comply with ISO 8380 for all guards, except for the test at -25ºC which does not apply to the guard of grass-trimmers.

Guard dimensions shall comply with the specifications in ISO 7918 before and after the tests specified in 4.8.2.

In a thrown-objects test in accordance with Annex B, no more than three penetrations in the area from 0,3 m to 2 m in height are allowed. If more than three penetrations occur, the test has to be repeated five times with no more than three penetrations in each of these tests. No cracks or breakages of the guards are allowed.

Guards that are to be removed in connection with a change of cutting attachment or as part of maintenance procedures, described in the instruction handbook, shall be fixed by systems that can be opened or removed only with tools. These guards-fixing systems shall remain attached to the guards or to the machinery when the guards are removed.

4.8.2 Verification

Guard dimensions, fixing system and locations shall be verified by inspection and measurements. Strength requirements shall be verified by testing in accordance with ISO 8380. The thrown-objects requirement shall be verified by testing in accordance with Annex B.

4.9 Transport cover

4.9.1 Requirements

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

4.9.2 Verification

The attachment of the transport cover to the cutting attachment shall be verified by inspection when holding the machine in any direction.

4.10 Length of flexible cutting lines

4.10.1 Requirements

Grass-trimmers with flexible cutting lines shall have a line-limiting device or other means of line-length control. The limiting device shall cut the flexible cutting lines to lengths compatible with the cutting-attachment guard.

4.10.2 Verification

The means to limit or control the line length shall be verified by a functional test and inspection.

4.11 Engine starting device

4.11.1 Requirements

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

Machines 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.

4.11.2 Verification

The means of starting the engine shall be verified by inspection and functional testing.

4.12 Engine stopping device

4.12.1 Requirements

The machine 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 while the machine is held with both hands by an operator wearing gloves. The colour of the control shall clearly contrast with the background.

4.12.2 Verification

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

4.13 Throttle control

4.13.1 Position

4.13.1.1 Requirements

The throttle trigger shall be positioned so that it can be pressed and released with a gloved hand while holding the handle to which the throttle trigger is mounted.

4.13.1.2 Verifications

The position shall be verified by inspection and functional testing.

4.13.2 Operation

4.13.2.1 Requirements

The machine shall be provided with a throttle trigger that, when released, automatically reverts to the idling position. The throttle trigger, except for grass-trimmers with a cutting attachment where each filament or pivoting non-metallic blade has a kinetic energy of less than 10 J, shall be retained in the idling position by the automatic engagement of a throttle trigger lock-out.

NOTE When fitted to assist starting, a throttle lock will maintain an engine speed higher than the idling speed until the throttle trigger is activated and released.

For brush-cutters and grass-trimmers with a cutting attachment where each filament or pivoting non-metallic blade has a kinetic energy of 10 J or more, after the starting procedure has been finished, activation of the throttle trigger to increase the engine speed, to a point where the cutting attachment starts to move, shall only be possible after the throttle trigger lock-out has been disengaged.

The starting procedure is finished when the operator disengages the throttle lock and the engine returns to idling speed.

Except for grass-trimmers with a cutting attachment, where each filament or pivoting non-metallic blade has a kinetic energy of less than 10 J, unintentional movement of the cutting attachment shall be minimized by a throttle control linkage so designed that a force applied to the handle, with the throttle trigger lock-out engaged, will not increase the engine speed to a point where the clutch engages and cutting-attachment movement begins.

For the calculation of kinetic energy, see 4.13.2.2.

4.13.2.2 Calculation of kinetic energy of filament and pivoting non-metallic blade

For the purposes of this part of ISO 11806 the kinetic energy (E_k) in joules, of filament and pivoting non-metallic blades shall be calculated by means of the following equation:

$$E_k = 0{,}5m\left[\frac{\pi}{30}n\left(r-\frac{L}{2}\right)\right]^2$$

where:

L is the maximum free length of a filament or the length from the pivoting point to the outer tip for the pivoting non-metallic blade, in metres;

m is the mass of length L, in kilograms;

n is the maximum rotational speed with a cutting element (blade or filament) with length L, in revolutions per minute;

r is the distance from the axis of rotation of the cutting head to the outer tip of the cutting element, in metres.

4.13.2.3 Verification

The function shall be verified by inspection while operating the machine. The throttle-control linkage design shall be verified by applying a force in the most unfavourable direction on the handle with the throttle control, equal to three times the weight of the machine (without a cutting attachment and with the tanks empty).

4.13.3 Throttle lock

4.13.3.1 Requirements

If a throttle lock is provided to aid starting and its engagement will result in a movement of the cutting attachment during starting, it shall be such that the throttle lock has to be engaged manually and shall be automatically released when the throttle trigger is operated. In these cases, the activation device for setting the throttle lock shall be located outside the gripping area of the handle and require at least two independent motions to engage the throttle lock.

For finger-type throttle control, the gripping area is defined as extending from 25 mm in front of the rear part of the throttle trigger to 75 mm behind the rear part of the throttle trigger.

For thumb-type throttle control, the gripping area is defined as the distance from the rear part of the throttle trigger to the rearmost part of the handle.

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

4.13.3.2 Verification

The function of the throttle lock shall be verified by inspection and measurements while operating the machine. The force to release the throttle lock shall be applied within 1 s at a position (5 ± 1) 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).

4.14 Clutch

4.14.1 Requirements

All machines to which a blade can be attached shall have a clutch so designed that the cutting attachment does not move when the engine rotates at any speed less than 1,25 times the idling speed.

4.14.2 Verification

Correct operation of the clutch shall be verified by inspection when increasing the engine speed from idling speed to 1,25 times the highest idling speed specified in the instruction handbook.

4.15 Tanks

4.15.1 Requirements

Fuel tank caps shall have retainers.

The fuel tank opening shall be at least 20 mm in diameter and the oil tank opening, if existent, at least 15 mm in diameter. Each opening or cap shall be clearly marked to indicate the function of the tank, and 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 machine is at its normal stable operating temperature, in all working positions and while being transported.

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

4.15.2 Verification

The cap retainers, opening dimensions and location shall be verified by measurement and inspection. The tightness of the caps shall be verified by inspection while turning the machine in any direction. Seepage from fuel tank ventilation systems is not regarded as leakage.

4.16 Protection against contact with parts under high voltage

4.16.1 Requirements

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

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

4.16.2 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 60745-1:2006, Figure 1. The ignition interruption or short-circuiting shall be verified by inspection.

4.17 Protection against contact with hot parts

4.17.1 Requirements

The cylinder and parts in direct contact with the cylinder or the muffler shall be protected against unintentional contact during normal operation of the machine.

Such hot surfaces shall be considered accessible if the contactable area exceeds 10 cm^2 when probed by the test cone as shown in Figure 5.

The temperature for the accessible parts of the machine defined above, including guards or shields provided to prevent access to such hot surfaces, shall not be more than 80 ºC for metallic surfaces or 94 ºC for plastic surfaces.

4.17.2 Verification

Verification shall be by determining the accessibility of identified hot surfaces using the test cone shown in Figure 5 and 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 °C ± 3 °C, the recorded temperatures shall be corrected using the formula

$$T_C = T_O - T_A + 20\ °C$$

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 5 in any direction and with a maximum force of $(10\ ^{0}_{-1})$ N. When moving the cone, determine whether there is any contact between the hot surface area or areas 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^2.

Dimensions in millimetres

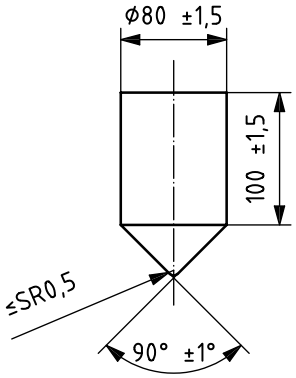


Figure 5 — Test cone

4.18 Exhaust gases

4.18.1 Requirement

The exhaust outlet shall be located such that it directs exhaust emissions away from the operator's face in normal working positions.

4.18.2 Verification

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

4.19 Vibration

4.19.1 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.

NOTE 1 CR 1030-1[13] gives general technical information on widely recognized technical rules and means, and provides guidelines for the design of reduced hand-arm vibration machines.

NOTE 2 ISO/TR 22521[12] provides useful information about comparative data on vibration levels of portable hand-held forestry machinery.

4.19.2 Vibration measurement

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

4.20 Noise

4.20.1 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 the air intake system, engine cooling system, engine exhaust system, cutting system and vibrating surfaces.

ISO/TR 11688-1 gives general technical information and guidance for the design of low-noise machines. Special care shall be taken in the acoustical design of brush-cutters and grass-trimmers.

NOTE 1 ISO/TR 11688-2[5] gives useful information on noise generation mechanisms in machinery and ISO 14163[9] provides guidelines for noise control by silencers. ISO 11691[6] and ISO 11820[7] address the testing of the silencer.

NOTE 2 Information about comparative data on emission sound pressure levels of portable hand-held forestry machinery can be found in ISO/TR 22520[11].

4.20.2 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.

4.21 Electromagnetic immunity

4.21.1 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.

4.21.2 Verification

Electromagnetic immunity shall be verified by testing in accordance with ISO 14982.

5 Information for use

5.1 Instruction handbook

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 instruction handbook shall give at least the following information for each model and/or shall mark where significant differences occur:

— machine mass (without fuel, cutting attachment and harness), in kg;

— volume (fuel tank), in cm^3;

— volume (oil tank, if any), in cm^3;

— cutting attachments (type, diameter for blades), in mm;

— engine displacement, in cm^3;

— maximum engine power, in accordance with ISO 8893, in kW;

— maximum rotational frequency of the spindle, in min^{-1};

— engine idling speed range, in min^{-1};

— values for equivalent vibration total value (for each handle), determined in accordance with ISO 22867, together with uncertainty of stated values, both in m/s^2;

— values for the equivalent A-weighted emission sound pressure level at the operator position, determined in accordance with ISO 22868, together with the uncertainty of the stated values, both in A-weighted dB;

— values for the A-weighted sound power level, determined in accordance with ISO 22868 (if required), together with the uncertainty of the stated values, both in A-weighted dB.

Sales literature describing the machinery should not contradict the instructions as regards health and safety aspects. Sales literature describing the performance characteristics of machinery should contain the same information on noise emissions and vibration values as are contained in the instruction handbook.

5.1.3 Other information

The instruction handbook shall contain, in accordance with ISO 12100:2010, 6.4.5, comprehensive instructions and information on all aspects of operator/user maintenance, safe use of the machine, including type and use of PPE and the need for training in all operations. The instructions shall take into account the use of the machine by a first-time and/or inexperienced operator.

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

The importance of reading the instruction handbook thoroughly before using the machine shall be stressed on the front page of the instruction handbook.

The terms used in all documentation shall be in accordance with ISO 7112.

The instruction handbook shall at least cover information relating to the following:

a) transport, handling and storage of the machine, including

   — instructions for securing the machine during transport to prevent loss of fuel, damage or injury,

   — cleaning and maintenance before storage, including the use of guards on cutting attachments with metal blades, and

   — use of a transport cover for metal blades during transport and storage;

b) commissioning of the machine, including

   — assembling instructions, initial adjustments and checks, including a description of the method to install or remove the cutting attachment including, for brush-cutters, a warning of sharp edges and need to wear gloves,

   — for machines with a clutch, routines for checking that the cutting attachment stops turning when the engine idles,

   — a list of recommended cutting attachments and appropriate guards and their location, including a warning of possible safety consequences from using other cutting attachments, e.g. metal multi-piece pivoting chains and flail blades,

   — information regarding regular maintenance, pre-operating procedures and daily maintenance routines, as well as the consequences of improper maintenance, and

   — filling of fuel and oil, especially concerning fire precautions;

c) the machine itself, including

   — a description, identification and the nomenclature of principal parts including the safety devices and harness and the use of the quick-release mechanism (when provided), explanations of their functions and necessary PPE to be used, including correct clothing,

   — an explanation of symbols and safety signs,

   — regular maintenance tasks, pre-operational measures and daily maintenance techniques, including checking for loose fasteners, fuel leaks and damaged parts, such as cracks in the cutting attachment,

— application of the machine and how it is intended to be used, including prohibited uses; for brush-cutters, information shall also be given about the risks of kick-back and blade-thrust,

— declared values of the A-weighed emission sound pressure level at the operator's position and of the A-weighted sound power level, including a warning about the risks and measures to be taken to minimize those risks, and

— equivalent vibration, including warning about the risks and measures to be taken to minimize those risks (including an explanation of white-finger risks and the means for the users to protect themselves);

d) the use of the machine, including

— a note alerting the user to the fact that national regulation can restrict the use of the machine,

— the need for daily inspection before use and after dropping or other impacts to identify any significant defects,

— instructions on general operation and common cutting tasks including warnings against unintended use,

— instructions on the use of PPE including recommendations for the appropriate type of hearing protection, eye protection and clothing,

— for brush-cutters, the clothing instructions shall include information to use slip-resistant foot protection, as well as protective clothing,

— a warning against the use of the machine when the operator is tired, ill or under the influence of alcohol or other drugs,

— hazards which could be encountered while using the machine and how to avoid them while performing typical tasks (e.g. removal of blockage),

— warning of risks for bystanders and the need to keep them at least 15 m away from the machine during its operation,

— starting and stopping techniques, with particular reference to safety,

— a warning about the emission of exhaust gases,

— information on correct working posture, the need for rest periods and changing working positions, and

— advice to keep firm footing and balance during operation, including the need to use the harness provided;

e) maintenance instructions, including

— a description of servicing and replacement tasks for the user, including the need to keep the machine in good working condition,

— specifications of the spare parts to be used, when these affect the health and safety of operators, for these machines the cutting attachment and the cutting-attachment guard,

— drawings or diagrams to allow user maintenance and fault-finding, and

— the provision of sufficient information to enable the user to maintain the safety system throughout the life of the product and an evaluation of the consequences of improper maintenance, use of non-conformant replacement components, or the removal or modification of safety components.

5.2 Marking

All machines 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;

— designation of machinery;

— year of construction, i.e. the year in which the manufacturing process was completed;

— serial number, if any;

— the maximum rotational frequency of the spindle, in min^{-1};

— the rotational direction for the cutting attachment on a component near the cutting attachment, when applicable.

NOTE The designation of machinery is to allow the technical identification of the product and this can be achieved by a combination of letters and/or numbers and can be combined with the designation of series or type.

In addition, the cutting attachment shall be marked with the following information:

— maximum rated rotational frequency, in min^{-1};

— rotational direction, when applicable;

— name or trade mark of the manufacturer.

The machine shall also bear the following information:

— identification and method of operation, preferably according to ISO 3767-1[1] and ISO 3767-5[2], of the controls for engine starting and stopping devices, choke control, primer and heated handle switch (if provided);

— identification of carburettor and oil adjustments (if provided);

— identification of fuel and oil tank (if provided) openings and/or caps.

If symbols are used, they shall be explained in the instruction handbook, 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 5.4.2, 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 0,09 w, in newtons, where w is the test specimen width, in millimetres.

5.3 Warnings

All machines shall be marked with the following warnings using text or pictograms:

— **Read the instruction handbook and follow all warnings and safety instructions.**

— **Wear eye and hearing protection.**

— **Wear head protection, where there is a risk of falling objects.**

— **For brush-cutters, wear slip-resistant footwear and gloves.**

— **The distance between the machine and bystanders shall be at least 15 m.**

— **Do not use metal blades** (if applicable)**.**

— **Beware of thrown objects.**

— **Beware of blade thrust** (on brush-cutters)**.**

If pictorials are used, they shall be explained in the instruction handbook.

NOTE Guidance for the design of pictorials is given in ISO 17080[10] and ISO 11684[4]. Examples can also be found in ISO 7010[3].

When pictorials 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 symbols shall be clearly legible when viewed from a distance of not less than 500 mm.

The warnings shall be 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 weathering exposure.

If labels are used, they 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 0,09 w, 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 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 sign, wherever possible, except where the physical limitations of the test equipment do not allow for testing of an entire sign or when the graphical content of the sign 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 protective layer shall be completely removed for the wipe resistance test (5.4.2) and for the adhesion test (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 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°C ± 5°C with a relative humidity of 50 % ± 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 300s ± 3s.

After being removed from the test liquid, wipe the test specimen with a force of 10 N and 1 cycle/s, using an unbleached cotton cloth soaked in the test liquid for 30 s ± 3 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 of (by volume) 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 min ± 1 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 a protective layer, to a pulling machine. Apply a pulling force upwards at an angle of 90° to the test panel and at a speed of (60 ± 6) 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.

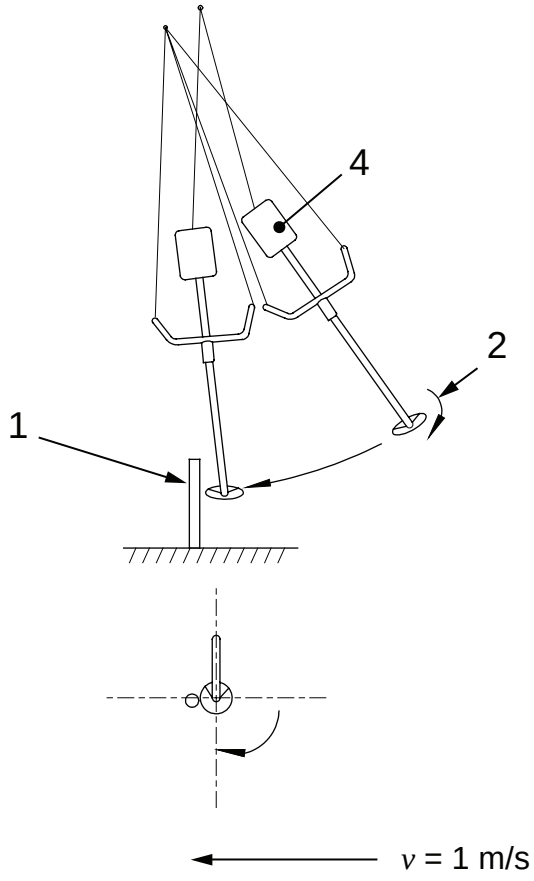
Annex A
(normative)

Cutting-attachment impact test

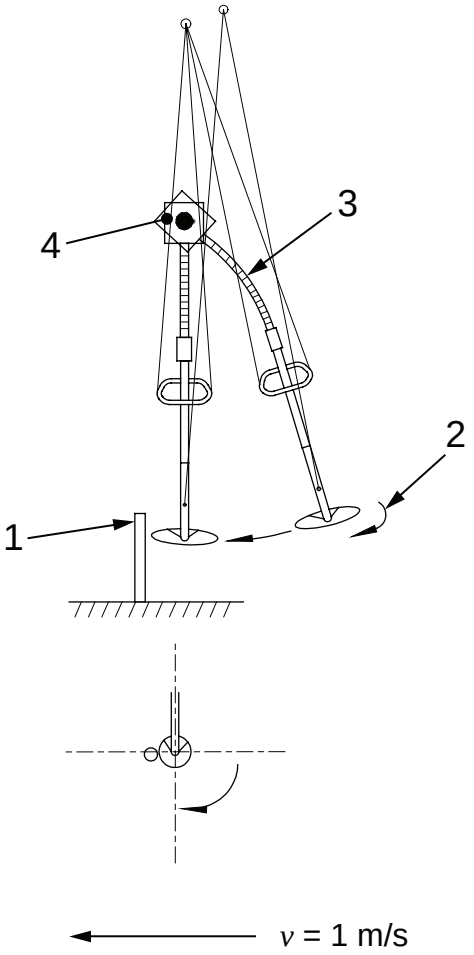
A.1 The machine shall be suspended freely in an operating position (see Figure A.1).

A.2 The test shall be conducted with one swing against a 25 mm ± 1 mm diameter steel rod of grade 1 in accordance with ISO 683-9:1988. The steel rod shall be impacted horizontally by the cutting attachment at an approach speed (v) of 1 ms^{-1} ± 0,1 ms^{-1}, as shown in Figure A.1, and with a rotational cutting-attachment speed corresponding to an engine speed of 1,33 times the maximum power speed in accordance with ISO 8893 or the racing speed, whichever is less.

A.3 The engine/motor shall be switched off immediately after the impact.



a) Machine with integral combustion engine power unit



b) Machine with backpack power unit

Key

1 steel rod
2 direction of rotation
3 flexible shaft
4 power unit

If the blade rotates in the opposite direction, the cutting attachment shall impact the steel rod from the other side.

Figure A.1 — Impact test

Annex B
(normative)

Thrown objects test

B.1 Test stand

B.1.1 The test shall be conducted on a test stand as shown in Figures B.1 and B.2.

B.1.2 The base shall be a flat board.

B.1.3 The base shall be covered with an artificial-grass mat with a maximum height of 15 mm and a fibre length of 6 mm to 8 mm.

B.1.4 The fibre shall not have any specific orientation.

NOTE For the insertion position of the test-piece injection tube, see Figure B.2

B.2 Test conditions

B.2.1 The machine shall be mounted rigidly above the base, and oriented in such a way that the device which inserts the test pieces is at a distance (l) which is half the depth of the cutting teeth or 13 mm inside the outer path line of the cutting attachment, whichever is less (see Figures B.1 and B.2). The flexible lines of the grass-trimmer shall be adjusted to their maximum length.

B.2.2 The insertion of the test pieces shall be made in a vertical direction from below, at one of the two positions shown in Figure B.2, as follows:

— if the cutting attachment rotates counter-clockwise, position A shall be used; and

— if the cutting attachment rotates clockwise, position B shall be used.

B.2.3 The lower surface of the cutting elements shall be parallel to and 30 mm ± 3 mm above the top of the fibre surface (see Figure B.2). In cases where the cutting head (see Figure B.2) extends more than 30 mm below the cutting elements, a clearance of 1 mm to 5 mm between the cutting head and the fibre surface shall be maintained.

B.2.4 Adjust the velocity with which the test piece is inserted, so that the test piece raises a minimum of 20 mm and a maximum of 30 mm above the cutting element.

B.3 Penetration wall

B.3.1 At the operator's position, a wall with a minimum height of 2 000 mm above the top of the base shall be established.

B.3.2 The wall shall be made of kraft paper (mass per unit area 80 g/m^2).

B.3.3 The paper shall be flatly attached without folds on a framework whose minimum inside dimensions are shown in Figure B.1.

B.4 Test pieces

B.4.1 The test pieces shall be ceramic prisms with triangular sides and a prism height of 6,5 mm ± 0,8 mm (see Figure B.3). The mass of one prism shall be 0,4 g ± 0,02 g.

B.5 Procedure

B.5.1 At the selected test-piece insertion position (A or B), 25 test pieces shall be inserted vertically and individually from below, into the circular path of the rotating cutting attachment.

B.5.2 The engine speed shall be for a wide-open throttle, using carburettor settings according to the manufacturer's recommendation or 133 % of the maximum power speed, whichever is less.

B.5.3 The base of the test stand shall be cleaned after the insertion of five test pieces.

B.6 Inspection of the cutting attachment

B.6.1 If the blade is damaged during the test, it shall be replaced with a new blade.

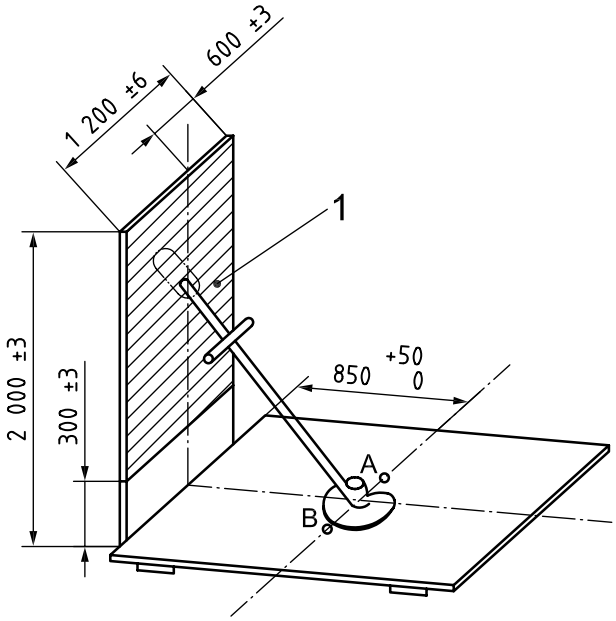
B.6.2 For grass-trimmers with a damaged line, pull out a fresh piece of line and cut it off to the original length.

B.7 Result

After the test, the penetration wall shall be examined to determine if there has been any penetration in the target zone.

Penetration is confirmed if a ball of 5 mm diameter can be pressed through the tear with a maximum force of 3 N.

Dimensions in millimetres



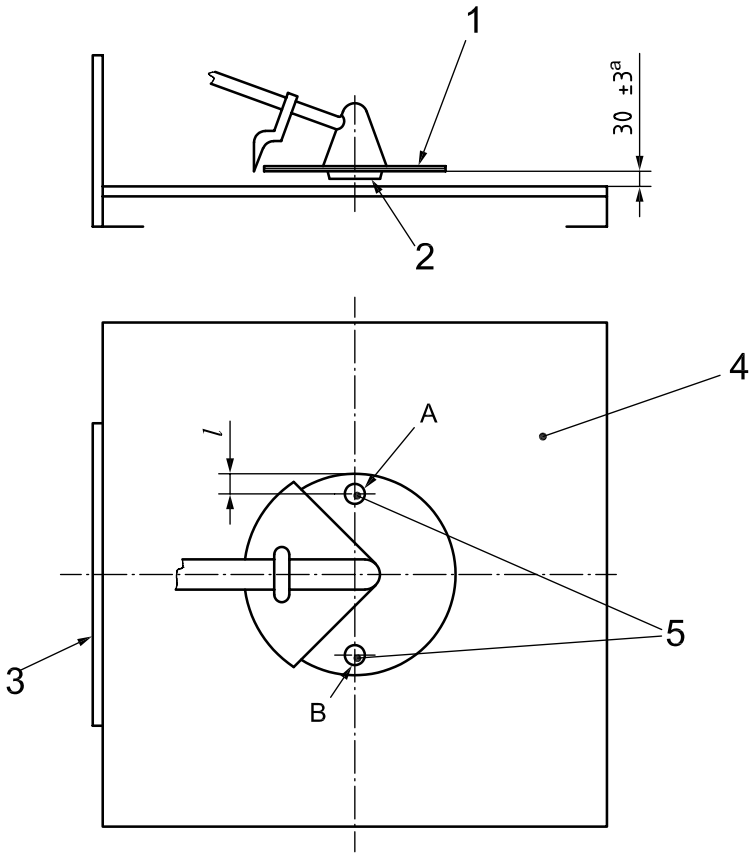
Key

1 target zone

NOTE For insertion positions of the test pieces, see Figure B.2.

Figure B.1 — Machine position on test stand

Dimensions in millimetres



Key

1 cutting element
2 cutting head
3 target zone
4 fibre surface
5 insertion positions for test probes (A and B)

[a] See B.2.3.

Figure B.2 — insertion positions of the test pieces

Dimensions in millimetres

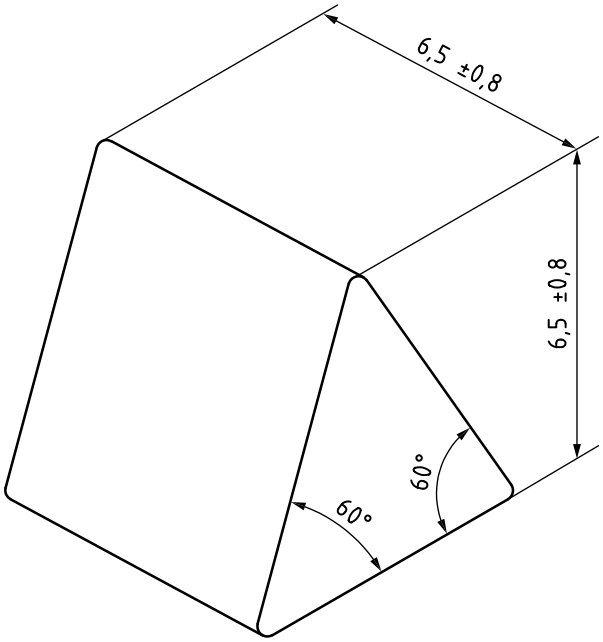


Figure B.3 — Test piece

Annex C
(informative)

List of significant hazards

This annex specifies the significant hazards, hazardous situations and significant hazardous events that have been identified as being significant for the brush-cutters and grass-trimmers within the scope of this part of ISO 11806 and which require specific action by the designer or manufacturer to eliminate or reduce the risk.

Table C.1 — List of significant hazards associated with brush-cutters and grass-trimmers

Ref. No.	Hazard		Subclause of this part of ISO 11806
	Origin (source)	Potential consequences	
1	**Mechanical hazards**		
	Rotary cutting attachment	Cutting or severing of upper and lower extremities	4.3, 4.5, 4.8, 4.13, 4.14
	Thrown objects from machine	Injury from impact of ejected objects	4.8
	Break-up of cutting attachment	Injury from ejected parts of cutting attachment	4.6, 4.7, 5.1
	Engine control system malfunction or controls resulting in unexpected start-up with cutting attachment engaged, unexpected over-run/over-speed	Shearing, cutting, severing or entanglement of upper and lower extremities	4.2, 4.11, 4.12, 4.13, 4.14, 4.21 5.1, 5.2
2	**Electrical hazards**		
	Live parts of electrical system (direct contact) or parts which have become under high voltage under faulty conditions (indirect contact)	Injuries from electric shock to the body	4.16
3	**Thermal hazards**		
	Hot engine parts including parts which have become hot caused by heat radiation	Injury from burns and scalds from accidental contact	4.17
4	**Noise hazards**		
	Engine, transmission and cutting system, including resonance of fixed machine parts	Discomfort, partial hearing loss, deafness, loss of balance, loss of awareness, stress	4.20, 5.1, 5.3
5	**Vibration hazards**		
	Engine, handles	Discomfort, neurological, osteo-articular and vascular disorders	4.19, 5.1
6	**Material/substance hazards**		
	Engine exhaust gases, gasoline	Respiration problems through inhalation of harmful gases and injuries to the skin from contact with harmful liquids	4.18
7	**Ergonomic hazards**		
	Location and design of controls, handles, etc.	Discomfort, fatigue, injuries to locomotor apparatus, loss of control	4.2, 4.4, 4.11, 4.12, 4.13, 5.1, 5.2
8	**Combination of hazards**		
	Poor posture or excessive effort in combination with inadequate design or location of manual controls, including inadequate consideration of human hand-arm anatomy, related to handle design and machine balance.	Discomfort, fatigue, injuries to locomotor apparatus, loss of control	4.2, 4.4, 4.11, 4.12, 4.13, 5.1, 5.2
	Hot engine parts/electrical short-circuiting in combination with leaking gasoline tank/ gasoline spilling	Burns and scalds caused by resulting fire	4.15, 4.17, 5.1

Bibliography

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

[2] ISO 3767-5:1992, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Symbols for operator controls and other displays — Part 5: Symbols for manual portable forestry machinery*

[3] ISO 7010:2003, *Graphical symbols — Safety colours and safety signs — Safety signs used in workplaces and public areas*

[4] ISO 11684:1995, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Safety signs and hazard pictorials — General principles*

[5] ISO/TR 11688-2:1998, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 2: Introduction to the physics of low-noise design*

[6] ISO 11691:1995, *Acoustics — Measurement of insertion loss of ducted silencers without flow — Laboratory survey method*

[7] ISO 11820:1996, *Acoustics — Measurements on silencers* in situ

[8] ISO 13732-1:2006, *Ergonomics of the thermal environment — Methods for the assessment of human responses to contact with surfaces — Part 1: Hot surfaces*

[9] ISO 14163:1998, *Acoustics — Guidelines for noise control by silencers*

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

[11] ISO/TR 22520:2005, *Portable hand-held forestry machines — A-weighted emission sound pressure levels at the operator's station — Comparative data in 2002*

[12] ISO/TR 22521:2005, *Portable hand-held forestry machines — Vibration emission values at the handles — Comparative data in 2002*

[13] CR 1030-1:1995, *Hand-arm vibration — Guidelines for vibration hazards reduction — Part 1: Engineering methods by design of machinery*

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