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

Part 2: Machines for use with backpack power unit

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

Partie 2: Machines pour utilisation avec source motrice portée à dos

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Contents

Page

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).

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).

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.

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 second edition cancels and replaces the first edition (ISO 11806-2:2011), which has been technically revised.

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

— the reference to ISO 11806-1:2021 has been updated to the latest edition;

— the requirements for the harness for the backpack power unit have been reworded and amended;

— the throttle control requirements for the backpack power unit have been added;

— the requirements for the fuel tank structural integrity for the backpack power unit has been added by including a new Annex B.

A list of all parts in the ISO 11806 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.

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:

— machine manufacturers (small, medium and large enterprises);

— health and safety bodies (regulators, accident prevention organisations, 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.

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

Part 2: Machines for use with backpack power unit

1 Scope

This document specifies safety requirements, and measures for their verification, for the design and construction of portable, hand-held, powered brush-cutters and grass-trimmers with a backpack-mounted combustion engine power source and mechanical power transmission between the power source and the cutting attachment (hereafter referred to as "machine"). 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, taken together with the relevant clauses of ISO 11806-1:2021 (see 4.1), deals with all significant hazards, hazardous situations and hazardous events, with the exception of whole-body vibration from the backpack power unit, relevant to these machines when they are used as intended and under conditions of misuse which are reasonably foreseeable by the manufacturer.

NOTE 1 A standardized test procedure for measuring whole-body vibration from the backpack power unit is not available at the time of publication.

NOTE 2 See Annex A, together with ISO 11806-1:2021, Annex A, for a list of significant hazards.

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

This document is not applicable to machines equipped with metallic cutting attachments consisting of more than one piece, such as pivoting chains or flail blades.

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 4413:2010, *Hydraulic fluid power — General rules and safety requirements for systems and their components*

ISO 4414:2010, *Pneumatic fluid power — General rules and safety requirements for systems and their components*

ISO 11806-1:2021, *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*

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

ISO 13857:2019, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 11806-1:2021 and the following apply.

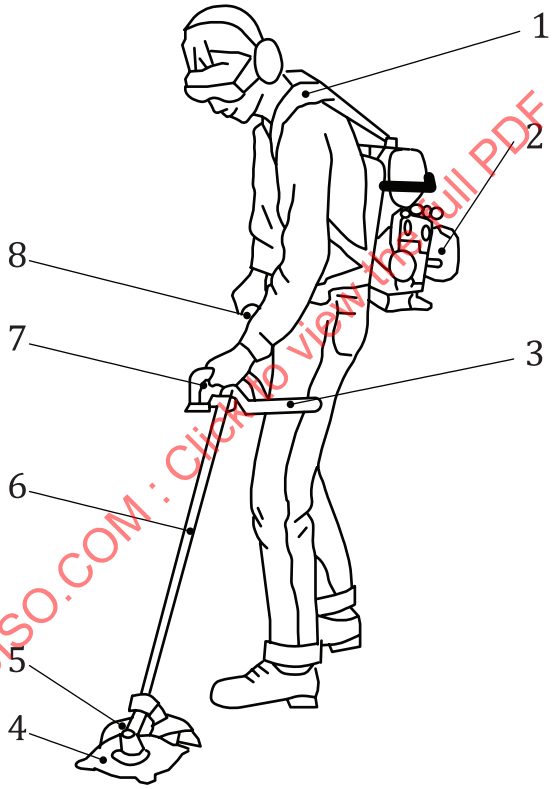
ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
machine
complete brush-cutter, brush saw or grass-trimmer, including backpack power unit and assembly of drive shaft tube and mechanical power transmission including cutting attachment, guard, handles and if applicable, barrier

Note 1 to entry: Figure 1 provides an example of a brush-cutter with a backpack power unit (machine) falling within the scope of this document.



Key
1 harness
2 backpack power unit
3 barrier
4 blade
5 cutting attachment guard
6 drive-shaft tube
7 front handle
8 rear handle

Figure 1 — Machine (brush-cutter) with backpack power unit

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 12100:2021 for relevant but not significant hazards which are not dealt with by this document.

Machines shall comply with ISO 11806-1:2021, Clause 4, except for 4.4, 4.5, 4.13 and 4.15.2.

The safe operation of a brush-cutter and a grass-trimmer also depends on the safe environment associated with the use of personal protective equipment (PPE), such as gloves, slip-resistance footwear, and leg, eye and hearing protective equipment, as well as safe working procedures (see ISO 11806-1:2021, 5.1).

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

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 Distance to cutting attachment

4.2.1 Requirements

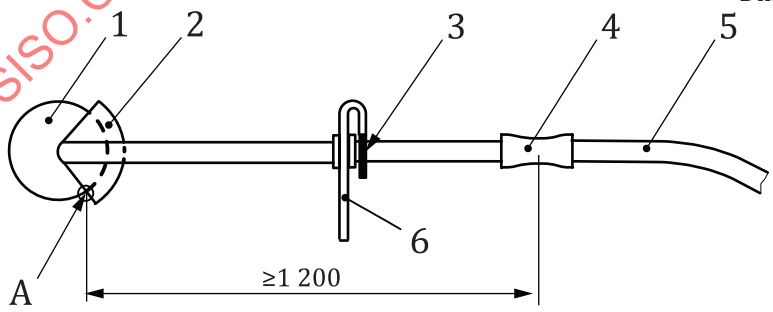
Machines with front and rear handles shall have a minimum straight-line distance of 1 200 mm from the mid-point of the rear handle to the nearest unguarded point of the cutting attachment (point A in Figure 2). Point A is the intersection between the plane perpendicular to the cutting path and the side-edge of the cutting attachment guard.

This minimum distance shall apply to all recommended cutting attachments.

4.2.2 Verification

The distance shall be verified by measurement.

Dimensions in millimetres



Key

1 cutting attachment
2 guard
3 front handle
4 rear handle
5 mechanical power transmission
6 barrier
A intersection point

Figure 2 — Distance to cutting attachment

4.3 Handgrip on backpack power unit

4.3.1 Requirement

A handgrip shall be available which may be a part of the frame and which shall allow an operator to grasp the backpack power unit for handling and transport.

The handgrip shall be designed such that

— it can be fully gripped by an operator when wearing gloves,

— it provides the necessary sureness of grip by its shaping and surface, and

— its length is at least 100 mm and where, for a bail or closed handgrip, this length is straight or curved at a radius greater than 100 mm together with any blend radius, but not more than 10 mm at one or both ends of the gripping surface.

4.3.2 Verification

The handgrip design shall be verified by inspection, measurement and functional testing.

4.4 Harness for backpack power unit

4.4.1 Requirements

All machines shall be equipped with a double shoulder harness. The harness shall be adjustable to the size of the operator and shall be:

— designed in a way for easy removal; or

— equipped with a quick-release mechanism that ensures that the machine can be removed or released quickly from the operator.

A double shoulder harness is considered to be designed in a way for easy removal, if the left and right shoulder straps are not connected to each other in front of the operator's body.

If a waist belt and/or supplementary straps to connect the left and right shoulder straps are provided, the double shoulder harness is also considered to be designed in a way for easy removal if they can be released under the load of the machine by using one hand, and there are no more than two release points.

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

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

It shall be possible to open the quick release mechanism while under load using only one hand and it shall have no more than two release points.

4.4.2 Verification

The harness, its functionality and its adjustment shall be verified by inspection. The quick-release mechanism shall be verified by a functional test, carried out by a person wearing the harness with a vertical load of three times the dry weight of the backpack power unit acting on the suspension point.

4.5 Hydraulic and pneumatic pipes and hoses

4.5.1 Requirements

Hydraulic systems shall be in accordance with the safety requirements of ISO 4413:2010. Pneumatic systems shall be in accordance with the safety requirements of ISO 4414:2010.

Hydraulic and pneumatic pipes and hoses subject to internal pressures in excess of 500 kPa shall be shielded so that in the event of rupture during operation of the machine, the fluid cannot be discharged directly onto the operator.

4.5.2 Verification

The shielding of pipes and hoses shall be verified by inspection.

4.6 Throttle control

4.6.1 Position

4.6.1.1 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.

4.6.1.2 Verification

The position shall be verified by inspection and functional testing.

4.6.2 Operation

4.6.2.1 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 control latch maintains 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 control latch and the engine returns to idling speed.

For the calculation of kinetic energy, see 4.6.2.2.

When a force is applied to the throttle trigger, while the throttle trigger lockout is engaged, engine speed shall not increase to a point where the clutch engages and cutting attachment movement begins, see 4.6.2.3.

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

For the purposes of this document the kinetic energy (E_k), in joules, of filament and pivoting non-metallic blades shall be calculated according to Formula (1):

$$E_k = 0{,}5m\left[\frac{\pi}{30}n\left(r-\frac{L}{2}\right)\right]^2 \quad (1)$$

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.

4.6.2.3 Verification

The function of the throttle trigger shall be verified by inspection while operating the machine.

The throttle trigger lock-out function shall be verified by applying a force (F) equal to (50 ± 2) N on the throttle trigger with the throttle trigger lock-out engaged. During the test, the handle shall be fixed, without contacting the throttle trigger lock-out. The force (F) shall be applied gradually to the throttle trigger in the direction of travel and held for (5 ± 1) s. For pivoting throttle triggers, the force shall be applied at the point furthest from the pivot, and for linear operating throttle triggers, the force shall be applied at the midpoint of the throttle trigger.

4.6.3 Throttle control latch

4.6.3.1 Requirements

If a throttle control latch 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 control latch 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 control latch shall be located outside the gripping area of the handle and require at least two independent motions to engage the throttle control latch.

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 control latch shall not exceed 25 N.

4.6.3.2 Verification

The function of the throttle control latch shall be verified by inspection and measurements while operating the machine. The force to release the throttle control latch 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 throttle trigger movement (perpendicular to the rotation radius of the throttle trigger).

4.7 Fuel tank structural integrity

4.7.1 Requirements

No visible tank leakage shall occur after testing the machine according to Annex B. Seepage from fuel tank ventilation systems is not regarded as leakage.

4.7.2 Verification

Inspect the machine for leakage while holding the machine for 30 s in each of the six orthogonal directions after testing the machine according to Annex B.

5 Information for use

The instructions to be provided with the machine shall be in accordance with ISO 11806-1:2021, 5.1.

The machine shall be marked in accordance with ISO 11806-1:2021, 5.2, and carry warnings in accordance with ISO 11806-1:2021, 5.3.

Annex A
(informative)

List of significant hazards

This annex specifies the additional significant hazards, hazardous situations and significant hazardous events that have been identified as being significant for the backpack power unit for brush-cutters and grass-trimmers and which require specific action by the designer or manufacturer to eliminate or reduce the risk. See Table A.1.

Table A.1 — List of significant hazards associated with backpack power unit for brush-cutters and grass-trimmers

Ref. No.	Hazard		Subclause of this document
	Origin (source)	**Potential consequences**	
1	**Mechanical hazards**		
	Hydraulic and pneumatic system	Injury from high-pressure fluid injection	4.5
	Rotary cutting attachment	Cutting or severing of upper and lower extremities	4.6
	Engine control system malfunction or controls resulting in unexpected start-up with cutting attachment engaged, unexpected over-run/overspeed	Shearing, cutting, severing or entanglement of upper and lower extremities	4.6
2	**Ergonomic hazards**		
	Location and design of controls, handles, etc.	Discomfort, fatigue, injuries to locomotor apparatus, loss of control	4.6
3	**Combination of hazards**		
	Poor postures 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	4.3
	Hot engine parts/electrical short-circuiting in combination with leaking gasoline tank/gasoline spilling	Burns and scalds caused by resulting fire	4.7