



BSI Standards Publication

Agricultural and forestry machinery - Pedestrian controlled motor mowers - Safety

National foreword

This British Standard is the UK implementation of EN 12733:2018. It supersedes BS EN 12733:2001+A1:2009, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee AGE/20, Powered lawn and garden equipment.

A list of organizations represented on this committee can be obtained on request to its secretary.

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conducteur à pied - Sécurité

Land- und forstwirtschaftliche Maschinen -
Handgeführte Motormäher - Sicherheit

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Contents

Page

European foreword.....	7
Introduction	8
1 Scope	9
2 Normative references	9
3 Terms and definitions	11
4 List of hazards	12
5 Safety requirements and/or protective/risk reduction measures.....	13
5.1 General.....	13
5.2 Engine starting and stopping devices	13
5.2.1 General.....	13
5.2.2 Primary engine starting.....	13
5.2.3 Secondary engine starting	13
5.2.4 Stopping.....	14
5.3 Location of controls.....	14
5.3.1 Controls in the hand reach zone	14
5.3.2 Controls in the hand reach zone or foot reach zone	14
5.3.3 Further controls	14
5.3.4 Hand reach zone	14
5.3.5 Foot reach zone.....	15
5.4 Identification of controls.....	15
5.5 Controls of the movement of the machine and of the cutting means	16
5.6 Reverse traction drive.....	17
5.7 Handlebars	18
5.8 Pressurized components	18
5.9 Liquid spillage	18
5.10 Exhaust system.....	18
5.10.1 Protection against exhaust gases	18
5.10.2 Protection against hot surfaces.....	18
5.11 Steering mechanism.....	20
5.11.1 General.....	20
5.11.2 Measurement of the steering force.....	20
5.12 Brakes.....	21
5.12.1 General.....	21
5.12.2 Service brake	22
5.12.3 Parking brake.....	22
5.13 Maximum travel speed.....	23
5.14 Electrical installations.....	23
5.15 Noise	23
5.15.1 Reduction by design and protective measures	23
5.15.2 Reduction by information	23
5.15.3 Noise emission measurement.....	23
5.16 Vibration	24
5.16.1 Reduction by design and protective measures	24
5.16.2 Reduction by information	24
5.16.3 Vibration measurement.....	24
6 Specific requirements.....	24

6.1	Sickle bar mowers	24
6.2	Grassland mowers	25
6.2.1	Protection against contact with cutting blades	25
6.2.2	Verification of the safety requirements and/or measures for grassland mowers	27
6.2.3	Cutting blades	35
6.2.4	Cutting blade stopping	35
6.3	Flail mowers	37
6.3.1	Protection against contact with cutting blades	37
6.3.2	Protection against thrown objects	38
6.3.3	Cutting blade stopping time	38
6.4	Scrub clearing machines	40
6.4.1	Protection against contact with cutting means	40
6.4.2	Protection against thrown objects	41
6.4.3	Structural integrity of the casing	41
6.4.4	Cutting blades	41
6.4.5	Cutting blade stopping time	41
7	Information for use	43
7.1	Instruction handbook	43
7.1.1	General	43
7.1.2	Additional information for scrub clearing machines	44
7.2	Marking	45
7.3	Warnings	45
Annex A	(normative) List of hazards	46
Annex B	(normative) Noise test code for motor mowers - Engineering method (grade 2)	50
B.1	Scope	50
B.2	A-weighted sound power level determination	50
B.3	A-weighted emission sound pressure level determination	52
B.4	Requirements for test floor	52
B.5	Installation, mounting and operating conditions	52
B.6	Measurement uncertainties and declaration of noise emission values	53
B.7	Information to be recorded and reported	53
Annex C	(normative) Vibration measurement of motor mowers	54
C.1	Quantities to be measured	54
C.2	Instrumentation	54
C.2.1	General	54
C.2.2	Fastening of transducer	54
C.2.3	Calibration	54
C.3	Measurement direction and measurement location	54
C.3.1	Measurement direction	54
C.3.2	Measurement location	54
C.4	Test procedure	55
C.4.1	General	55
C.4.2	Test procedure for machine with rotary cutting blade(s)	55
C.4.2.1	Test condition	55

C.4.2.2	Test procedure for reciprocating machine.....	55
C.4.2.2.1	Driving speed	55
C.4.2.2.2	Cutting blade	55
C.4.2.2.3	Machine centre of gravity	55
C.4.2.2.4	Test conditions	55
C.5	Measurement procedure	56
C.6	Determination of the measurement result.....	56
Annex D	(normative) Foot probe test	58
D.1	Test equipment.....	58
D.2	Test method	58
D.3	Test acceptance.....	58
Annex E	(normative) Testing of protective skirts	60
E.1	General.....	60
E.2	Tensile resistance test.....	60
E.2.1	Procedure.....	60
E.2.2	Preparation of the samples	60
E.2.3	Clamping.....	60
E.2.4	Acceptance criteria.....	61
E.3	Perforation resistance test	61
E.3.1	Procedure.....	61
E.3.2	Acceptance criteria.....	62
E.4	Wear resistance test.....	62
E.4.1	Procedure.....	62
E.4.2	Acceptance criteria.....	63
Annex F	(normative) Corrugated fibreboard penetration tests on grassland mowers - Test enclosure wall panels (see 6.2.2.2.4.2)	64
F.1	Purpose	64
F.2	Test fixture	64
F.3	Fibreboard samples	64
F.4	Procedure.....	64
F.5	Acceptance criteria.....	64
Annex G	(normative) Target elevation areas	66
G.1	Lower elevation target.....	66
G.2	Middle elevation target.....	66
G.3	Top elevation target.....	66
G.4	Operator target area	66
Annex H	(normative) Test enclosure	67
H.1	Base	67

H.2	Target composition.....	67
Annex I (normative)	Thrown object test for flail mower	70
I.1	Principle.....	70
I.2	Testing conditions.....	70
I.2.1	Mower used for test	70
I.2.1.1	General	70
I.2.1.2	Thrown-object guard adjustment.....	70
I.2.1.3	Cutting height.....	70
I.2.2	Test surface area.....	70
I.2.2.1	Ground conditions.....	70
I.2.2.2	Coconut matting	70
I.2.2.3	Sand layer (natural, crushed or uncrushed).....	70
I.2.2.4	Moisture	70
I.3	Target.....	71
I.3.1	General	71
I.3.2	Target construction	71
I.3.2.1	General	71
I.3.2.2	Panels.....	71
I.3.2.3	Target material attachment.....	71
I.3.3	Reference lines	72
I.4	Test material	74
I.4.1	Test material preparation	74
I.4.2	Moisture for test material.....	75
I.4.3	Test material configuration	75
I.5	Test run conditions.....	76
I.6	Test procedure	76
I.7	Test result and report.....	77
I.8	Acceptance criteria	77
I.9	Thrown object test report for flail mower machine	78
I.9.1	Specifications	78
I.9.2	Primary tests report.....	79
I.9.3	Additional test report	81
Annex J (normative)	Thrown object test for scrub clearing machines	83
J.1	Test equipment.....	83
J.1.1	Test surface.....	83
J.1.2	Target.....	83
J.1.3	Balls	83

J.1.4	Injection point.....	83
J.1.5	Injection tube.....	83
J.1.6	Preliminary adjustments of the velocity	83
J.2	Test method	83
J.2.1	General.....	83
J.2.2	Balls velocity.....	83
J.2.3	Test procedure	84
J.2.4	Test result and acceptance	84
J.3	Data sheet - Thrown object test for scrub clearing machine.....	85
Annex K	(informative) Example of a material and construction fulfilling the requirements for an artificial surface.....	86
K.1	Material.....	86
K.2	Construction.....	86
Annex L	(informative) Examples of machines	89
Annex ZA	(informative) Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42/EC amended by Directive 2009/127/EC aimed to be covered	91
Bibliography		92

European foreword

This document (EN 12733:2018) has been prepared by Technical Committee CEN/TC 144 “Tractors and machinery for agriculture and forestry”, the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2019 and conflicting national standards shall be withdrawn at the latest by January 2020.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 12733:2001+A1:2009.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

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

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 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 and events are covered are indicated in the scope of this document.

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

The requirements of this document concern designers, manufacturers and their authorized representatives of pedestrian controlled motor mowers. This document also includes information to be provided by the manufacturer to the user.

1 Scope

This European Standard specifies safety requirements and their verification for design and construction of pedestrian controlled motor mowers with rotary or reciprocating cutting means used in agricultural, forestry and landscaping to cut and/or mulch grass or similar plants or scrub and woody vegetation.

For the purposes of this standard the following types of pedestrian controlled machines are considered to be motor mowers:

- flail mowers;
- grassland mowers;
- scrub clearing machines;
- sickle bar mowers.

This standard applies also to multipurpose machines when used for cutting or mulching grass or scrub.

NOTE When they are used for other operations (e.g. soil working) other standards can apply.

This standard does not cover lawn mowers (see EN ISO 5395-1, EN ISO 5395-2), engine driven brush cutters and grass trimmers (see EN ISO 11806) or other lawn maintenance equipment.

This document deals with significant hazards, hazardous situations and events, as listed in Annex A, relevant to pedestrian controlled motor mowers when used as intended and under conditions of misuse foreseeable by the manufacturer during normal operation and service. Additionally, it specifies the type of information to be provided by the manufacturer on safe working practices.

Environmental aspects (except noise) have not been considered in this standard.

This document is not applicable to motor mowers manufactured before the date of its publication.

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.

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

EN 709:1997+A4:2009, *Agricultural and forestry machinery - Pedestrian controlled tractors with mounted rotary cultivators, motor hoes, motor hoes with drive wheel(s) - Safety*

EN 12096, *Mechanical vibration - Declaration and verification of vibration emission values*

EN 61672-1:2013, *Electroacoustics - Sound level meters - Part 1: Specifications (IEC 61672-1:2013)*

EN 61672-2:2013, *Electroacoustics - Sound level meters - Part 2: Pattern evaluation tests (IEC 61672-2:2013)*

EN 61672-3:2013, *Electroacoustics - Sound level meters - Part 3: Periodic tests (IEC 61672-3:2013)*

EN ISO 354:2003, *Acoustics - Measurement of sound absorption in a reverberation room (ISO 354:2003)*

EN ISO 845:2009, *Cellular plastics and rubbers - Determination of apparent density (ISO 845)*

EN ISO 2758:2014, *Paper - Determination of bursting strength (ISO 2758)*

EN ISO 3744, *Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Engineering methods for an essentially free field over a reflecting plane (ISO 3744)*

EN ISO 4413:2010, *Hydraulic fluid power - General rules and safety requirements for systems and their components (ISO 4413:2010)*

EN ISO 4871, *Acoustics - Declaration and verification of noise emission values of machinery and equipment (ISO 4871)*

EN ISO 5395-1:2013, *Garden equipment - Safety requirements for combustion-engine-powered lawnmowers - Part 1: Terminology and common tests (ISO 5395-1:2013)*

EN ISO 5395-2:2013, *Garden equipment - Safety requirements for combustion-engine-powered lawnmowers - Part 2: Pedestrian-controlled lawnmowers (ISO 5395-2:2013)*

EN ISO 11102-1:2009, *Reciprocating internal combustion engines - Handle starting equipment - Part 1: Safety requirements and tests (ISO 11102-1:1997)*

EN ISO 11102-2:2009, *Reciprocating internal combustion engines - Handle starting equipment - Part 2: Method of testing the angle of disengagement (ISO 11102-2:1997)*

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

EN ISO 11688-1:2009, *Acoustics - Recommended practice for the design of low-noise machinery and equipment - Part 1: Planning (ISO/TR 11688-1:1995)*

EN ISO 11688-2:2000, *Acoustics - Recommended practice for the design of low-noise machinery and equipment - Part 2: Introduction to the physics of low-noise design (ISO/TR 11688-2:1998)*

EN ISO 12100:2010, *Safety of machinery - General principles for design - Risk assessment and risk reduction (ISO 12100:2010)*

EN ISO 13857:2008, *Safety of machinery - Safety distances to prevent hazard zones being reached by upper and lower limbs (ISO 13857:2008)*

EN ISO 20643:2008, *Mechanical vibration - Hand-held and hand-guided machinery - Principles for evaluation of vibration emission (ISO 20643:2005)*

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

ISO 3767-3, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment - Symbols for operator controls and other displays - Part 3: Symbols for powered lawn and garden equipment*

ISO 3864-1:2011, *Graphical symbols - Safety colours and safety signs - Part 1: Design principles for safety signs and safety markings*

ISO 5718:2013, *Harvesting equipment - Blades for agricultural rotary mowers - Requirements*

3 Terms and definitions

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

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

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

3.1

attachment

device designed for mounting only on a specific machine to perform a specific task related to mowing and not intended to be universally adaptable to other lawnmowers

[SOURCE: EN ISO 5395-1:2013, 3.1]

3.2

discharge chute

extension of the discharge opening designed to safely guide the ejection of the cut material

3.3

discharge opening

opening in the cutting blade enclosure through which the cut material is ejected

[SOURCE: EN ISO 5395-1:2013, 3.13, modified]

3.4

flail mower

mower with a multiplicity of free-swinging cutting elements that rotate about a horizontal axis, which cuts the grass by impact and mulches it with the same tools

Note 1 to entry: See Figure L.4.

[SOURCE: EN ISO 5395-1:2013, 3.14]

3.5

grassland mower

motor mower with rotary cutting blade(s) rotating about a vertical axis designed for cutting or mulching high grass, having a minimum cutting height of 50 mm and the cutting blade protective enclosure of which is not fully enclosing

Note 1 to entry: See Figure L.2.

[SOURCE: EN ISO 5395-1:2013, 3.16, modified]

3.6

handlebar

device equipped with grips enabling the machine to be manually controlled

[SOURCE: EN 709:1997+A4:2009, 3.6]

3.7

maximum operating engine speed

highest engine speed obtainable when adjusted in accordance with the machine manufacturer's specifications and/or instructions with the cutting blades engaged

[SOURCE: EN ISO 5395-1:2013, 3.19, modified]

3.8

multipurpose machine

machine on which different attachments can be mounted

3.9

normal operation

use of the machine, by the operator, which is reasonably foreseeable and which is consistent with such activities as starting, cutting grass, stopping, fuelling, connecting to (or disconnecting from) a power source

[SOURCE: EN ISO 5395-1:2013, 3.22, modified]

3.10

normal use

normal operation, routine maintenance, servicing, cleaning, transporting, storage, attaching or removing attachments, and making routine adjustments as determined by the manufacturer's instructions

[SOURCE: EN ISO 5395-1:2013, 3.23, modified]

3.11

rotary cutting blade

cutting blade on which one or more knives or several blades fixed on drums or discs rotate around a vertical or horizontal axis

3.12

scrub clearing machine

motor mower, with rotary cutting blade(s) rotating about a vertical axis, designed for cutting scrub and woody vegetation, with no ground support forward of cutting blade(s) and supported on either side by skids, not wheels

Note 1 to entry: At the front the cutting blade(s) enclosure may be open.

Note 2 to entry: See Figure L.3.

[SOURCE: EN ISO 5395-1:2013, 3.34, modified]

3.13

sickle bar mower

motor powered mower that reciprocates a knife or knives to provide a shearing action with a stationary cutter bar or movable knife

Note 1 to entry: See Figure L.1.

[SOURCE: EN ISO 5395-1:2013, 3.36, modified]

4 List of hazards

The hazards, among those appearing in EN ISO 12100 considered as applicable to the machines covered in this standard, are given in Annex A.

5 Safety requirements and/or protective/risk reduction measures

5.1 General

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

Unless otherwise specified in this standard, the machine shall conform to the requirements of EN ISO 13857:2008, Tables 1, 3, 4 and 6 as appropriate.

5.2 Engine starting and stopping devices

5.2.1 General

For the purpose of the following requirements, the meaning of “within the hand reach zone of the operator” shall be determined in accordance with 5.3.

A control to allow starting the engine shall be provided within the hand-reach zone of the operator.

A control for stopping the engine shall be provided within the hand-reach zone of the operator.

A control which combines starting and stopping according to the requirements above is allowed.

5.2.2 Primary engine starting

5.2.2.1 A switch operated by a removable key, or a similar device shall be provided to prevent unauthorized or unintended starting of the engine unless a manual starter is the only means of engine starting.

5.2.2.2 Engine starting controls may be outside the hand reach zone defined in 5.3 if starting can only be accomplished with the cutting blade drive disengaged.

5.2.2.3 Movement of the wheels when the engine is started shall be prevented.

NOTE This requirement can also be regarded as fulfilled, when a separate hold-to-run control which only actuates the traction drive is released.

In addition the device to start the engine shall be located so that it can be reached by the operator only staying out of the danger zone. The danger zone is defined as the forward projection of the width of the machine measured as distance between the wheels or width of the cutting means, whichever is the largest.

5.2.2.4 Should the operator have to lean on the machine to start the engine manually, the appropriate place shall be described regarding its location and proper use in the instruction handbook or a support shall be provided and described regarding its location and proper use in the instruction handbook.

5.2.2.5 With the exception of hand cranks (see EN ISO 11102-1:2009 and EN ISO 11102-2:2009) starting devices shall be integral with the machine (e.g. recoil pull start). Loose belts, cables, etc. are not accepted.

5.2.2.6 If starting is achieved by means of a hand crank it shall be equipped with a device that disconnects the hand crank immediately when the engine starts and prevents its connection when the engine is running or kick-back during starting.

5.2.3 Secondary engine starting

If a secondary or an auxiliary starting device is provided it shall also conform to the requirements of the primary starting device.

5.2.4 Stopping

5.2.4.1 A stopping device shall be provided. The device shall not depend on sustained manual pressure for its continued operation.

5.2.4.2 Engine stopping controls may be outside the hand reach zone defined in 5.3 if stopping can only be accomplished with the cutting blade drive disengaged.

5.3 Location of controls

5.3.1 Controls in the hand reach zone

The following controls shall be located within the “hand reach zone” according to 5.3.4:

- clutch;
- service brakes;
- traction speed control;
- reversing device;
- steering system;
- control of the engine working speed;
- hold-to-run control (see 5.5);
- tool transmission;
- stop control. See also 5.2.4.2.

5.3.2 Controls in the hand reach zone or foot reach zone

The following controls shall be located within the “hand reach zone” according to 5.3.4 or the “foot reach zone” according to 5.3.5:

- traction speed control if selection is not intended to be operated during the work;
- parking brake;
- differential lock.

5.3.3 Further controls

Controls, other than those in the lists above, which are only used before work is started or after it is finished may be located outside the “hand/foot reach zones”.

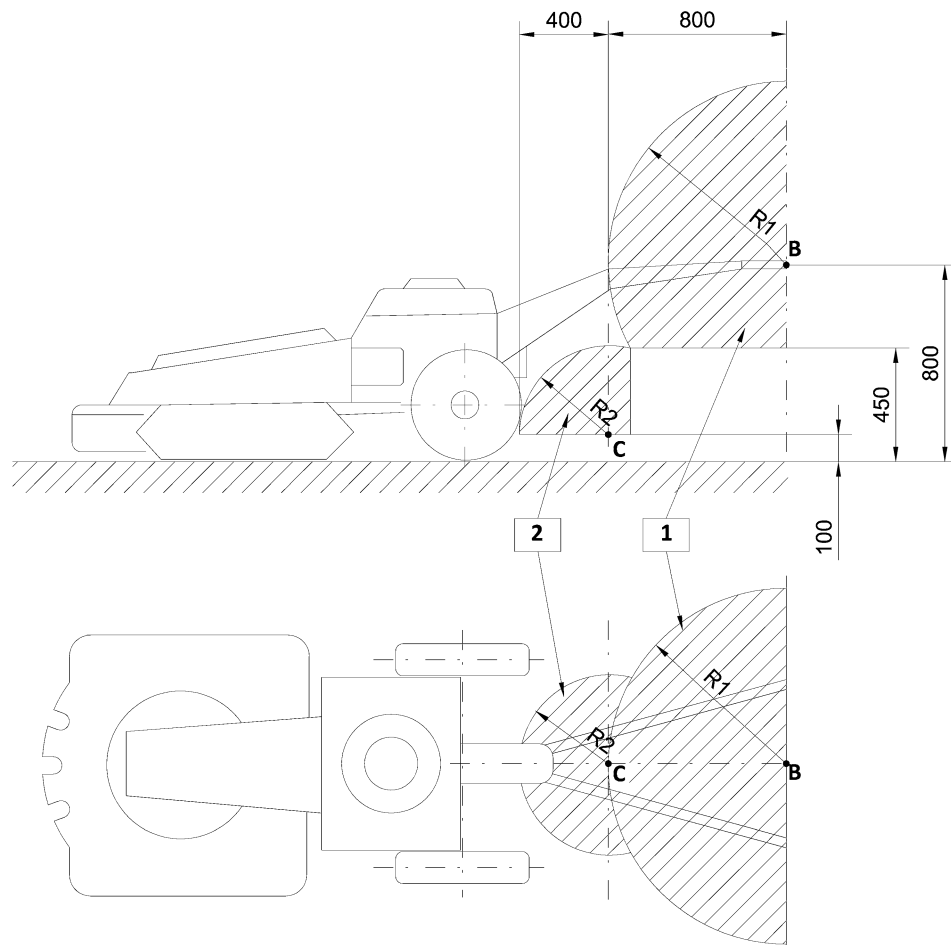
5.3.4 Hand reach zone

“Hand reach zone” is the truncated hemispherical volume of radius $R_1 = 800$ mm (see Figure 1). The centre of the hemisphere is located at point B (the midpoint of a line joining the handlebar grip ends when the grips are set to a height of 800 mm above the ground, or set to the next available lower height setting where this is not available). The flat face of the hemisphere is on the vertical plane through the line joining the handlebar grip ends. The hemisphere is truncated below by a horizontal plane positioned 450 mm above the ground.

5.3.5 Foot reach zone

“Foot reach zone” is the truncated hemispherical volume of radius $R_2 = 400$ mm (see Figure 1). The centre of the hemisphere is located at point C (800 mm forward of point B and 100 mm above the ground). The flat face of the hemisphere is on the horizontal plane at 100 mm above the ground. The hemisphere is truncated by a vertical plane positioned rearward of the centre of the hemisphere at the point where it would be intersected by a horizontal plane 450 mm above the ground.

Dimensions in millimetres



Key

- 1 hand reach zone
- 2 foot reach zone
- B centre of radius of hand reach zone
- C centre of radius of foot reach zone

Figure 1 — Volume of “hand reach zone” and “foot reach zone”

5.4 Identification of controls

The controls used for the tool transmission and for locking the differential in their different positions and the gear positions (including the neutral position) and controls, whose purpose is not obvious, shall have the function, direction and/or method of operation clearly identified by a durable label or mark.

Detailed instructions on the operation of all controls shall be provided in the instruction handbook.

Operator control symbols shall comply with ISO 3767-1 and ISO 3767-3, and ISO 3864-1:2011 for signs and colours.

5.5 Controls of the movement of the machine and of the cutting means

On motor mowers with traction drive it shall be possible to engage or disengage the traction drive when the cutting means is operating.

The machine shall be equipped with (a) hold-to-run control(s). Hold-to-run control shall be comply to well-trying principles and applies well-trying components in accordance with EN ISO 5395-2:2013/A1:2016.

The hold-to-run control(s) shall be located on at least one of the handlebar grips.

All movements of the machine and of the blade(s) shall be stopped when the hold-to-run control(s) is (are) released that is when the operator's hands are removed from the handlebar grips.

Releasing the hold-to-run control(s) shall not stop the engine. This requirement does not apply to the hold-to-run control related only to the activation of the tool(s), in a machine without any device to separate the power of the engine from the power of the tool(s).

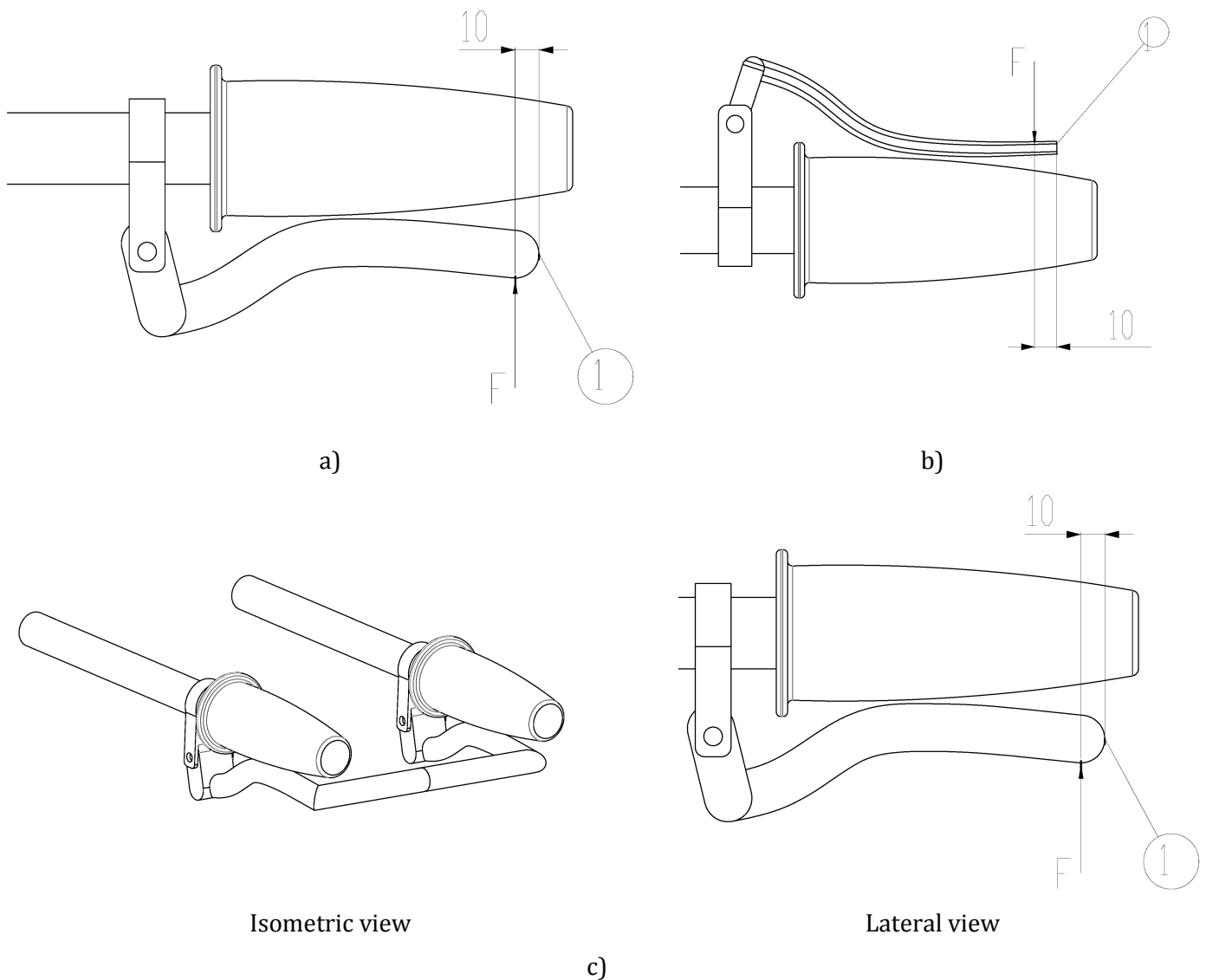
The force required to maintain the hold-to-run control in engaged position shall not be greater than 27,5 N when the hold-to-run control is located on only one handlebar.

If the hold-to-run control is located so that it can be operated by either, or both, hands when they are holding the handle-grips the force required to maintain the hold-to-run control in the engaged position shall not be greater than 35 N.

The measuring of these values shall be carried out with the following method:

The measurement shall be performed with a device having an accuracy of $\pm 0,5 \%$ (e.g. dynamometer) with the engine stopped. The force (F) required to maintain the hold-to-run control shall be measured at 10 mm from the end of the hold-to-run control. The measurement shall be taken when the control is at the end of the displacement run or when it comes in contact with the handlebar grip, see Figure 2.

Dimensions in millimetres

**Key**

1 end of the control

F force required to maintain the hold-to-run control

Figure 2 — Locations of the force F

The hold-to-run control(s) shall prevent unintentional operation of the cutting means by requiring two separate and distinct actions (e.g. pressing a button then lowering a lever). This requirement shall be verified by functional test.

The movement of the machine shall not start until the operator is able to grip both the control and the handlebar grip.

5.6 Reverse traction drive

In all machines with reverse gear, it shall not be possible to go directly from forward to reverse motion. For example this requirement is fulfilled by providing a perceptible neutral position such as one or more changes in direction of the lever.

Except for mowers with blades mounted behind the rear ground support point of the machine the cutting means and the reverse traction drive may operate simultaneously.

5.7 Handlebars

The handlebars shall be fastened to the machine so as to prevent loss of control by unintentional uncoupling from the machine while in operation.

Except in the handle park position, a positive means (latch or upper stop) shall be provided which cannot be unintentionally disengaged during normal operation of the machine.

The horizontal safety distance between the cutting blade tip circle or the rear edge of a sickle bar mower blade assembly and the rear end of the handlebars shall be at least 600 mm.

5.8 Pressurized components

Pressurized hoses shall be located or shielded so that in the event of rupture the fluid cannot be discharged directly onto the operator when in the operating position.

Hydraulic equipment shall comply with EN ISO 4413. Identification requirements of EN ISO 4413:2010, 7.4.2.1 can also be achieved with identification in the user's manual or the spare parts list or catalogue.

5.9 Liquid spillage

When filled to the maximum according to the instruction handbook and/or the information marked on the machine, liquid containers, batteries, fuel systems, oil reservoirs, and coolant systems shall be constructed to prevent spillage for 1 min whilst the machine is tilted at 20° lateral and 30° longitudinal. Weeping at vent systems shall not be considered spillage.

5.10 Exhaust system

5.10.1 Protection against exhaust gases

The exhaust gas outlet shall be arranged in such a manner that the fumes are not directed towards any designated position of the operator.

The requirement can be fulfilled, for example, by directing the outlet of gases sideways between the angles of 60° and 120° along the axis of the machine.

5.10.2 Protection against hot surfaces

5.10.2.1 Requirements

A guard shall be provided to prevent unintentional contact with any exposed engine exhaust components larger than 10 cm² which have a surface temperature greater than 80 °C at 20 °C ± 3 °C ambient temperature during normal starting, mounting and operation of the machine.

The temperature of the guard, when provided, shall not exceed 80 °C measured in the above described conditions.

5.10.2.2 Test equipment

The temperature measuring equipment shall have an accuracy of ± 2 °C.

5.10.2.3 Test method

The engine shall be operated at its maximum operating speed until the surface temperatures stabilize.

The test shall be conducted in the shade.

If the test is conducted at an ambient temperature outside of the nominal 20 °C ± 3 °C the reported temperatures shall be determined by correcting the observed temperature by adding the difference between the 20 °C and the actual test ambient temperature.

Identify the hot surface area(s) on the engine exhaust system.

When the distance between the identified hot area and the nearest control is in excess of 100 mm, cone A as shown in Figure 3 shall be used. For distances less than 100 mm between the identified hot area and the nearest control, cone B as shown in Figure 3 shall be used.

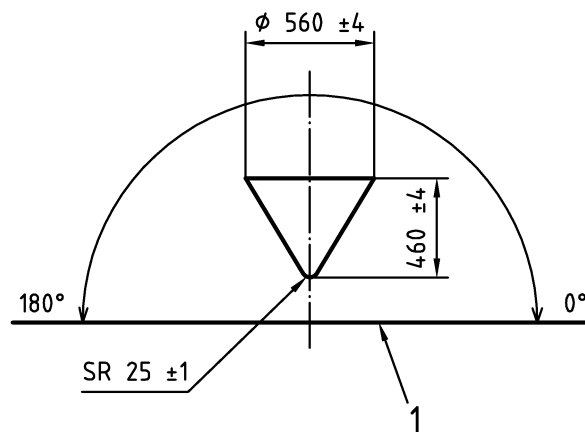
For cone A with the axis of the cone anywhere between 0° and 180° to the horizontal and with the point of the cone in a downward to horizontal direction, move the cone towards the hot surface. The cone shall not be moved in an upwards direction. When moving the cone, determine if the cone tip or conical surface of the cone makes contact with the hot surface area(s).

Cone B shall be moved in any direction.

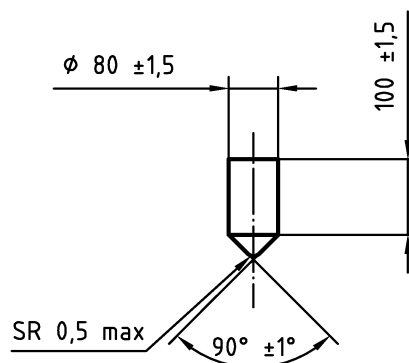
5.10.2.4 Test acceptance

When tested in accordance with 5.10.2.3, using the test equipment given in 5.10.2.2 the tip or conical surface of cone A or B shall not make contact with the hot surface of the exhaust system as described in 5.10.2.1.

Dimensions in millimetres



a) Cone A



b) Cone B

Key

1 horizontal plane

Figure 3 — Test cones

5.11 Steering mechanism

5.11.1 General

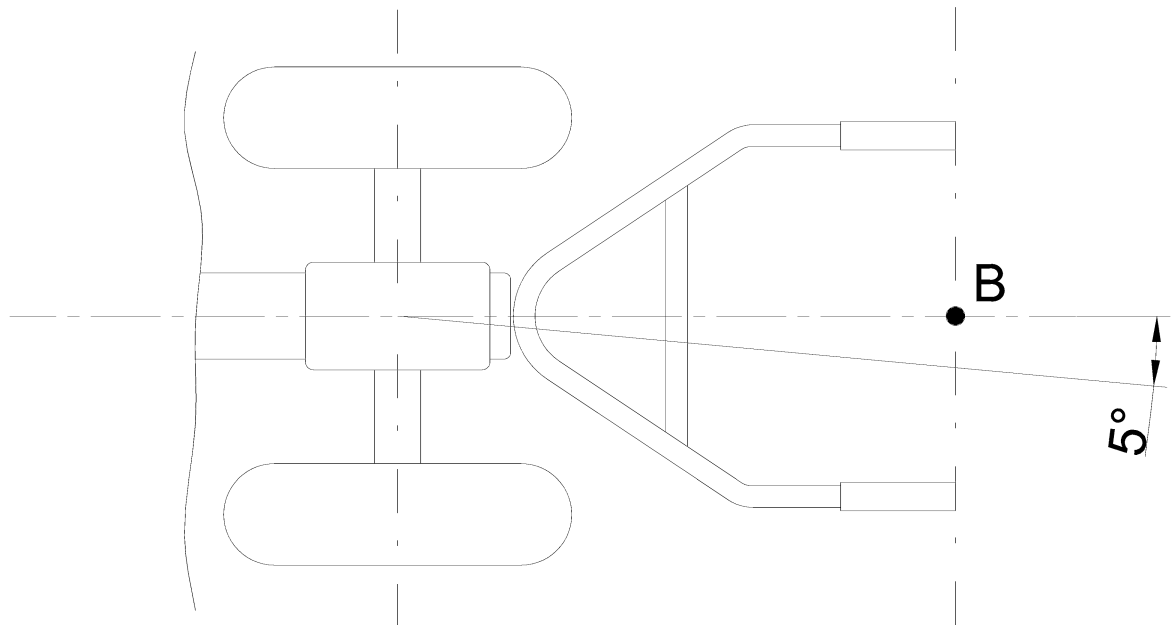
The machine design shall allow for easy manual changing of direction.

Easy means of direction change shall be considered achieved if:

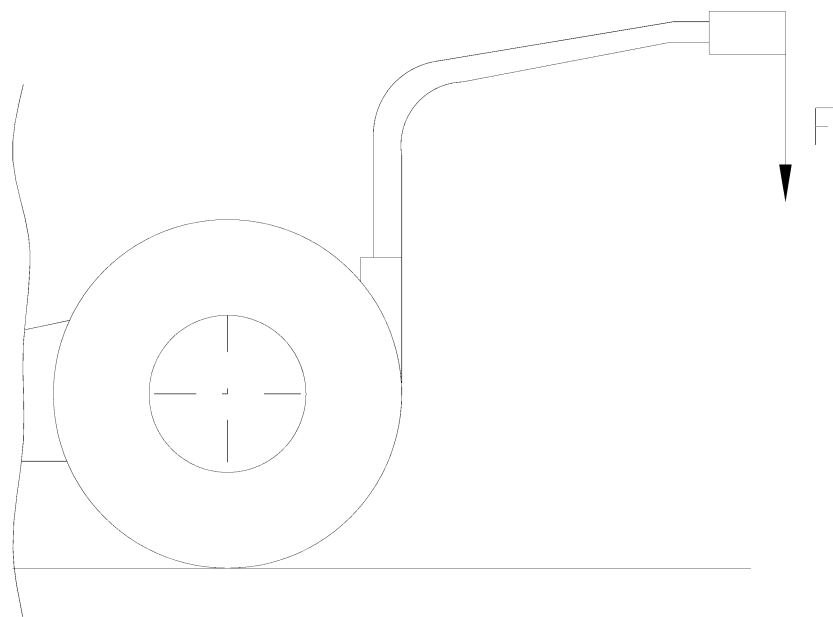
- the steering force measured in accordance with 5.11.2 does not exceed 180 N; or
- the mass of the machine, including the blades, does not exceed 120 kg; or
- the transmission is fitted with a differential gear or with a device permitting the independent disengagement of the driving wheels by use of a control on the handlebars.

5.11.2 Measurement of the steering force

- a) The measurement shall be carried out at point B (see Figure 4) with the blade(s) mounted and the machine stationary on a flat, dry, smooth concrete surface;
- b) the handlebars shall be placed in their central working position and locked during the test so that they cannot involuntarily swing out laterally with the grips at 800 mm above the ground, or, should this not be possible owing to the adjustment limitations, to the next lower height. A metal rod shall be placed between the two handlebar grips rigidly. The middle point of this rod identifies the measuring point B;
- c) the machine shall be fitted with the wheels and tyres recommended by the manufacturer. The tyres shall be inflated to the maximum recommended pressure and the wheels adjusted to the maximum recommended track width;
- d) if a downward force F has to be applied at the handlebars to maintain the front–rear equilibrium of the machine, sufficient counterweights shall be applied on the line joining the handlebars to achieve this (see Figure 4 b);
- e) the steering force shall be applied at measuring point B, perpendicularly to the longitudinal central plane, until the machine moves through at least 5° (see Figure 4 a) and b)).



a) Top view



b) Lateral view

Figure 4 — Application and measurement of steering force

5.12 Brakes

5.12.1 General

A means shall be provided for stopping the machine's motion in both forward and reverse directions if a force more than 220 N, applied at the centre of the wheel axle and parallel to the slope, is required to hold the machine with the gear in a neutral position on a 30 % (16,7°) slope.

Service and parking brake systems shall be tested in accordance with 5.12.2 and 5.12.3.

The machine shall be equipped with the tyres recommended by the manufacturer having the least tread area in contact with the test surface.

If steering brakes are also used for service brakes, it shall be possible to connect them in a way that they apply both brakes with equal force.

If the machine is equipped with steering brakes, these shall be capable of being combined or active simultaneously.

5.12.2 Service brake

5.12.2.1 Performance requirements

The machine shall be equipped with a means capable of stopping its motion in both forward and reverse directions within a braking distance of 0,19 m for each 1 km/h of speed, when tested in accordance with 5.12.2.2.

5.12.2.2 Test method

Test stops shall be conducted on a substantially level (not to exceed 1 % gradient) dry, smooth, hard surface roadway of concrete (or equivalent test surface).

When testing a machine with separate clutch and brake control means, the clutch shall be simultaneously disengaged with brake engagement.

The test shall be carried out in both forward and reverse directions at the maximum ground speed attainable.

Five test stops shall be carried out and the result is the mean of the five stopping distances.

5.12.3 Parking brake

5.12.3.1 General requirements

A parking brake shall be provided on machines requiring a service brake.

The parking brake, whether hand-operated or not, may be in combination with the service brake.

An automatic parking brake, when provided, shall be activated when the transmission hold-to-run control is released.

5.12.3.2 Performance requirements

The parking brake shall hold the machine stationary facing both uphill and downhill, on a 30 % (16,7°) slope when tested in accordance with 5.12.3.3. The force required to engage and unlock the brake shall not exceed 220 N.

5.12.3.3 Test method

5.12.3.3.1 Test equipment and condition

The test shall be conducted on a 30 % (16,7°) slope with a coefficient of friction such that the machine does not slide down the slope.

The transmission shall be in neutral, the traction clutch disengaged and the engine off.

5.12.3.3.2 Test procedure

The machine shall be positioned on the test slope with its parking brake engaged and locked. The machine shall be tested both with its front downhill and its rear downhill.

5.12.3.3.3 Test acceptance

The machine shall not move.

5.13 Maximum travel speed

The maximum travel speed of the machine shall not exceed 9 km/h in forward direction and 4,5 km/h in reverse direction.

NOTE Further evaluation needed on the forward limit.

5.14 Electrical installations

Electrical cables shall be protected if located in potentially abrasive contact with metal surfaces and shall be resistant to, or protected against, contact with lubricant and fuel.

The wiring assembly shall, where possible, be grouped together, and be properly supported so that no portion is in contact with the carburettor, metallic fuel lines, the exhaust system, moving parts or sharp edges. Any edges of metal members likely to be in contact with cables shall be rounded or protected to prevent possible damage to the cables by cutting or abrasion.

5.15 Noise

5.15.1 Reduction by design and protective measures

The machine shall be designed to generate a noise level as low as practicable. The main sources causing noise are:

- air intake system;
- engine exhaust system;
- engine cooling system;
- cutting system;
- vibrating surfaces.

EN ISO 11688-1:2009 and EN ISO 11688-2:2000 give general technical information on widely recognized technical rules and means to be followed in the design of low-noise machines.

For combustion engine driven machines special care shall be taken in the design of the exhaust system and the selection of the silencer.

NOTE EN ISO 11691 and EN ISO 11820 can be used for testing of silencers.

5.15.2 Reduction by information

After taking possible technical measures for noise reduction, it is still recommended that, when appropriate, the instruction manual shall recommend:

- the use of low-noise operating modes, and/or limited time of operation;
- a warning of noise level and the use of ear protection.

5.15.3 Noise emission measurement

The determination of the sound power level and of the emission sound pressure level at the operator's position shall be carried out using the methods given in Annex B.

5.16 Vibration

5.16.1 Reduction by design and protective measures

The machine shall be designed to generate a vibration value as low as practicable. The main sources causing vibration are:

- oscillating forces from the engine;
- cutting means;
- unbalanced moving parts;
- impact in gears, bearings and other mechanisms;
- interaction between operator, machine and material being worked;
- machine design related to mobility;
- travelling surface, speed, tyre pressure.

CR 1030-1 gives general technical information on widely recognized technical rules and means to be followed in the design of low vibration machines.

Besides the vibration reduction of the source, technical measures to isolate the vibration source from the handle may be used, when appropriate, such as isolators and resonating masses.

5.16.2 Reduction by information

After taking possible technical measures for vibration reduction it is still recommended that the instruction handbook precise, when appropriate:

- the use of low-vibration operating modes, and/or limited time of operation;
- the wearing of personal protection equipment (PPE).

5.16.3 Vibration measurement

The level of vibration on handlebar grips shall be measured in accordance with Annex C.

6 Specific requirements

6.1 Sickle bar mowers

Except for blades, their guiding devices and moving parts located in the zones A and B shown in Figure 5, all moving parts on the sickle bar driving mechanism shall be guarded to prevent access.

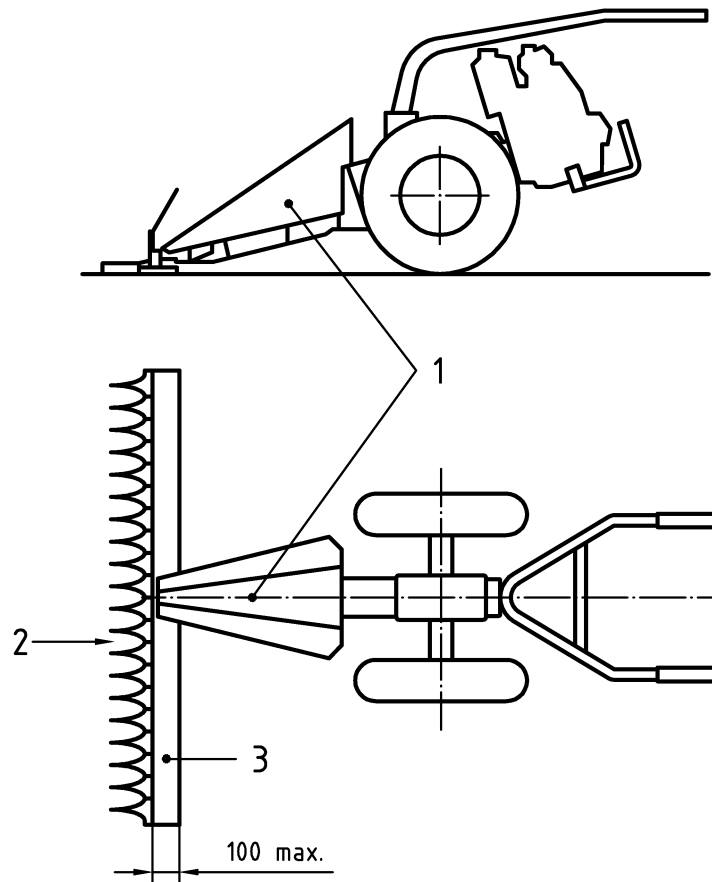
If there is more than one moving blade, the 100 mm distance defining the zone B is measured from the back of the blade nearest to the drive.

Swinging of the outrigger cover is not considered to create significant risk of harm (see Figure 5).

Devices intended to facilitate the separation or the flow and the side ejection of the cut grass are not considered to create significant risk of harm. Parts of these devices which present a crushing hazard shall be at a distance of not less than 25 mm from fixed parts or other moving parts of the machine.

A guard shall be provided with the machine to cover the cutting elements when not in use.

Dimensions in millimetres

**Key**

- 1 swinging outrigger cover
- 2 zone A
- 3 zone B

Figure 5 — Sickle bar mower**6.2 Grassland mowers****6.2.1 Protection against contact with cutting blades**

The cutting blade tip circle shall not extend beyond the upper enclosure of the machine.

Except for an arc at the front of the machine concentric with the cutting blade tip circle and extending up to 90° on either side of the line of working, and up to 30° more on the side from which the grass is ejected (see Figure 6), the casing shall extend vertically at least 3 mm below the plane of the cutting blade tip circle.

This requirement shall not apply to the fastening elements of the cutting blade(s) extending downwards if they lie within a concentric circle whose diameter is half that of the outer cutting blade tip circle.

For every section of the perimeter of the cutting blade tip circle with less than 3 mm overlap, the casing, a deflector or barrier shall prevent access to the cutting blade. This requirement is considered to be satisfied if either:

- this zone shall satisfy the foot probe test in Annex D, or if this is not practically achievable;

- this zone (see Figure 6) is provided with a barrier located at a minimum horizontal distance of 200 mm from the cutting blade tip circle and at a maximum vertical distance of 400 mm above the ground.

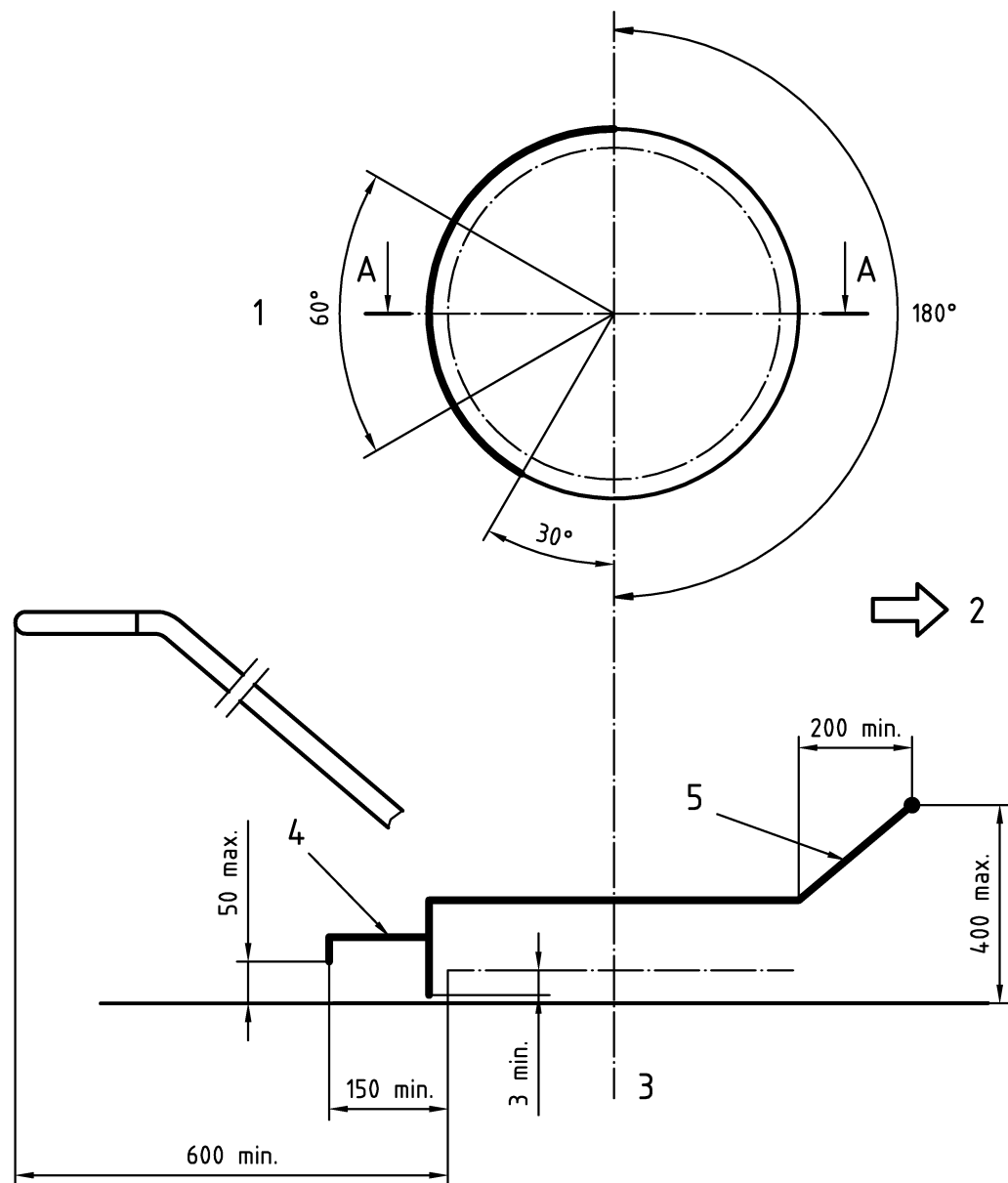
NOTE The barrier described in the second indent represents the practical available solution at the time of drafting the standard taking into account the required method of feeding the grass into the cutting means. This situation will be reviewed at the next revision of the standard.

In the zone between the two rear wheels (see Figure 6):

- this zone shall satisfy the foot probe test in Annex D; or if this is not practically achievable;
- this zone (see Figure 6) is provided with a barrier located at a minimum horizontal distance of 150 mm from the cutting blade tip circle and at a maximum vertical distance of 50 mm above the ground.

If a flexible skirt is used it shall also comply with the requirements of Annex E.

Dimensions in millimetres

**Key**

1 zone between the two rear wheels

2 front

3 rotation axis of the cutting blade

NOTE 4 and 5 show optional front and rear barriers to indicate the 200 mm all-round the 180° - 30°.

Figure 6 — Grassland mower - Covering of the cutting blade tip circle (plane view and sectional view)**6.2.2 Verification of the safety requirements and/or measures for grassland mowers****6.2.2.1 General**

A new machine shall be used for each of the following tests.

All tests of 6.2.2 which are conducted with the engine running are dangerous. Test personnel should be adequately protected.