BRITISH STANDARD

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12733:2001

Agricultural and forestry machinery — Pedestrian controlled motor mowers — Safety

The European Standard EN 12733:2001 has the status of a British Standard

ICS 65.060.70

National foreword

This British Standard is the official English language version of EN 12733:2001.

The UK participation in its preparation was entrusted to Technical Committee AGE/20, Powered lawn and garden equipment, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

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

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Agricultural and forestry machinery - Pedestrian controlled motor mowers - Safety

Matériel agricole et forestier - Motofaucheuses à conducteur à pied - Sécurité

Land- und forstwirtschaftliche Maschinen - Handgeführte Motormäher - Sicherheit

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

Foreword

This European Standard 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of an identical text or by endorsement, at the latest by November 2001, and conflicting national standards shall be withdrawn at the latest by November 2001.

This European Standard 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 standard.

Annexes A, B, C, D, E, F, G, H, I and J are normative. Annexes K and L are informative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

The extent to which hazards are covered is indicated in the scope of this standard.

1 Scope

This standard specifies safety requirements and their verification for design and construction of pedestrian controlled motor mowers with rotary or reciprocating cutting blades 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 are used for cutting or mulching grass or scrub.

This standard does not cover lawn mowers (see EN 836), engine driven brush cutters and grass trimmers (see EN ISO 11806) or other lawn maintenance equipment.

This standard describes methods for the elimination or reduction of hazards arising from the use of motor mowers. Additionally, it specifies the type of information to be provided by the manufacturer on safe working practices.

Environmental aspects have not been considered in this standard.

This standard applies primarily to machines which are manufactured after the date of issue of the standard.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 292-1:1991, *Safety of machinery — Basic concepts, general principles for design — Part 1 : Basic terminology, methodology*.

EN 292-2:1991+A1:1995, *Safety of machinery — Basic concepts, general principles for design — Part 2 : Technical principles and specifications.*

EN 294:1992, *Safety of machinery — Safety distances to prevent danger zones being reached by the upper limbs*.

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

EN 836:1997, *Garden equipment — Powered lawnmowers — Safety*.

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

EN 1033:1995, *Hand-arm vibration — Laboratory measurement of vibration at the grip surface of hand-guided machinery – General*.

EN ISO 354:1993, Acoustics — Measurement of sound absorption in a reverberation room (ISO 354:1985).

EN 60651:1994, *Sound level meters (IEC 60651:1993)*.

EN 60804:1994, *Integrating-averaging sound level meters (IEC 60804:1985 and A1:1989)*.

EN ISO 3744:1995, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Engineering method in an essentially free field over a reflecting plane (ISO 3744:1994)*.

ISO 3767-1:1991, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Symbols for operator controls and other displays — Part 1 : Common symbols.*

ISO 3767-3:1995, *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.*

EN ISO 4871:1996*, Acoustics — Declaration and verification of noise emission values of machinery and equipment (ISO 4871:1996).*

EN ISO 11201:1995, *Acoustics — Noise emitted by machinery and equipment — Measurement of emission sound pressure levels at a work station and at other specified positions — Engineering method in an essentially free field over a reflecting plane (ISO 11201:1995).*

EN ISO 11688-1:1998, *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 2758:1983, *Paper — Determination of bursting strength*.

ISO 3789-1:1982, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Location and method of operation of operator controls — Part 1 : Common controls*.

ISO 5718-1:1989, *Harvesting equipment — Flat blades for rotary mowers — Specifications — Part 1 : Type A flat blades*.

ISO 5718-2:1991, *Harvesting equipment — Flat blades for rotary mowers — Part 2 : Specifications for type B flat blades*.

ISO 11102-1:1997, *Reciprocating internal combustion engines — Handle starting equipment — Part 1 : Safety requirements and tests*.

ISO 11102-2:1997, *Reciprocating internal combustion engines — Handle starting equipment — Part 2 : Method of testing the angle of disengagement*.

3 Terms and definitions

For the purposes of this standard, the terms and definitions given in EN 292-1:1991 and EN 292-2:1991/A1:1995 apply together with the following :

3.1
sickle bar mower
motor mower which uses a power source to reciprocate a knife or knives to provide a shearing action with a stationary cutter bar or movable knife (see Figure L.1)

NOTE Adapted from EN 836:1997.

3.2
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

3.3
grassland mower
motor mower with rotary cutting blade(s) rotating about a vertical axis designed for cutting or mulching high grass, the cutting blade protective enclosure of which is not fully enclosing (see Figure L.2). The minimum cutting height is limited by design to 50 mm

3.4
flail mower
grass-cutting machine with a multiplicity of free-swinging cutting elements that rotate about an axis parallel to the cutting plane and cut by impact

[EN 836:1997]

3.5
scrub clearing machine
motor mower with rotary cutting blade(s) rotating about a vertical axis designed for cutting scrub and woody vegetation. There is no ground support in front of cutting blade(s). The front of the machine is supported at either side by skids, not wheels. At the front the cutting blade(s) enclosure may be open (see Figure L.3)

3.6
discharge opening
opening in the protective enclosure of the cutting blade through which the cut material can be ejected

3.7
discharge chute
extension of the discharge opening generally used to safely guide the ejection of the material coming from the cutting blade

3.8
handlebar
device equipped with grips enabling the machine to be manually controlled

[EN 709:1997]

3.9
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

NOTE Adapted from EN 836:1997.

3.10
normal operation
any use of the machine which is reasonably foreseeable, as seen by the user, and which is consistent with such activities as cutting grass, starting, stopping, fuelling, or connecting to (or disconnecting from) a power source

NOTE Adapted from EN 836:1997.

3.11
normal use
normal operation, plus routine maintenance, servicing, cleaning, transporting, attaching or removing accessories, and making ordinary adjustments as determined by the manufacturer's instructions

[EN 836:1997]

3.12
multipurpose machine
machine on which different attachments can be mounted

4 List of hazards

The hazards, among those appearing in EN 292-1:1991, EN 292-2:1991 and EN 292-2:1991/A1:1995 considered as applicable to the machines covered in this standard, are given in annex A.

5 Safety requirements and/or measures

5.1 General

Unless otherwise specified in this standard, the machine shall conform to the requirements of Tables 1, 3, 4 and 6 of EN 294:1992.

5.2 Engine starting and stopping devices

5.2.1 Primary starting

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

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

With the exception of hand cranks (see ISO 11102-1:1997 and ISO 11102-2:1997) starting devices shall be integral with the machine (e.g. recoil pull start). Loose belts, cables, etc. are not accepted.

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.

5.2.2 Secondary starting

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

5.2.3 Stopping

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

5.3 Manual controls

The hand operated controls for :

— clutch ;

— brakes ;

— traction gearbox (within the selected range) ;

— reversing device ;

— steering system ;

— control of the engine working speed ;

— hold-to-run control (see 5.5) ;

— blade clutch lever ;

— stop control ;

shall be within the “hand reach zone” (see below and Figure 1).

Gear box range, parking brake and differential lock controls may be located in the “foot reach zone” (see below and Figure 1).

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”.

“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 bellow by a horizontal plane positioned 450 mm above the ground.

“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

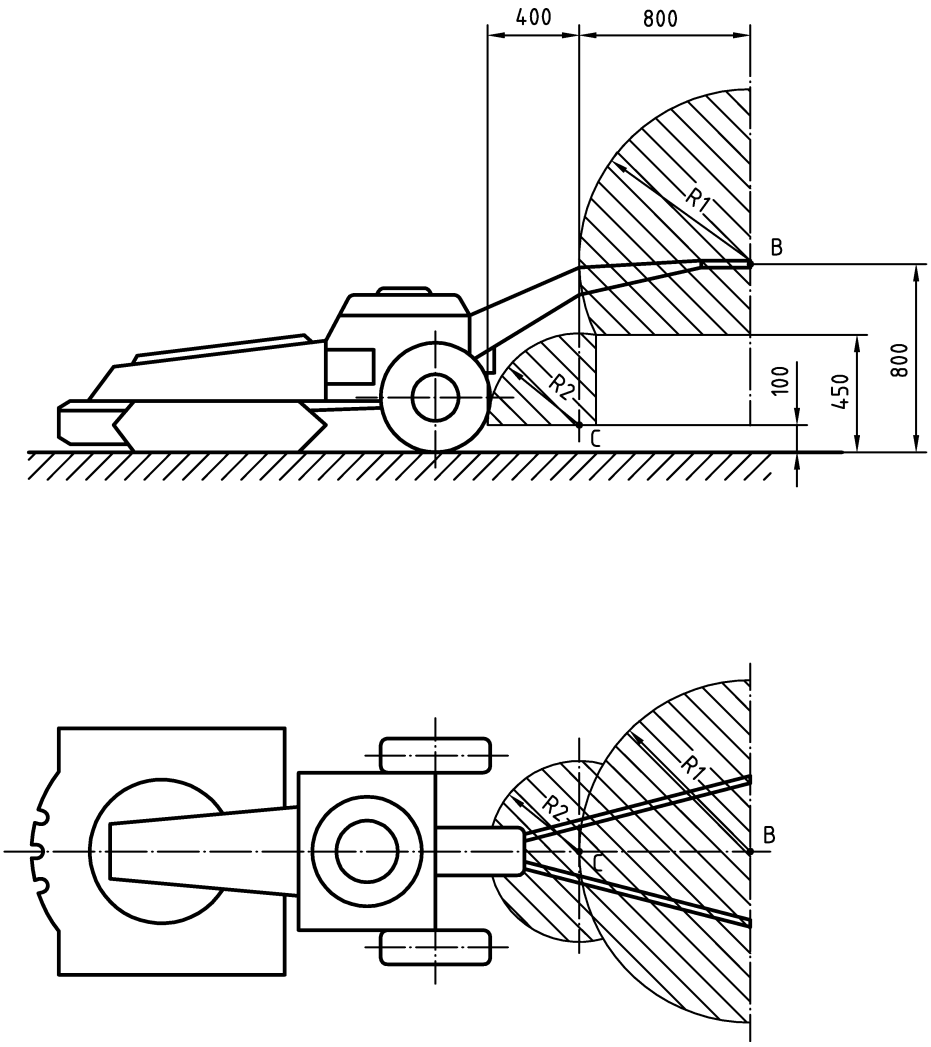


Figure 1 — Volume of “hand reach zone” and “foot reach zone”

5.4 Marking of controls

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.

If symbols are used for marking controls, they shall correspond to those in ISO 3767-1:1991 and ISO 3767-3:1995.

5.5 Controls of the movement of the machine and of the blade(s)

On motor mowers which are self-propelled it shall be possible to engage or disengage the traction drive when the cutting blade is operating.

The movement of the machine and the movement of the blade(s) shall be possible only by actuating hold-to-run controls. The hold-to-run controls shall be located on at least one of the handlebar grips.

Motor mowers shall be fitted with a device on the control handle which will automatically stop blade movement when the operator's hands are removed from the handle. For restarting blade movement the hold-to-run control shall require two separate actions.

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 gear

Controls for reverse drive direction shall conform to ISO 3789-1:1982.

In all machines with reverse gear, a positive neutral position of the driving mechanism shall be provided.

Except for blades mounted behind the rear ground support point of the machine the blades and the reverse gear 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.

5.9 Liquid spillage

When filled to the maximum according to the manufacturer's instructions 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 cm^2 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.

NOTE The temperature of 80 °C is to be reviewed at the next revision of this standard taking into account any relevant values given in EN 563.

5.10.2.2 Test equipment

The temperature measuring equipment shall have an accuracy of ± 4 °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 2 shall be used. For distances less than 100 mm between the identified hot area and the nearest control, cone B as shown in Figure 2 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).

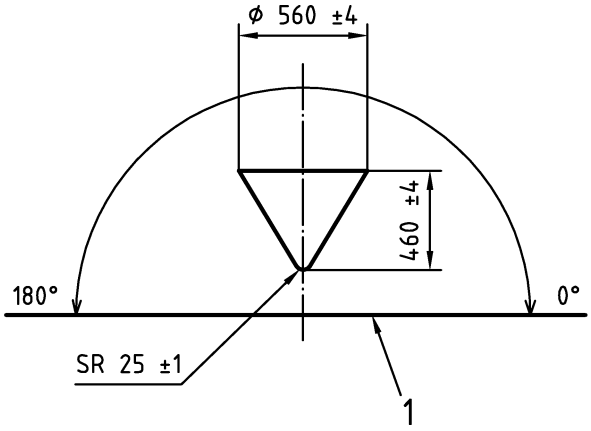
Cone B shall be moved in any direction.

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.

NOTE This method is under further study.

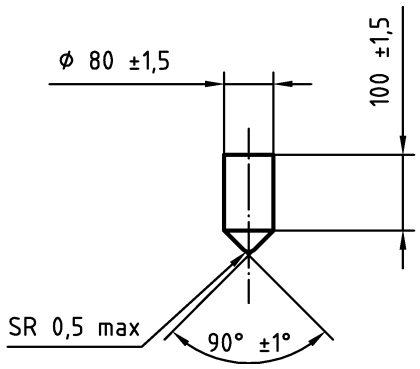
Dimensions in millimetres



Key

1 Horizontal plane

a) Cone A



b) Cone B

Figure 2 — 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

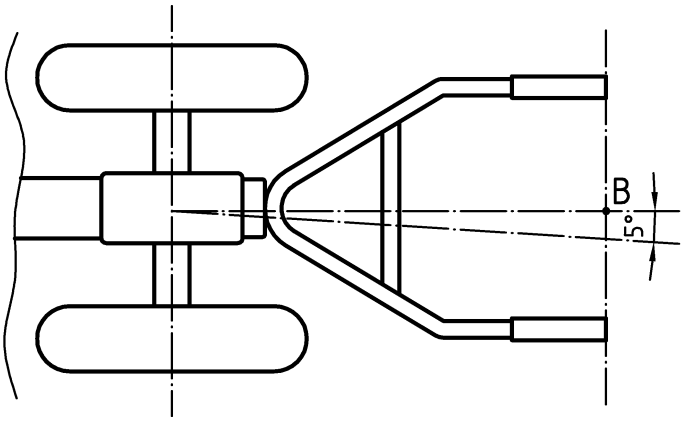
a) The measurement shall be carried out at point B (see Figure 3 a)) with the blade(s) mounted and the machine stationary on a flat, dry concrete surface ;

b) the handlebars shall be placed in their central working position and locked during the test so that they cannot swing out laterally. The grips shall be set 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 rigidly fixed between the two handlebar grips. The middle point of this rod is the measuring point B ;

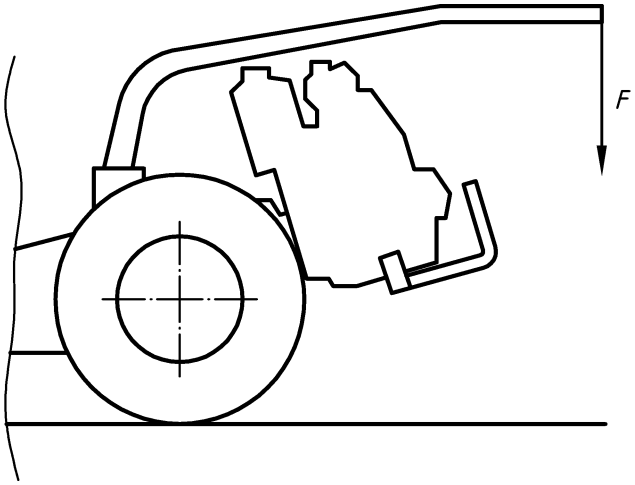
c) the machine shall be fitted with the wheels and tyres recommended by the manufacturer. The tyres shall be inflated to the maximum recommended pressure and the wheels adjusted to the maximum recommended track width ;

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 3 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 3 a)).



a)



b)

Figure 3

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 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-assist 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.

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.

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

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.

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.

Test acceptance : The machine shall not move.

5.13 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 oil and petrol.

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.

5.14 Noise

5.14.1 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 11688-1:1998 and EN ISO 11688-2 give general technical information on widely recognised 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.

5.14.2 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.

5.14.3 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.

5.15 Vibration

5.15.1 Reduction by design and protective measures

The machine shall be designed to generate a vibration level 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 1030-1:1995 gives general technical information on widely recognised 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.

5.15.2 Reduction by information

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

— the use of low-vibration operating modes, and/or limited time of operation ;

— the wearing of personal protection equipment (PPE).

5.15.3 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 zone A and B shown in Figure 4, all moving parts on the bar driving mechanism shall be guarded.

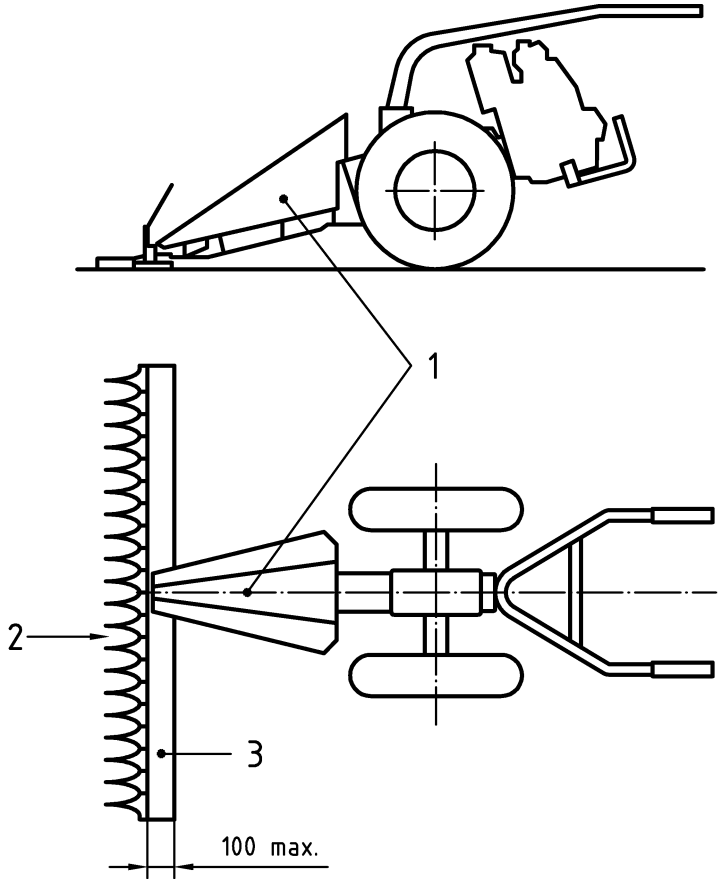
If there is more than one moving blade, the 100 mm distance defining the zone B is measured from the back of the blade nearest to the drive.

The swinging outrigger cover is not considered a danger area (see Figure 4).

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

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

Dimensions in millimetres



Key

1 Swinging outrigger cover
2 Zone A
3 Zone B

Figure 4 — 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 5), 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 (see Figure 5) 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 ; or

— this zone shall satisfy the foot probe test in annex D.

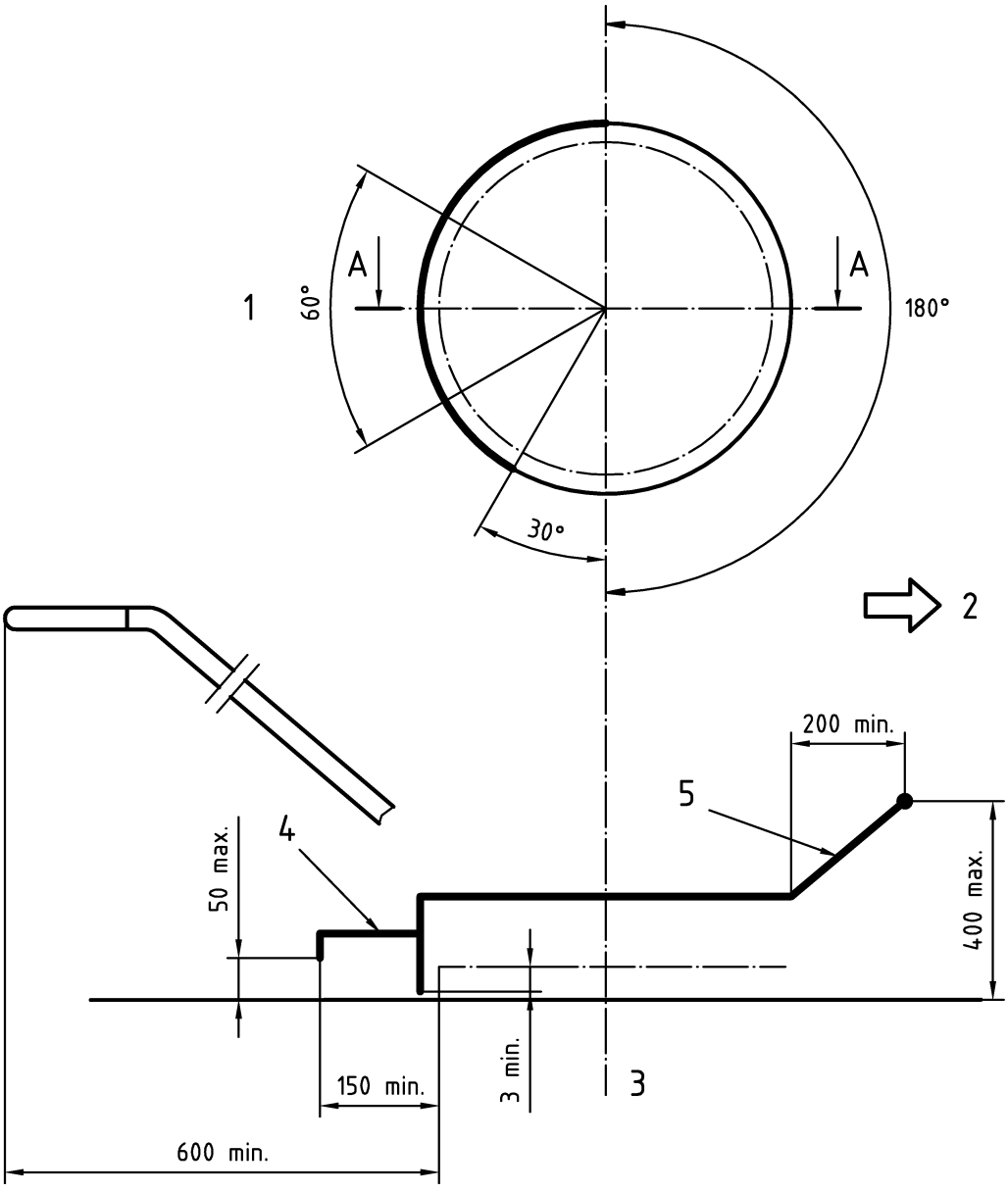
In the zone between the two rear wheels (see Figure 5) :

— this zone shall satisfy the foot probe test in annex D ; or

— this zone (see Figure 5) 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 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 5 — 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.

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

6.2.2.2 General test conditions

6.2.2.2.1 Engine speed

Where it is specified that the grassland mower shall run during the tests it shall be operated at the highest engine speed obtainable when adjusted in accordance with the manufacturer's specifications and/or instructions with the cutting blades engaged. Sealed adjustments shall not be moved when checking the maximum operating speed.

6.2.2.2.2 Restraint

The method of restraint shall not affect the test results.

NOTE Where necessary the grassland mower may be elastically restrained at the handle to limit horizontal movement during the tests.

6.2.2.2.3 Configuration/attachments

For the tests the grassland mower shall be tested with all guards in place.

6.2.2.2.4 Test enclosure and "target" arrangements for tests 6.2.2.3, 6.2.2.4 and 6.2.2.5

6.2.2.2.4.1 The test enclosure required for the thrown object, imbalance and impact tests shall be constructed generally as shown in Figure 6.

6.2.2.2.4.2 The walls shall consist of eight panel areas, each 900 mm high, perpendicular to the base of the test fixture so as to form an octagon. The test fixture target panel composition shall meet the material specification of annex F.

NOTE In order to facilitate the counting of hits, the panel supports should be designed to allow sliding in and out of at least one target panel.

The targets shall be located perpendicular to a radial line extending (750 ± 50) mm from the blade tip circle. If a target interferes with a part of the grassland mower such as a handle or a wheel the target shall be moved back sufficient to just avoid such interference.

The target shall be divided into elevation zones by horizontal lines as indicated in Figure 6 and described in annex G. The target in the operator target area of a grassland mower above 900 mm shall consist of a single sheet of Kraft paper rising to a height of 2 000 mm.

6.2.2.2.5 Ambient temperature during the tests shall be not less than 15 °C.

6.2.2.3 Thrown object test

NOTE Possible modifications to this test are under study for consideration at the next revision of this standard.

6.2.2.3.1 Test equipment

6.2.2.3.1.1 The grassland mower shall be tested in the test enclosure described in 6.2.2.2.4 and shall be placed on coconut matting/plywood base as specified in annex H.

The operator target area is determined by the intersection of lines extending from centre “A” of the blade tip circle and tangent to the 1 000 mm diameter operator area (see Figure 7). The centre of the operator area is located 330 mm to the rear of the handles, when against the upper stop, on a line passing from centre “A” through the centre of the handgrip part of the handlebar. The target surface between the intersection of the two tangents and the target is the operator target area.

For grassland mowers with adjustable handlebars, the handlebar shall be positioned to the left to locate the left limit of the operator target area and then to the right to locate the corresponding right limit.

The machine shall be constrained in a suitable manner such that the specified position relative to the injection point is maintained throughout the test. The constraint(s) shall not obstruct free passage of the balls from under the machine.

6.2.2.3.1.2 Five hundred 6,35 mm diameter balls of hardened steel 45 HRC minimum, (e.g. balls used as ball bearings) shall be used as projectiles.

6.2.2.3.1.3 An injection point shall be provided at the 12 h position as in Figure 7 and located (25 ± 5) mm inside the blade tip circle for injection of balls.

The injection tube outlets shall be fixed and flush with, or below, the upper surface of the coconut mat and the system shall be so arranged that the balls can be injected with variable velocity.

6.2.2.3.2 Test method

The grassland mower blade shall be adjusted to the lowest attainable cut height when set on a hard level surface.

The ball injection mechanism shall ensure consistent free rise heights within a range of 100 mm. Adjust the velocity with which the ball is ejected so that the ball rises not less than 40 mm above the surface of the coconut matting and within an angle of 10° of the vertical axis. Then with the grassland mower in place and operating at maximum engine speed allow balls one at a time into the grassland mower. Increase the velocity of the balls in small increments until each ball is hit by the grassland mower blade.

NOTE This procedure is intended to ensure that the ball rise height is as low as possible consistent with regular blade impact.

Start the test when this minimum velocity is established. Chipped or damaged balls shall be replaced.

During the tests, in the event of excessive hits in a localised area, the target shall be repaired or replaced before continuing with the tests. A target panel shall be replaced if hits from previous tests leave holes that cannot be covered by a 40 mm square gummed label. Not more than one thickness of gummed labels (patch) shall be placed over any one area. Balls remaining within the test fixture (on test surface) shall be removed at the option of the tester to minimise ricochet hits.

NOTE The test does not require that the machine has to suitable for use after test.

6.2.2.3.3 Test results

Only test balls passing completely through all layers of the target material shall be regarded as hits. Balls that hit the line dividing one elevation zone from the next shall be scored with the target area below that line.

6.2.2.3.4 Test acceptance (pass/fail criteria)

6.2.2.3.4.1 Machines less than or equal to 1 200 mm width of cut

For each test (500 balls) not more than 30 balls shall hit the target between the base and the 450 mm line (lower and middle elevation area) of which not more than 6 may hit the target above the 300 mm line (middle elevation area). There shall be no hits above the 450 mm line (top elevation area).

Additionally there shall be not more than 2 hits allowed in the operator target area between the base and the 450 mm line.

6.2.2.3.4.2 Machines greater than 1200 mm width of cut

The total number of hits allowed in accordance with 6.2.2.3.4.1 shall be 40. All other conditions of 6.2.2.3.4.1 shall apply.

6.2.2.3.4.3 Additional testing

In the event of a test failure, two additional identical mowers shall be tested. If either of the additional grassland mowers fails a test, the model shall have failed the test.

6.2.2.4 Impact test

6.2.2.4.1 Test equipment

The grassland mower shall be tested in the test enclosure described in 6.2.2.2.4. An example of a suitable impact test fixture is shown in Figure 8.

6.2.2.4.2 Test method

The grassland mower shall be positioned over a 25 mm steel rod that has been placed in the test fixture. The blade shall be adjusted to the cutting height closest to 50 mm and shall be so positioned that when the rod is inserted into the path of the rotating blade, the blade will strike the exposed portion of the rod within 10 mm to 15 mm of the blade tip (see Figure 8 a)). The rod shall be inserted once into the path of the blade assembly. A new piece of rod shall be used for each test.

The grassland mower shall be run for 15 s, or until the impacted cutter stops or until the rod is severed.

Where it is not possible to insert the rod due to grassland mower design, the grassland mower shall be moved the minimum distance necessary to permit the rod to be inserted.

6.2.2.4.3 Test acceptance

No complete blade, blade-arm or disc on which it is mounted shall become detached nor shall any part of the grassland mower pass through all layers of the wall of the fibreboard enclosure. Any breakage of the blade or blade retaining device shall be considered failure of the test. Breakage of a drive shearing device or chipping of the blade cutting edge shall not be deemed test failure.

NOTE The test does not require that the machine be suitable for use after test.

6.2.2.5 Structural integrity test for blade enclosure and guards

6.2.2.5.1 Test equipment

6.2.2.5.1.1 Test fixture

The test fixture base shall consist of a steel plate of at least 1,5 mm thickness backed by a 19 mm plywood panel. The steel plate shall be large enough to extend at least 25 mm beyond the blade enclosure of the grassland mower.

An air inlet hole shall be provided that is concentric with the cutting blade tip circle with an approximate maximum diameter of 30 % of the cutting blade tip circle diameter.

The machine shall be constrained such that its specified position relative to the injection point is maintained throughout the test. The constraint(s) shall not obstruct free passage of the balls from under the machine.

6.2.2.5.1.2 Injection points

For machines with a discharge chute the location of one injection point "B" shall be (25 ± 5) mm inside the blade tip circle on a line "BC" which is 45° from a line "AC" in a direction counter to the direction of blade rotation, where "A" is the centre of the discharge chute exit and "C" is the centre of the blade axis (see figure 9).

If there is no discharge chute the injection point "B" shall be directly forward of the centre of the blade axis and located (25 ± 5) mm inside the blade tip circle.

Nine further injection points, equally spaced apart from point "B" and the centre "C", of approximately 15 mm in diameter shall be used for the introduction of balls, or if preferred instead of using ten injection points the grassland mower may be rotated in 36° increments from injection point "B".

The injection tubes shall not protrude above the steel plate.

6.2.2.5.1.3 Balls

100 hardened 13 mm $\binom{+0}{-0,5}$ mm diameter balls of steel, 45 HRC minimum (e.g. balls used as ball bearings) shall be used as the projectiles.

6.2.2.5.1.4 Injection method

Means shall be provided to inject the steel balls with variable velocity. Adjust the velocity with which the ball is injected so that the ball rises a minimum of 13 mm and a maximum of 300 mm above the cutting plane of the blade.

6.2.2.5.2 Test method

The grassland mower to be tested shall be positioned on the steel plate with the blade axis C over the centre of the test panel. The blade(s) shall be set at the lowest adjustable cutting height.

The 100 balls shall be divided into 10 lots of 10. One lot shall be injected through each of the 10 injection points.

6.2.2.5.3 Test acceptance

The blade enclosure and guard shall be considered to have failed the test if any of the following occurs :

a) a hole in the blade enclosure or guard(s) which has allowed the ball to pass through. A hole in a secondary enclosure, such as an internal baffle, shall not be considered a failure ;

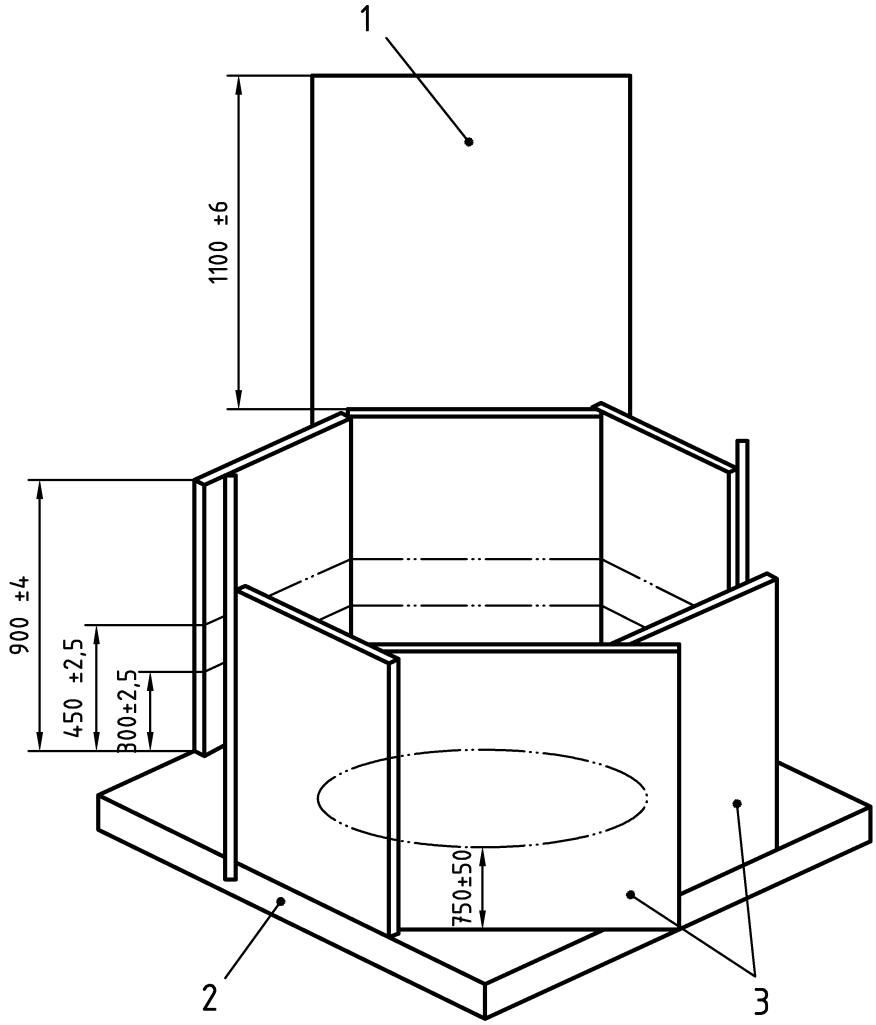
b) deformation of any part of the blade enclosure or guard(s) into the path of the blade ;

c) the dislodging of the guard(s) from their correct guarding position.

In the event of a test failure, two additional identical grassland mowers shall be tested. If either of the additional grassland mowers fails a test, the model shall have failed the test.

NOTE The test does not require that the machine has to be suitable for use after test.

Dimensions in millimetres

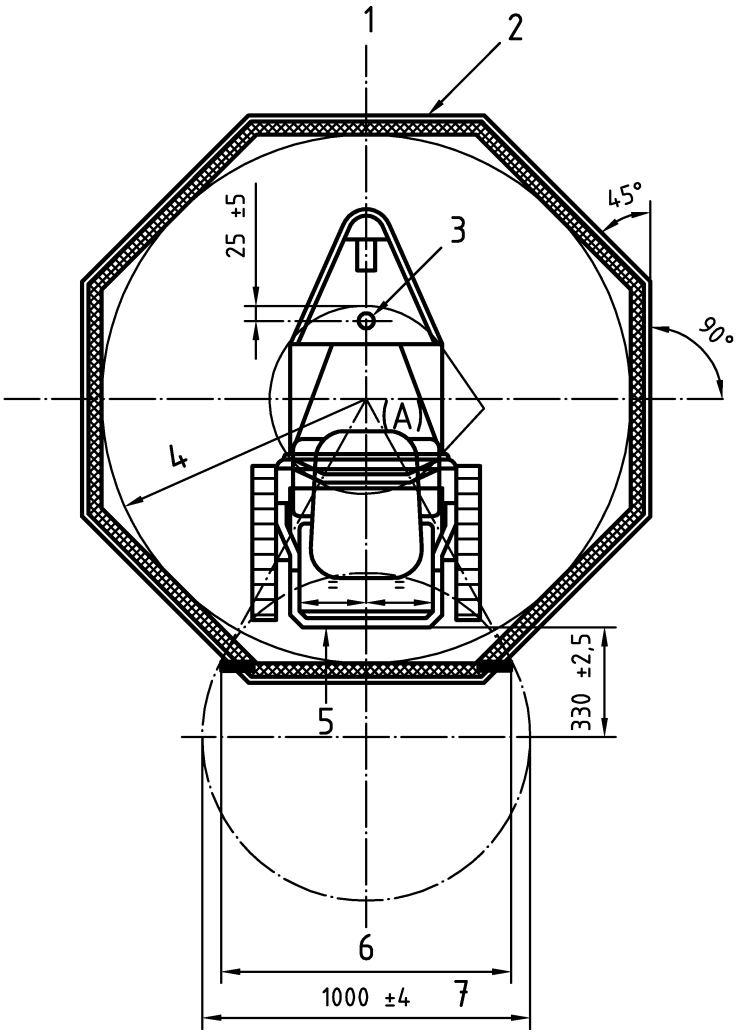


Key

1 Kraft paper target panel
2 Base
3 Corrugated fibreboard target panels

Figure 6 — Test enclosure – General layout

Dimensions in millimetres



Key

1 Front

2 Eight target panels, fibreboard, 900 high (see Figure H.2)

3 1st injection point B

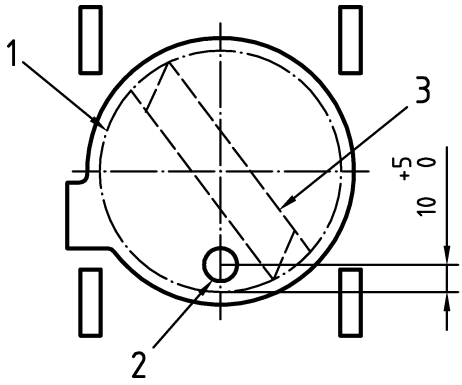
4 $R = \left(750 + \frac{\text{BTC}\varnothing}{2} \pm 50 \right)$ where BTC ∅ = Blade tip circle diameter

5 Handlebar against upper stop

6 Operator target area 900 to 2000 high target Kraft paper

7 Operator area

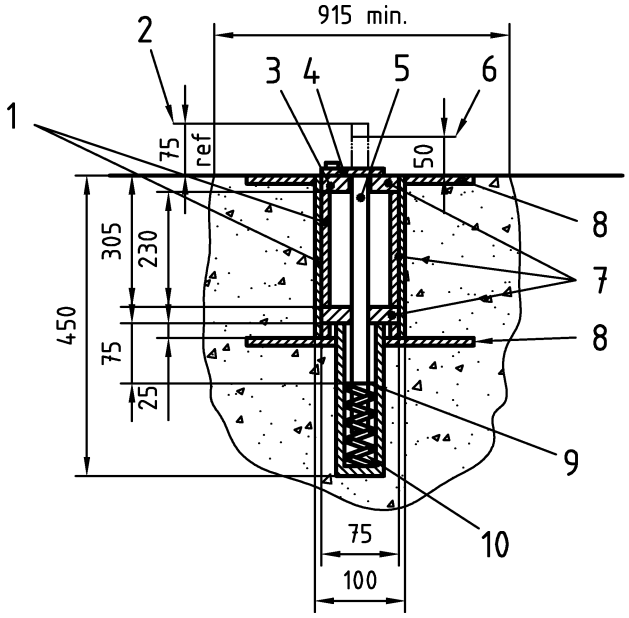
Figure 7 — Grassland mower – Test enclosure



Key

1 Cutting blade tip circle
2 Steel rod
3 Blade

a) Schematic view from above

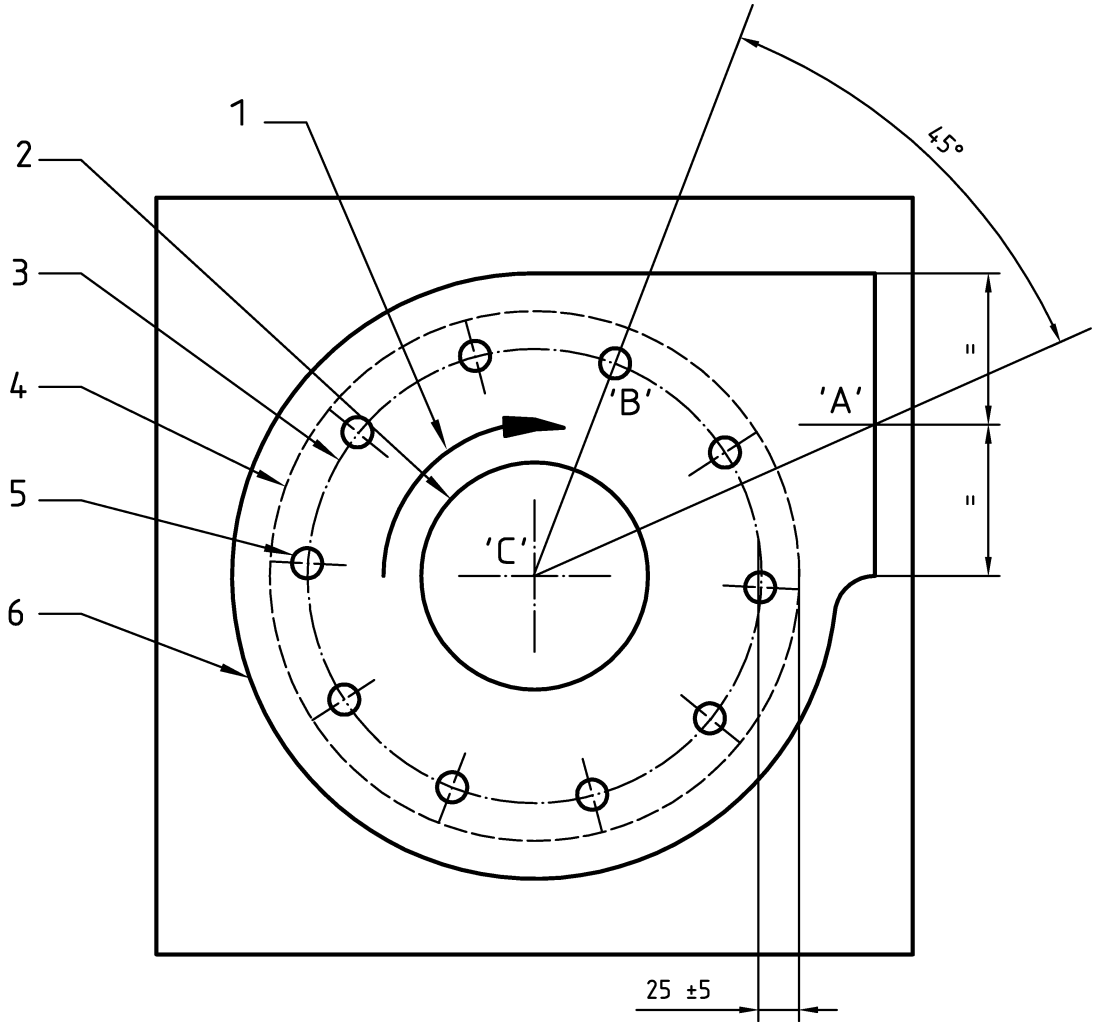


Key

1 Standard pipe
2 Released position of rod
3 End fittings (see Note)
4 Remote control actuating lever (metal plate)
5 25 mm diameter steel rod
6 Blade height
7 Removable cylinder assembly
8 2 plates 12,5 thick
9 Pin or washer fixed to tube
10 Compression spring

NOTE End fittings – Diameter 27 mm in internal diameter 100 mm standard pipe 1,5 mm to 3,0 mm clearance – identical parts both ends 25 mm thick – hardness 350 HB with central hole.

Figure 8 — Example of impact test fixture



Key

1 Direction of rotation
2 Air inlet hole (see 6.2.2.5.1.1)
3 Injection hole centreline (see 6.2.2.5.1.2)
4 Cutting blade tip circle
5 10 x 15 Diameter injection points equally spaced
6 Blade enclosure

Figure 9 — Structural integrity of blade enclosure and guards -Test enclosure

6.2.3 Cutting blades

The impact test in 6.2.2.4 shall be performed for rigid blades.

When there are pivoting blades they shall comply with the material and brittleness requirements of ISO 5718-1:1989 or ISO 5718-2:1991 if applicable or similar standards.

6.2.4 Cutting blade stopping

6.2.4.1 Stopping time

For grassland mowers the following blade stopping times shall apply :

a) cutting width up to and including 500 mm the blades shall stop from their maximum rotational speed within 5 s after the operator releases the controls that govern the operation of the cutting blades ;

b) cutting width greater than 500 mm the blades shall stop from their maximum rotational speed within 7 s after the operator releases the controls that govern the operation of the cutting blades.

NOTE During the next revision CEN/TC 144/WG 4 will take into account the possibility to reduce the blade stopping times respectively to 3 s and 5 s.

6.2.4.2 Measurement of blade stopping time

Prior to the test the grassland mower shall be assembled and adjusted according to the manufacturers published instructions for use. Grassland mowers shall be "run in" for a period as requested by the manufacturer or for 15 min. whichever is the less. During the "run in" period the blade operating control shall be operated 10 times.

The grassland mower shall be mounted and instrumented in such a manner that the results of the test are not affected. If an external starting device is used it shall not influence the results. A device shall be provided to detect the moment of release of the blade operator presence control and another to detect movement of the cutting blades.

The time recording measurement system shall have a total accuracy of 25 ms and any tachometers used shall have an accuracy of ± 2,5 %. The ambient test temperature shall be (20 ± 5) °C.

The means of operating the grassland mower during the test shall be such that the operator presence control for the blade is released abruptly from the full "on" position and it returns to the "idle" or "off" position by itself.

Stopping time is measured from the moment of release of the blade operator presence control until the last time a cutting blade passes the sensing device.

The grassland mower shall be subjected to a sequence of 5 000 stop/start cycles. The 5 000 test cycles are not required to be continuous. The grassland mower shall be maintained and adjusted during the test in accordance with the manufacturers published instructions for use. There shall be no maintenance or adjustment after 4500 cycles have been completed.

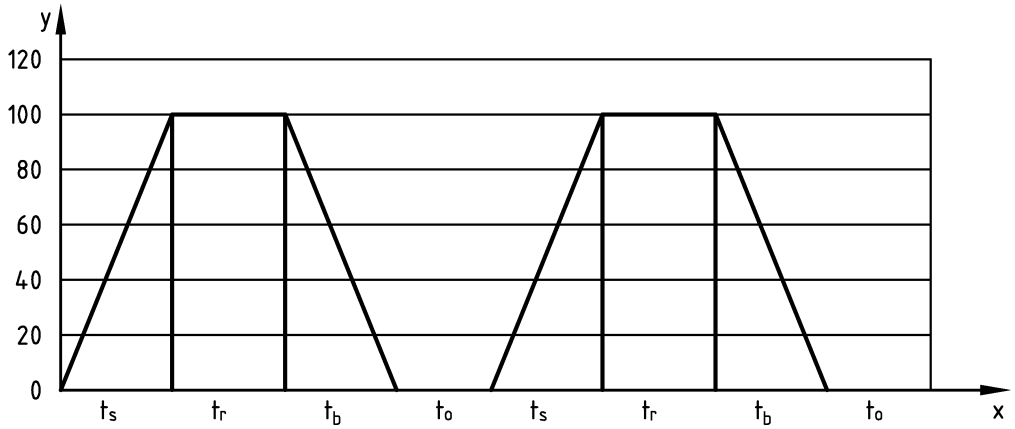
Figure 10 gives a schematic representation of two cycles. Each cycle shall consist of the following sequence :

— accelerate the blade from rest to the maximum operating engine/motor speed (m), (time = t_s) ;

— hold it at this speed for a short time to ensure that it is stable (time = t_r) ;

— release the operator presence control that controls the blade(s) and allow the blade to come to rest, (time = t_b) ;

— allow a short time at rest before commencing the next cycle (time = t_o).



Key

x = Time

y = Running speed (% of "m")

Figure 10 — Example of test cycles

If the total time for one cycle is t_c then $t_c = t_s + t_r + t_b + t_o$. The test cycle times for "on" ($t_s + t_r$) and "off" ($t_b + t_o$) shall be decided by the manufacturer but shall not exceed 100 s "on" and 20 s "off".

NOTE This test is not representative of normal use and therefore the cycle times should be specified by the manufacturer to avoid unnecessary wear or damage to the machine.

The blade stopping time shall be measured for the following :

— each of the first five cycles of the 5 000 cycle test sequence (i.e. not including the 10 preparatory operations) ; and

— each of the last five cycles prior to any brake maintenance or adjustment carried out during the test ; and

— each of the last five cycles of the 5 000 test cycles.

No other stopping times shall be recorded.

Each of the measured stopping times (t_b) shall comply with the requirement of 6.2.4.1. If the test sample fails to complete the full number of cycles but otherwise meets the requirements of this test either the machinery may be repaired if the brake mechanism is not affected and the test continued or if the machine cannot be repaired one further sample may be tested which shall then comply fully with the requirements.

6.3 Flail mowers

6.3.1 Protection against contact with cutting blades

The side guard of the enclosure shall overlap at least 3 mm around the whole extent of the circumference of the cutting blade tip circle (see Figure 11). If a flexible skirt is used it shall comply with the requirements of annex E.

The upper enclosure shall cover the upper part of the cutting blade tip. At the rear, it shall extend below the horizontal plane that includes the axis of rotation of the cutting blade.

At the front, the blade enclosure shall extend to at least reach a plane tangential to the cutting blade tip circle projected forwards and downwards at 30° minimum to the horizontal (see Figure 12). Also the machine shall either :

— be provided with a barrier located in 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 (see Figure 5) ; or

— this zone shall satisfy the foot probe test shown in annex D.

In the zone between the two rear wheels (see Figure 5) :

— this zone shall satisfy the foot probe test in annex D ; or

— this zone (see Figure 5) 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.

6.3.2 Protection against thrown objects

The thrown object test shall be carried out in accordance with annex I.

6.3.3 Cutting blades

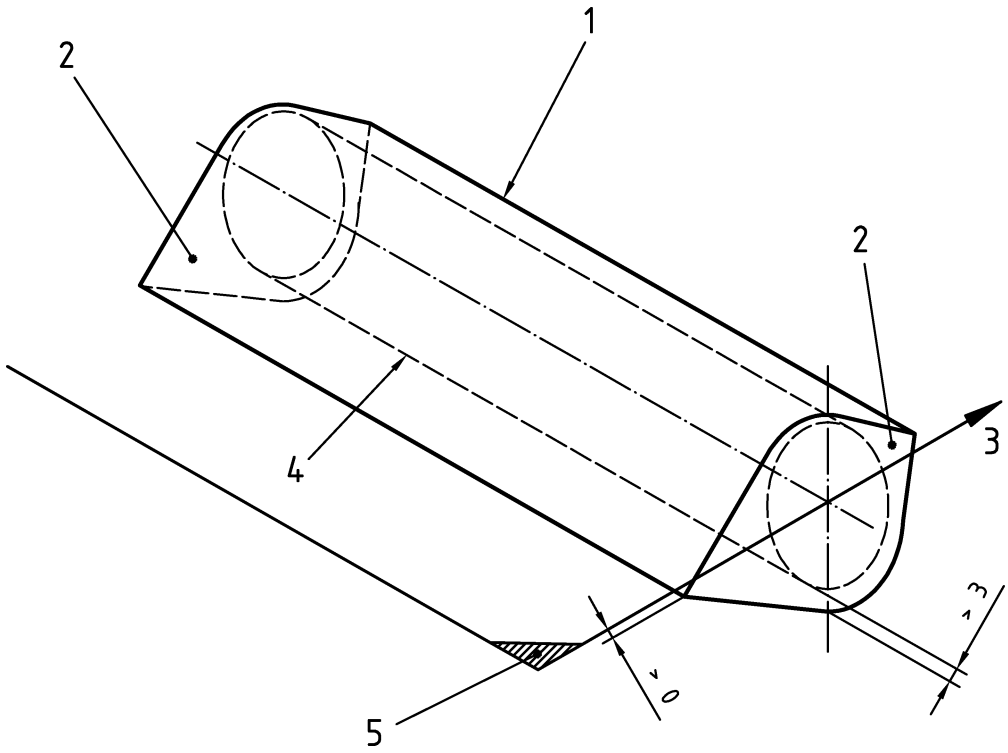
Cutting blades shall comply with the material and brittleness requirements of ISO 5718-1:1989 or ISO 5718-2:1991 if applicable or similar standards.

6.3.4 Cutting blade stopping time

The blade axle shall stop from its maximum rotational speed within 7 s after the operator releases the controls that govern the operation of the cutting blades.

The measurement of blade stopping time shall be carried out in accordance with 6.2.4.2.

Dimensions in millimetres

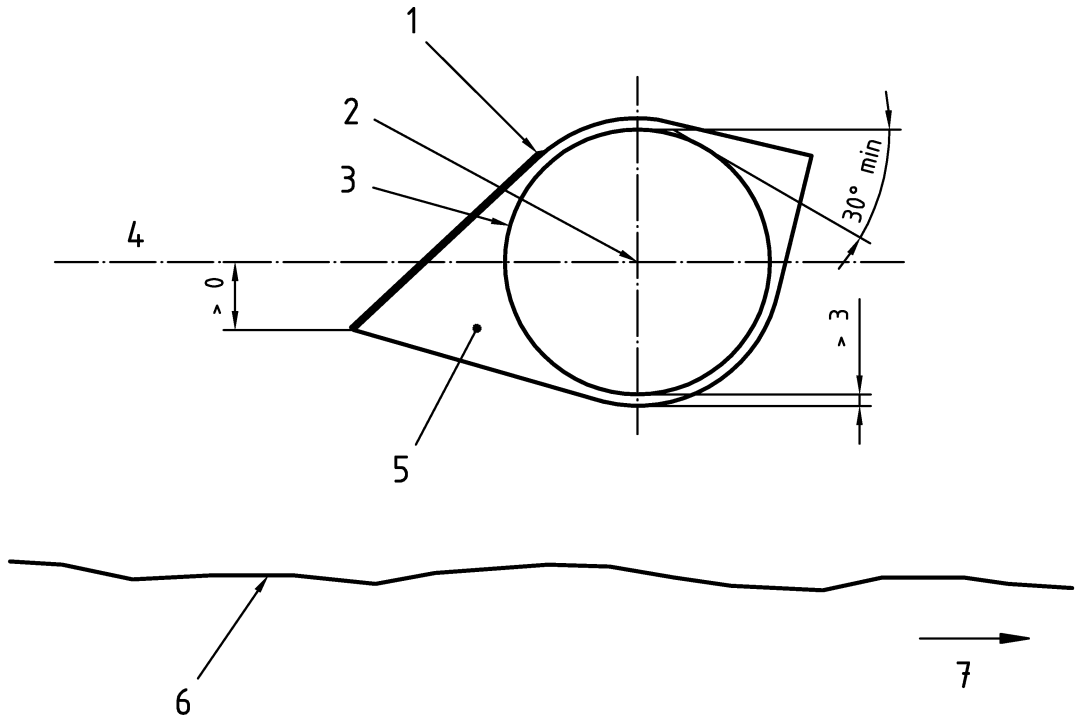


Key

1 Upper guard
2 Side guard
3 Forward
4 Tool path
5 Horizontal plane including rotation axis

Figure 11 — Opening of the protective enclosure

Dimensions in millimetres



Key

1 Upper guard
2 Rotation axis
3 Tool path
4 Horizontal plane
5 Side guard
6 Ground
7 Forward

Figure 12 — Cutting tool with horizontal axle (side view)

6.4 Scrub clearing machines

6.4.1 Protection against contact with cutting blades

Except for cut-out sections, the cutting blade tip circle shall not extend beyond the upper enclosure of the machine.

The open front of the cutting means enclosure shall not exceed 180°. The opening may be rotated up to 30° either side of the straight ahead direction to ease the evacuation the cut matter (see Figure 13).

Except for :

a) cut-out sections ; and

b) the ± 90° arc at the front of the machine concentric with the cutting blade centre and bisected by the direction of working (see Figure 13) ;

the enclosure shall be rigid and imperforate and shall extend vertically at least 3 mm below the plane of the cutting blade tip circle.

The upper enclosure may be fitted with cut-out sections to more easily facilitate the cutting of tall or thick vegetation (see Figure 14). Cut-out sections shall only be located in the ± 65° arc at the front of the machine concentric with the cutting blade centre and bisected by the direction of working. Cut-out sections shall have a maximum depth of 70 mm and a maximum width of 50 mm.

In the zone between the two rear wheels (see Figure 5) :

— this zone shall satisfy the foot probe test in annex D ; or

— this zone (see Figure 5) 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.

6.4.2 Protection against thrown objects

The thrown object test shall be carried out in accordance with annex J.

Manufacturers shall carry out tests in order to determine the area in which a hazard may exist due to the ejection either of scrub vegetation or of elements from the ground.

The manufacturer shall determine the maximum distance that ejected material may travel and draw a sketch of the hazardous area in the instruction handbook taking into account the area that is to be kept cleared of personnel when the machine is working.

6.4.3 Structural integrity of the casing

The structural integrity test shall be carried in accordance with 6.2.2.5.

6.4.4 Cutting blades

The impact test in 6.2.2.4 shall be performed for rigid blades.

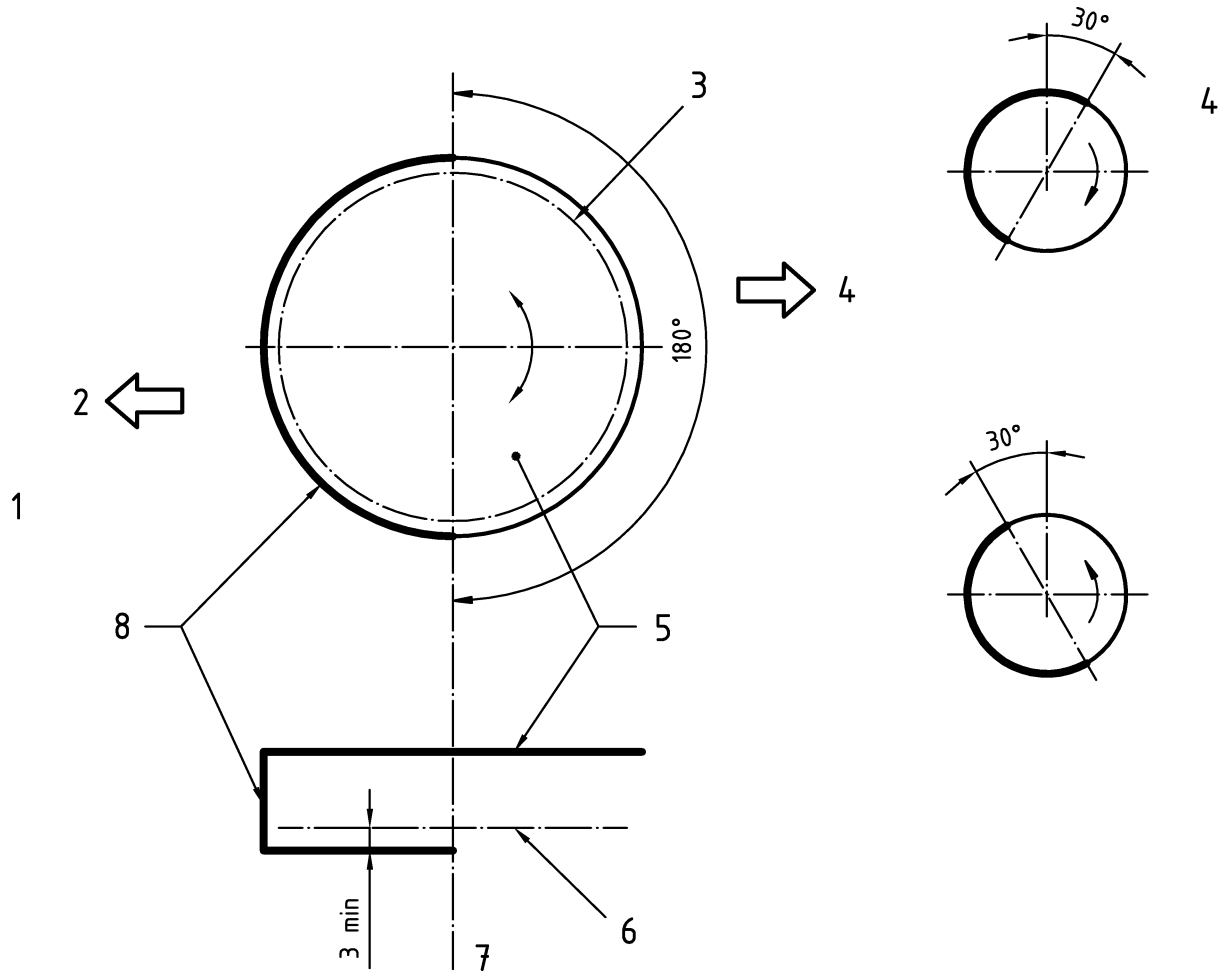
When there are pivoting blades they shall comply with the material and brittleness requirements of ISO 5718-1:1989 or ISO 5718-2:1991 if applicable or similar standards.

6.4.5 Cutting blade stopping time

The blade shall stop from its maximum rotational speed within 7 s after the operator releases the controls that govern the operation of the cutting blades.

The measurement of blade stopping time shall be carried out in accordance with 6.2.4.2.

Dimensions in millimetres



Key

1 Towards operator zone
2 Rear
3 Tool path
4 Front
5 Upper guard
6 Tool path plane
7 Rotation axis of the cutting blades
8 Side guard

Figure 13 — Covering of the scrub clearing machines (top view)

Dimensions in millimetres

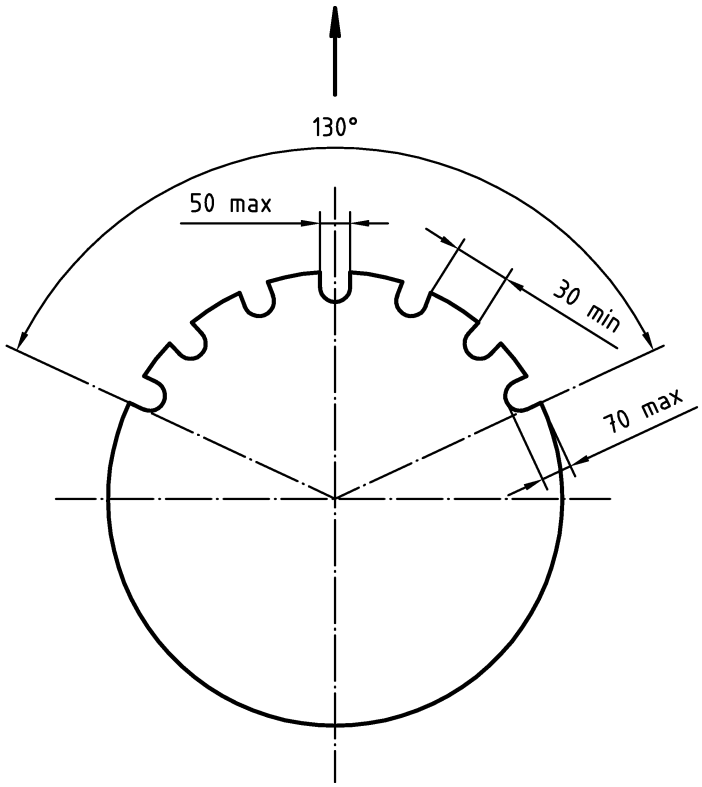


Figure 14 — Upper enclosure

7 Information for use

7.1 Instruction handbook

7.1.1 General

Comprehensive instructions and information on all aspects of maintenance and safe use for the machine shall be provided in the instruction handbook. It shall comply with 5.5 of EN 292-2:1991. In particular the following points shall be emphasized :

a) that the machine shall always be used in accordance with the manufacturer's instructions laid down in the instructions handbook ;

b) the engine shall be stopped when carrying out maintenance and cleaning operations, when changing blades and when being transported by means other than under its own power ;

c) information on the hazards when working on slopes and the precautions to take ;

d) the need to use ear protection as appropriate ;

e) the level of vibrations on handlebar grips measured according to annex C ;

f) recommendations for starting up under normal conditions and, if deemed necessary, when an emergency device is used ;

g) the procedures to modify the vertical load on the handlebars to balance the machine for a particular operator and set of working conditions ;

h) that the machines with internal combustion engine shall not be started in closed room ;

i) give the declared dual number noise emission value as defined in EN ISO 4871:1996 and determined according to 5.14.3 ;

j) give the reference to the noise test code specified in 5.14.3 ;

k) if appropriate, give the information required in 5.14.2 ;

l) instruction for recommendation for timing inspection of the blades, and the attachment of the flail ;

m) during mowing, that solid shoes shall be worn ;

n) that when starting the engine, the operator shall not lift the machine, and that the machine shall only be brought into an inclined position when the cutting blade is turned to the side opposite to the operator ;

o) that before transport of the machine, the engine has to be turned off and the cutting blade has to have stopped moving, and that whilst moving the machine outside of the workplace, the cutting blade has to be disengaged from the power source ;

p) information on the special hazards when working on banks and slopes ;

q) special information with regard to the safe changing of the cutting blades ;

r) only cutting blades approved by the manufacturer shall be fitted to the machine according to the manufacturer’s instructions.

7.1.2 Additional information for scrub clearing machines

In addition to the information for the instruction handbook given in 7.1.1, the following specific information for scrub clearing machines are to be included in the instruction handbook :

— clear warnings shall be installed all around the area in which there is a risk of ejection of objects from the cutting blade. These warnings shall state that it is prohibited to enter in this area. A sketch of this area according to 6.4.2 shall be given in the instruction handbook. If the operator becomes aware of persons or animals in the danger area he shall immediately switch off the machine and not restart until the area is clear.

7.2 Marking

All machines shall be marked legibly and indelibly with at least the following information :

— name and address of the manufacturer ;

— designation of series or type ;

— serial number, if any ;

— nominal rated power in kW (if over 20 kW) ;

— mass of the machine in its standard version in kg (if over 25 kg).

Annex A
(normative)

List of hazards

Table A.1 gives the list of hazards based on EN 292-1:1991 and EN 292-2:1991 and annex A of EN 292-2:1991/A1:1995.

Tables A.2 gives the list of hazards due to the mobility of the machine.

The meaning of the different statements given in the last column (solutions given by this standard) of these tables are :

— “not relevant”: the hazard is not significant for the machine ;

— “dealt with”: the hazard is significant. The measures given in the indicated clauses provide guidance for dealing with the hazard in accordance with the principles of safety integration of EN 292; that means :

  — elimination or reduction of the risk by design, as far as possible ;

  — protection measures ;

  — information for the residual risks.

— “partly dealt with”: the hazard is significant for several parts of the machine. The measures given in the indicated clauses deal with this hazard for some of these parts. In other parts where the hazard is significant, other measures, not included in this standard, will have to be applied in order to deal with this hazard ;

— “not dealt with”: the hazard is significant for the machine but has not been taken into account during the preparation of this European Standard.

Table A.1 — List of hazards

Hazards		Relevant clauses (informative)		Solutions given by this standard
		EN 292-1	EN 292-2	
1	**Mechanical hazard** (caused for example by: — shape, — relative location, — mass and stability (potential energy of elements), — mass and velocity (kinetic energy of elements), — inadequacy of the mechanical strength, — accumulation of potential energy by: — elastic elements (springs), or — liquids or gases under pressure, or — vacuum of the machine parts or workpieces).	4.2	—	—
1.1	Crushing hazard	4.2.1, 4.2.2	3.2	dealt with in 5.5, 5.6, 5.12
1.2	Shearing hazard	4.2.1, 4.2.2	3.2, 4.1.1	dealt with in 6.1, 6.2.1, 6.3.1, 6.4.1
1.3	Cutting or severing hazard	4.2.1, 4.2.2	3.2	dealt with in 5.5, 6.1, 6.2.1, 6.3.1, 6.4.1
1.4	Entanglement hazard	4.2.1, 4.2.2	—	dealt with in 6.2.1, 6.3.1, 6.4.1
1.5	Drawing-in or trapping hazard	4.2.1	3.1.1, 4.1.1, 6.1.2	not relevant
1.6	Impact hazard	4.2.1	—	not relevant
1.7	Stabbing or puncture hazard	4.2.1	—	not relevant
1.8	Friction or/abrasion hazard	4.2.1	3.3 b)	not relevant
1.9	High pressure fluid ejection hazard	4.2.1	—	dealt with in 5.8
1.10	Ejection of parts (of machinery and processed material/workpieces)	4.2.2	3.8	dealt with in 6.2.1, 6.2.2, 6.3.1, 6.3.2, 6.4.1, 6.4.2, 6.4.3, 7.1
1.11	Loss of stability (of machinery and machine parts)	4.2.2	3.3, 6.2.5	dealt with in 7.1
1.12	Slip, trip and fall hazards in relationship with machinery (because of their mechanical nature)	4.2.3	6.2.4	dealt with in 5.6, 5.7
2	**Electrical hazards**, caused for example by:	4.3	3.9	—
2.1	electrical contact (direct or indirect)	4.3	—	dealt with in 5.13
2.2	electrostatic phenomena	4.3	—	not relevant
2.3	thermal radiation or other phenomena such as ejection of molten particles, and chemical effects from short-circuits, overloads, etc.	4.3	—	not relevant
2.4	external influences on electrical equipment	4.3	3.4	not relevant
3	**Thermal hazards** resulting in:	4.4	3.6.3	—
3.1	burns and scalds, by a possible contact of persons, by flames or explosions and also by the radiation of heat sources	4.4	—	dealt with in 5.10, 5.10.1, 5.10.2
3.2	health-damaging effects by hot or cold work environment	4.4	—	not relevant
				« continued »

Table A.1 *(continued)*

Hazards		Relevant clauses (informative)		Solutions given by this standard
		EN 292-1	**EN 292-2**	
4	**hazards generated by noise,** resulting in:	4.5	3.6.3	—
4.1	hearing losses (deafness), other physiological disorders (e.g. loss of balance, loss of awareness)	4.5	—	dealt with in 5.14, 5.14.1, 5.14.2, 5.14.3
4.2	interferences with speech communications, acoustic signals, etc	4.5	—	not relevant
5	**hazards generated by vibration** (resulting in a variety of neurological and vascular disorders)	4.6	3.6.3	dealt with in 5.15, 5.15.1, 5.15.2, 5.15.3
6	**hazards generated by radiation,** especially by**:**	4.7	—	—
6.1	electrical arcs	—	—	not relevant
6.2	Lasers	—	—	not relevant
6.3	ionizing radiation	4.7	—	not relevant
6.4	machines making use of high frequency electromagnetic fields		—	not relevant
7	**Hazards generated by materials and substances processed, used or exhausted by machinery** for example :	4.8	3.3 b)	—
7.1	hazards resulting from contact with or inhalation of harmful fluids, gases, mists, fumes and dusts	4.8	—	dealt with in 5.8, 5.9, 5.10.1, 5.13
7.2	fire or explosion hazard	4.8	—	not dealt with
7.3	biological and micro-biological (viral or bacterial) hazards	4.8	—	not relevant
8	**Hazards generated by neglecting ergonomic principles** in machine design (mismatch of machinery with human characteristics and abilities) caused for example by:	4.9	3.6	—
8.1	unhealthy postures or excessive efforts	4.9	3.6.1, 3.6.4	dealt with in 5.3, 5.11
8.2	inadequate consideration of human hand-arm of foot-leg anatomy	4.9	3.6.9	dealt with in 5.3
8.3	neglected use of personal protection equipment	5.5	—	dealt with in 5.3, 7.1
8.4	inadequate area lighting	—	3.6.5	not relevant
8.5	mental overload or underload, stress, etc.	4.9	3.6.4	not relevant
8.6	human error	4.9	3.6	dealt with in 6.1, 6.2, 6.3, 6.4
9	**hazard combinations**	4.10	—	not relevant
10	**Hazards caused by failure** of energy supply, breaking down of machinery parts and other functional disorders, for example:	5.2.2	3	—
10.1	failure of energy supply (of energy and/or control circuits)	3.16	3.7	not relevant
10.2	unexpected ejection of machine parts or fluids	—	3.8, 4	dealt with in 5.8, 6.2.2.3, 6.2.2.4, 6.3.2, 6.4.2, 6.4.3
10.3	failure, malfunction of control system (unexpected start up, unexpected overrun)	3.15, 3.16, 3.17	3.7	dealt with in 5.3
10.4	errors of fitting	—	—	not relevant
10.5	overturn, unexpected loss of machine stability	4.2.2	6.2.5	dealt with in 5.5
				« continued »

Table A.1 *(concluded)*

Hazards		Relevant clauses (informative)		Solutions given by this standard
		EN 292-1	**EN 292-2**	
11	**Hazards caused by** (temporary) **missing** and/or **incorrectly positioned safety related measures/means,** for example:	—	4	—
11.1	all kinds of guard	3.22	4.2	dealt with in 6.1, 6.2, 6.3, 6.4
11.2	all kinds of safety related (protection)devices	3.23	4.2	dealt with in 6.1, 6.2, 6.3, 6.4
11.3	starting and stopping devices	—	3.7	dealt with in 5.2, 5.3
11.4	safety signs and signals	—	3.6.7, 5.2, 5.3, 5.4	dealt with in 7.1
11.5	all kinds of information or warning devices	—	5.4	dealt with in 7.1
11.6	energy supply disconnecting devices	—	6.2.2	dealt with in 5.5
11.7	emergency devices	—	6.1	dealt with in 5.5
11.8	feeding/removal means of workpieces	—	3.11	not relevant
11.9	essential equipment and accessories for safe adjusting and/or maintaining	3.3, 3.11	3.12, 6.2.1, 6.2.3, 6.2.6	dealt with in 7.1
11.10	equipment evacuating gases, etc.	—	—	not relevant

Table A.2 — List of hazards due to mobility

Hazards		Solutions given by this standard
12	**Inadequate lighting of moving/working area**	not relevant
13	**hazards due to sudden movement, instability etc. during handling**	dealt with in 5.5
14	**inadequate/unergonomic design of driving/operating position**	—
14.1	hazards due to dangerous environments (contact with moving parts, exhaust gases etc.)	dealt with in 5.10, 6.1, 6.2, 6.3, 6.4
14.2	inadequate visibility from drivers/operators position	not relevant
14.3	inadequate seat/seating (seat index point)	not relevant
14.4	inadequate/unergonomic design/positioning of controls	dealt with in 5.2, 5.3, 5.5, 5.7
14.5	starting/moving of machinery	dealt with in 5.2
14.6	traffic of machinery	not relevant
14.7	movement of pedestrian controlled machinery	dealt with in 5.5, 5.6
15	**Mechanical hazards**	—
15.1	hazards to exposed persons due to uncontrolled movement	not relevant
15.2	hazards due to break-up and/or ejection of parts	dealt with in 6.2, 6.3, 6.4
15.3	hazards due to roll over (ROPS)	not relevant
15.4	hazards due to falling objects (FOPS)	not relevant
15.5	inadequate means of access	not relevant
15.6	hazards caused due to towing, coupling, connecting, transmission etc.	not relevant
15.7	hazards due to batteries, fire, emissions etc.	dealt with in 5.9

Annex B
(normative)

Noise test code for motor mowers - Engineering method (grade 2)

B.0 Scope

This noise test code specifies all the information necessary to carry out efficiently and under standardized conditions the determination and declaration of the noise emission characteristics of pedestrian controlled motor mowers.

Noise emission characteristics include the emission sound pressure level at the workstation and the sound power level. The determination of these quantities is necessary for :

— manufacturers to declare the noise emitted ;

— comparing the noise emitted by machines in the family concerned ;

— purposes of noise control at the source at the design stage.

The use of this noise test code ensures reproducibility of the determination of the noise emission characteristics within specified limits determined by the grade of accuracy of the basic noise measurement method used. Noise measurement methods allowed by this Standard are grade 2 (engineering) methods."

B.1 A-weighted sound power level determination

For the determination of sound power level, EN ISO 3744:1995 shall be used subject to the following modifications:

— the reflecting surface shall be replaced by an artificial surface which complies with B.3 ;

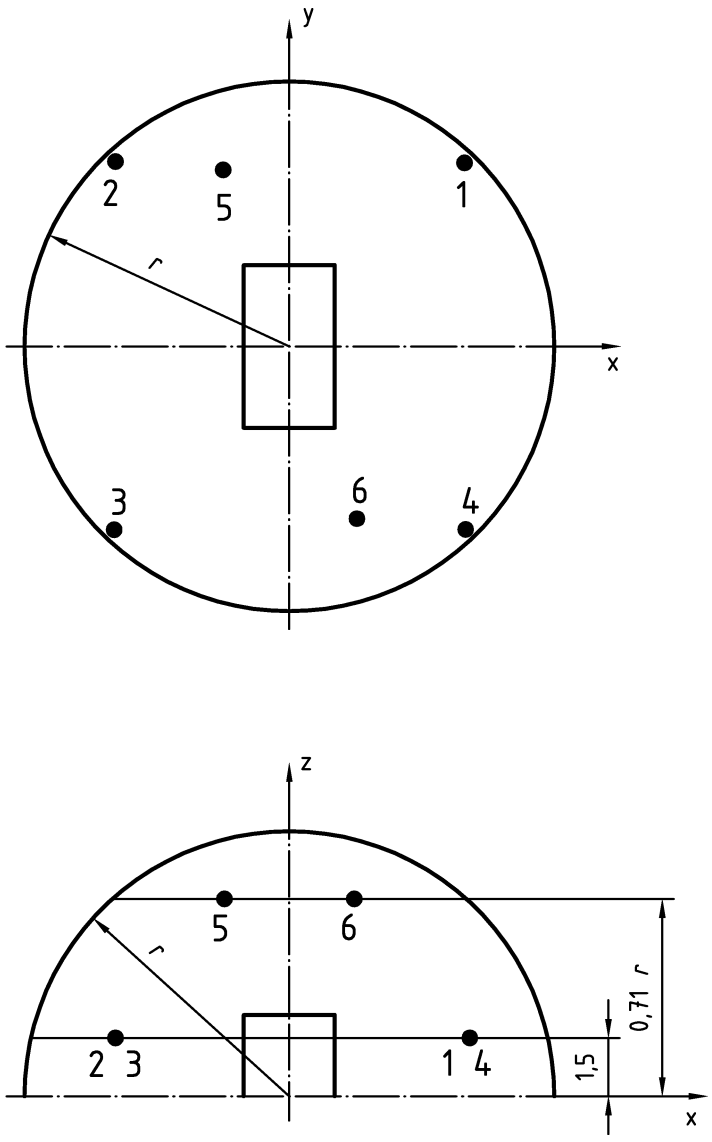
— the measurement surface shall be a hemisphere with a radius, r, of 4 m ;

— the microphone array shall be composed of six microphone positions as defined in Figure B.1 and Table B.1 ;

— environmental conditions shall be within the limits specified by the manufacturers of the measuring equipment. The ambient air temperature shall be in the range from 5 °C to 30 °C and the wind speed shall be less than 5 m/s ;

— the noise emitted by this type of machine being stable, it is sufficient to use a sound level meter of class 1, according to EN 60651:1994, or an integrating-averaging sound level meter of class 1, according to EN 60804:1994.

Dimensions in metres



Key

1 r, radius of hemisphere

Figure B.1 — Microphone positions on the hemisphere (see Table B.1)

Table B.1 — Coordinates of microphone positions

Position No.	x / r	y / r	z
1	+ 0,7	+ 0,7	1,5 m
2	- 0,7	+ 0,7	1,5 m
3	- 0,7	- 0,7	1,5 m
4	+ 0,7	- 0,7	1,5 m
5	- 0,27	+ 0,65	0,71 r
6	+ 0,27	- 0,65	0,71 r

B.2 A-weighted emission sound pressure level determination

For the determination of the A-weighted emission sound pressure level, EN ISO 11201:1995 shall be used subject to the following modifications :

— the reflecting surface shall be replaced by an artificial surface which complies with B.3 ;

— environmental conditions shall be within the limits specified by the manufacturers of the measuring equipment. The ambient air temperature shall be in the range from 5 °C to 30 °C, and the wind speed shall be less than 5 m/s ;

— the noise emitted by this type of machine being stable, it is sufficient to use a sound level meter of class 1, according to EN 60651:1994, or an integrating-averaging sound level meter of class 1, according to EN 60804:1994 ;

— the microphone shall be head mounted (200 ± 20) mm from the median plane of the head on the louder side and in line with the eyes. The microphone shall be aimed with its axis of maximally flat response (as specified by the manufacturer) pointing at the front handle of the machine. The operator may wear a helmet on which the microphone may be attached. The helmet shall be of a shape so that its outer edge is at least 30 mm closer to the head than the microphone. The operator shall be (1, 75 ± 0, 05) m tall.

B.3 Requirements for test floor

The artificial surface shall have absorption coefficients as given in Table B.2, measured in accordance with EN ISO 354:1993.

Table B.2 — Absorption coefficients

Frequencies in Hz	Absorption coefficients	Tolerance
125	0,1	± 0,1
250	0,3	± 0,1
500	0,5	± 0,1
1 000	0,7	± 0,1
2 000	0,8	± 0,1
4 000	0,9	± 0,1

The absorptive material shall be placed at the centre of the test area on a hard, reflecting surface and have a size of at least 3,6 m x 3,6 m. The construction of the supporting structure shall be such that the requirements for the acoustic properties are also met with the absorptive material in place. The structure shall support the motor mower to avoid compression of the absorbing material.

NOTE See annex K for an example of a material and construction which can be expected to fulfil these requirements.

B.4 Installation, mounting and operating conditions

Measurements shall be carried out on a new, normal production machine featuring standard equipment as provided by the manufacturer.

The height of cut shall be adjusted to the lowest position provided.

Before the test is commenced the engine shall be run-in and warmed up until stable conditions are reached. The carburettor and ignition shall be set and the cutting device(s) lubricated according to the instructions of the manufacturer.

During the test the cutting means shall be engaged and unloaded.

The test shall be carried out at the maximum operating engine speed (see 3.9).

An engine speed indicator shall be used to check the speed of the engine. It shall have an accuracy of ± 2,5 % of the reading. The indicator and its engagement with the motor mower shall not affect the operation during the test.

For the sound power level determination, machines shall be measured by placing them on the surface in such a way that the projection of the geometrical centre of their main parts (excluding handle, etc.) coincides with the origin of the coordinate system of the microphone positions. The artificial surface in accordance with B.3 shall be placed so that its geometrical centre also coincides with the origin of the coordinate system of the microphone positions. The longitudinal axis of the machine shall be on the x axis. The measurement shall be carried out without an operator.

For the emission sound pressure level determination, adjustable handles shall be set to suit the operator.

B.5 Measurement uncertainties and declaration of noise emission values

Tests shall be repeated to attain the required grade of accuracy, and until three consecutive A-weighted results give values within not more than 2 dB; the higher of these shall be the sound level of the machine.

Using this standard, the measurement uncertainty of the determination of :

— A-weighted sound power levels is that specified in EN ISO 3744:1995 ;

— A-weighted emission sound pressure levels at the operator position is that offered by EN ISO 11201:1995.

When preparing the noise declaration, the total uncertainty shall be determined by combining the measurement uncertainty and the production uncertainty (variation of noise emission from one machine to another of the same type made by the same manufacturer), see EN ISO 4871:1996.

B.6 Information to be recorded and reported

The information to be recorded and reported is that required by EN ISO 3744:1995 and EN ISO 11201:1995.

Annex C
(normative)

Vibration measurement of motor mowers

C.1 Quantities to be measured

— weighted r.m.s acceleration according to 3.1 of EN 1033:1995 for hand-arm vibration ;

— maximum operating engine speed obtainable (see 3.9). Sealed adjustments shall not be moved when checking the maximum operating speed.

C.2 Instrumentation

C.2.1 General

Tachometers shall have an accuracy of ± 2,5 %. For specification of other instrumentation see 4 of EN 1033:1995 for the hand-arm vibration measurement.

C.2.2 Fastening of transducer

For fastening the transducer 4.2 of EN 1033:1995 shall apply. If a resilient coating is being used between the hand and vibration structure (for example, a cushioned handle or steering wheel), it is permissible to use a suitable mounting for the transducer (for example, a thin suitably formed metal sheet) placed between the hand and the surface of the resilient material. In either case, care shall be taken that the size, shape and mounting of the transducer or of the special transducer support does not significantly influence the transfer of vibration to the hand. Care shall also be taken when mounting the transducer that the transfer function is flat up to 1,5 kHz for all three directions.

C.2.3 Calibration

Calibration shall be in accordance to 4.7 of EN 1033:1995 for the hand-arm vibration.

C.3 Measurement direction and measurement location

C.3.1 Measurement direction

Measurements shall be made simultaneously for the three (3) directions x, y and z (see Figure C.2).

C.3.2 Measurement location

A maximum of two transducers shall be used. The transducer(s) shall be placed where an operator holds the steering device(s) according to Figure C.2.

C.4 Test procedure

C.4.1 General

Measurements shall be carried out on a new, normal production machine featuring standard equipment as provided by the manufacturer. The machine shall be maintained and serviced in accordance with the manufacturers instructions. Before the test is commenced the engine shall be run with the cutting means engaged until stable conditions are reached.

The hands of the operator shall be in the designated gripping area, close to the transducer. The operator shall be in the normal operating position. Tyre pressures shall be in accordance with the manufacturers specifications. The fuel tank shall be full. The cutting height of the blades shall be set at the lowest available setting. The machine shall be tested with all attachments provided for by the manufacturer.

Adjustable handles shall be set to suit the operator.

The measurements shall be carried out with an operator who shall be (1,75 ± 0,05) m tall.

NOTE The vibration measurements are influenced by the operator. He should therefore be familiar with the normal operation of the machine (see 3.10).

C.4.1.1 Test procedure for machine with rotary cutting blade(s)

C.4.1.1.1 Test condition

Testing shall be carried out with the machine stationary and at the maximum operating engine speed (see 3.9).

Measurements shall be carried out on a surface in accordance with annex H.

C.4.1.2 Test procedure for reciprocating machine

C.4.1.2.1 Driving speed

Testing shall be carried out with the machine stationary and at the maximum operating engine speed (see 3.9). The test shall be carried out at by selecting the gear which gives an operating speed most close to 0,5 m/s (approx. 1,8 km/h). The actual gear selected and the actual operating speed shall be included in the test report.

C.4.1.2.2 Cutting blade

The cutting blade shall be sharpened and adjusted in accordance with the manufacturer’s instructions.

C.4.1.2.3 Machine centre of gravity

For machines with a variable centre of gravity, the machine shall be adjusted to the operating conditions stated by the manufacturer. The vertical force of the cutting blade of the free standing machine (without operator) shall be evaluated by appropriate means (i.e. balance) and shall be included in the test report.

C.4.1.2.4 Test conditions

The test shall be carried out by operating the machine in the forward direction and with the cutting blade engaged and in its working position. Other modes of operation, e.g. with the cutting blade raised or the cutter bar switched off, shall not be considered.

The operating surface for the test is flat or slightly inclined (max. 5°) firm ground (e.g. asphalt or concrete), covered by a securely fixed elastic layer to simulate the damping behaviour of grassy land, e.g. meadow. The elastic layer shall have the following physical characteristics :

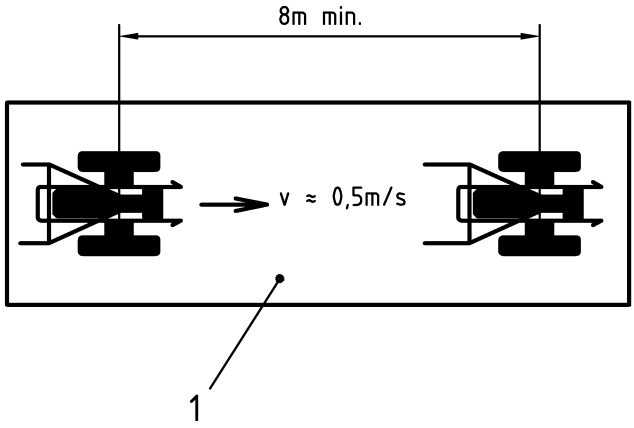
— static spring constant : ca. 0,15 N/mm^3 - 0,20 N/mm^3 (field charge/spring deflection) ;

— dynamic elasticity modules : ca. 2,0 N/mm^3 - 4,0 N/mm^3 ;

— mechanic dissipation factor : ca. 0,1 - 0,15 ;

and shall be resilient enough to withstand the strain on it caused by the test.

Each test run shall comprise operation of the machine along an 8 m path, and so a test track of length somewhat greater than 8 m is required (see Figure C.1). The working parts of the machine normally in contact with the ground shall be kept in contact with the elastic surface for the whole of the test run. The time taken to cover the test track shall be recorded, e.g. with a stopwatch, and shall be included in the test report.



Key

1 Elastic surface

Figure C.1 — Measuring track and location of the elastic layer for evaluation of vibration characteristics

C.5 Measurement procedure

For each transducer position a series of five tests shall be carried out using one operator.

NOTE Issues such as validity of test and number of test operators are to be considered for future revision in the light of experience gained using the present test method.

Each reading shall be obtained from a signal time suitable for the test equipment being used. Duration of the test shall not be less than 8 s.

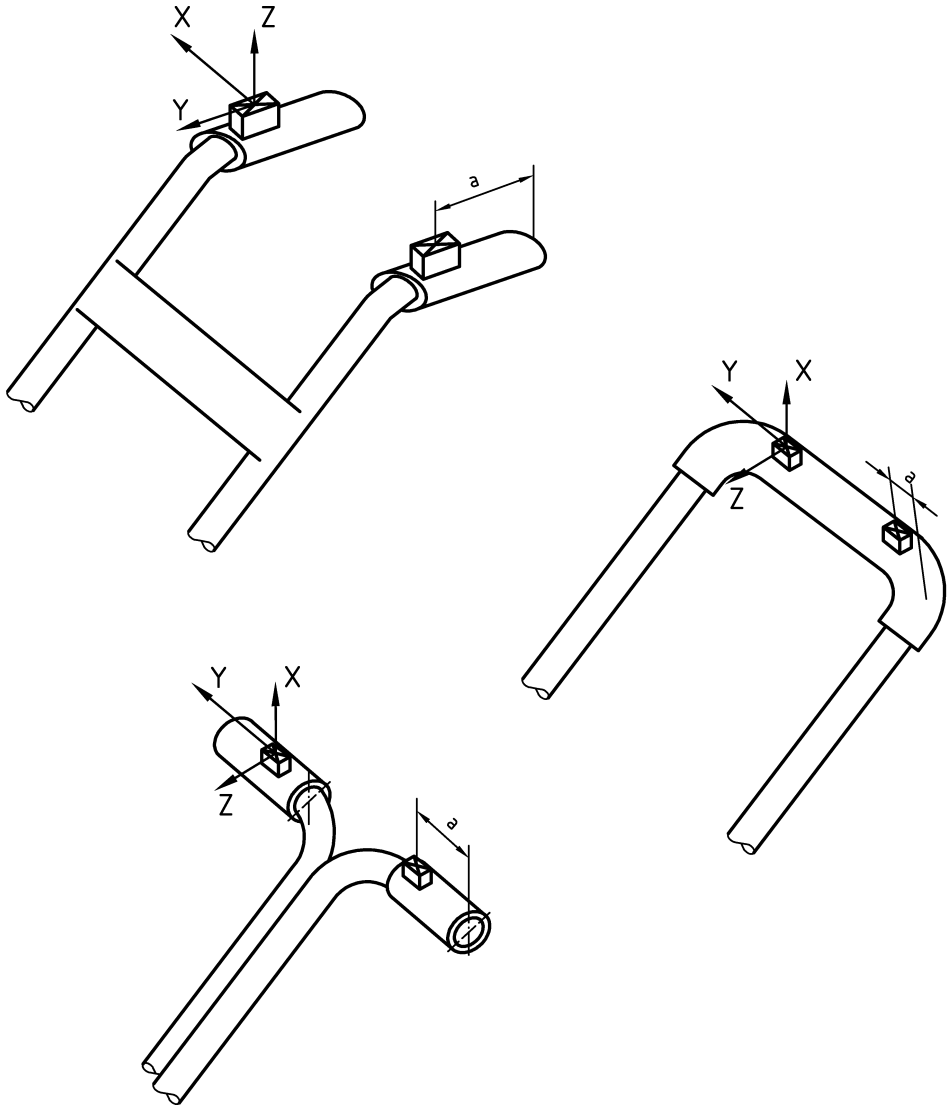
NOTE An equivalent level of accuracy may be achieved by using a shorter duration than 8 s. In this case equivalence of the results should be justifiable.

Measurement for the three directions shall be made simultaneously.

C.6 Determination of the measurement result

The measurement result of each hand position shall be determined as the arithmetic mean over the $a_{h,W}$ values of each test. If a single figure is quoted it shall be the higher of the two.

Dimensions in millimetres



Key
a= 100 mm

Figure C.2 — Examples of transducer location/orientation

Annex D
(normative)

Foot probe test

D.1 Test equipment

The test shall be performed with a foot probe as illustrated in Figure D.1.

D.2 Test method

The motor mower shall be placed on a hard flat surface. The guards or deflectors, or both, shall be in the normal operating position on the blade enclosure and the motor mower support members shall be in contact with the supporting surface.

Components such as wheels and frames shall be considered as part of the blade enclosure for the purpose of this test. The test shall be conducted with the motor mower and the blade(s) stationary.

The tests shall be made with the blades in the highest and lowest cutting positions. If the blade path height is different at different blade speeds, the test shall be conducted so as to include the two extremes of blade height.

Whilst applying the probe, its movements shall be limited as follows :

a) the base of the probe may be inclined forwards or backwards by up to 15°; and

b) the probe may be on or at any height above the supporting surface ; and

c) the probe shall be applied with a horizontal force of 20 N or until the blade enclosure lifts from its original position, whichever occurs first.

The probe shall be applied at any point of the discharge opening. The sides of any discharge chute shall be probed if these are less than 3 mm below the plane of the cutting blade tip circle.

D.3 Test acceptance

The test probe shall not enter the path of the blade(s) assembly.

Dimensions in millimetres

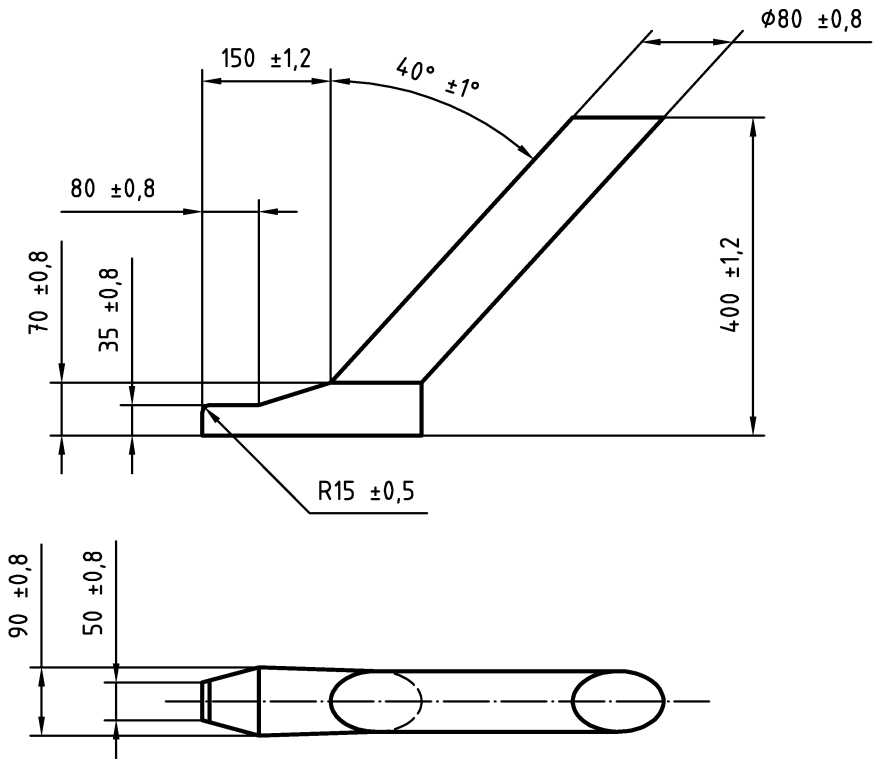


Figure D.1 — Foot probe

Annex E
(normative)

Material of protective skirts

E.1 Tearing resistance test

E.1.1 Test method

Five horizontal samples and five vertical strips 50 mm wide are cut from the protective skirt. These samples are put into a strength measuring device allowing a 250 mm length of material to be submitted to an increasing tractive force of 666 N/min.

E.1.2 Test acceptance

Tearing resistance is considered to be sufficient when the resistance force for all ten samples is at least 3 000 N.

E.2 Perforation resistance test

E.2.1 Test method

Five circular samples cut from the skirt are each put into a ring of 100 mm internal diameter. These samples are subject to an increasing load of 666 N/min by means of a punch of 10 mm x 10 mm section having a chamber of 1 mm x 45°.

E.2.2 Test acceptance

Perforation resistance is considered to be sufficient when the average perforation force for the five samples at least 1 000 N and when the minimum perforation work is 8 Nm.

E.3 Wear resistance test

E.3.1 Test method

A sample 200 mm wide is cut from the full height of the protective skirt. This sample is put into a grinding device so that a 400 cm^2 surface of its free end rests on a grinder which is 200 mm wide and has a diameter of 800 mm. The grinder shall have 24 grain size running at 25 rpm. The pressure shall be 5 N. In order to obtain uniform pressure, the sample is coated with a layer of 30 mm thick polyester having a density of 35. The sample support shall match the grinder radius.

E.3.2 Test acceptance

Wear resistance is considered to be sufficient when :

— on armoured skirts armature fibres are not worn after 10 000 rotations ;

— on non-armoured skirts in no point the thickness is less than half of that of the original thickness after 10 000 rotations.

Annex F
(normative)

Corrugated fibreboard penetration tests on grassland mowers - Test enclosure wall panels (see 6.2.2.2.4.2)

F.1 Purpose

The purpose of these tests is to provide a means of selecting a uniform target material for throwing tests on grassland mowers.

F.2 Test fixture

The test fixture shall be in accordance with Figure F.1.

F.3 Fibreboard samples

Fibreboard shall be cut into squares of 150 mm per side.

F.4 Procedure

Immediately before and after the grassland mower tests five samples of the fibreboard shall be tested and the requirements of F.5 shall be met.

Place a fibreboard square centrally on the bottom plate. The square may be secured at the edges by tape or adhesive. Cover with the top plate and make sure that the centre holes of the top and bottom plates are aligned and that the fibreboard is flattened by the steel top plate.

Raise the penetrator to the recommended height as shown in Figure F.1, and allow to fall on to the fibreboard samples.

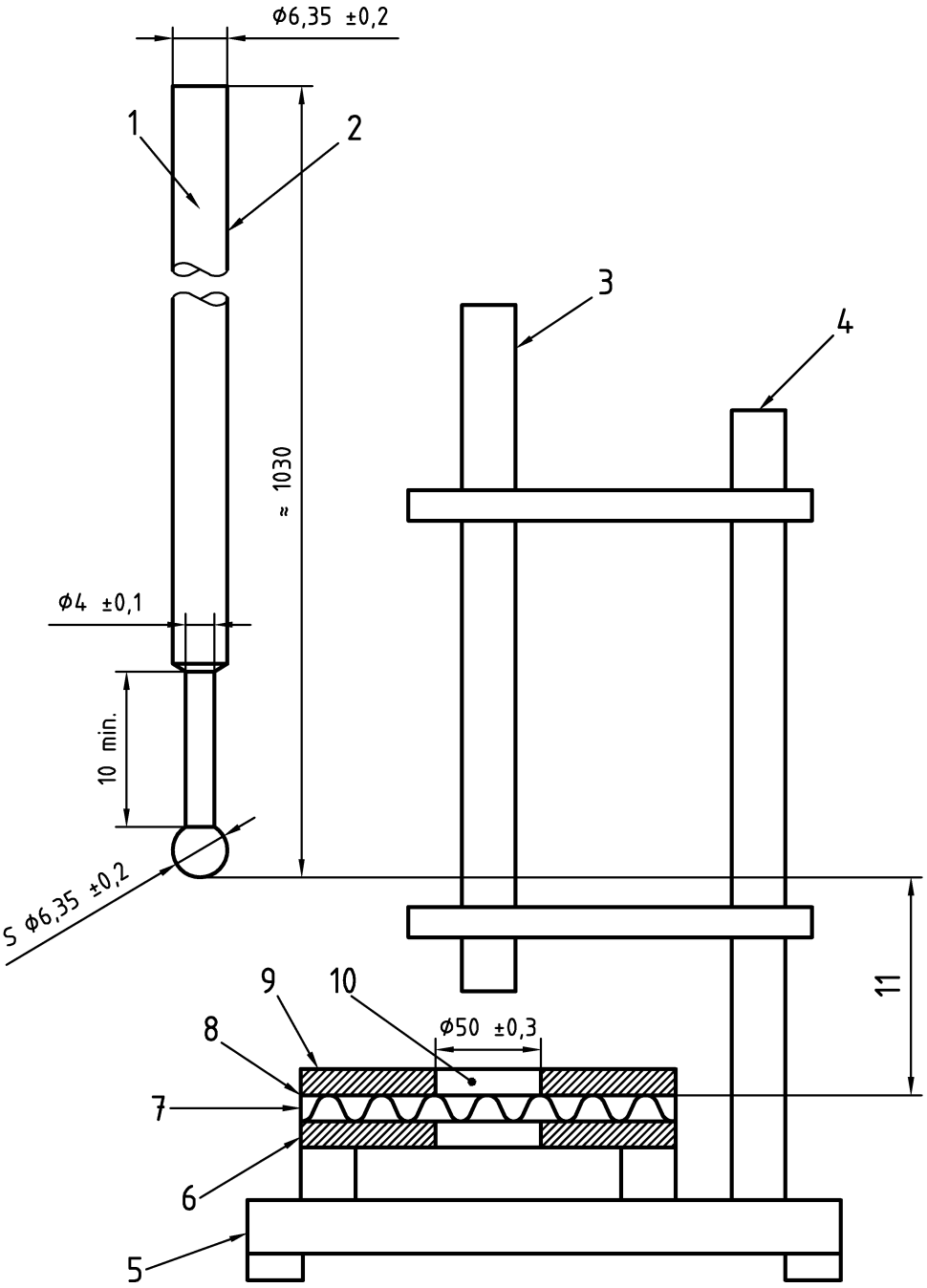
F.5 Acceptance criteria

The spherical end of the penetrator shall not penetrate completely through the test sample more than 2 out of 5 drops when dropped 300 mm.

The spherical end of the penetrator shall penetrate completely through the test sample in at least 4 out of 5 drops when dropped 400 mm.

NOTE If the penetrator penetrates the fibreboard more than the allowed number of times permitted by the acceptance criteria when dropped 300 mm, add sufficient sheets of Kraft paper to the target face of the fibreboard in order to meet penetration requirements.

Dimensions in millimetres



Key

1 Steel rod
2 Penetrometer – Mass (0,25 ± 0,005) kg
3 Guide tube - vertical ± 2°
4 Support tube
5 Base
6 Steel bottom plate (6,35 x 150 x 150)
7 Fibreboard sample
8 Add extra kraft paper here
9 Steel top plate (20 x 150 x 150)
10 Hole
11 Drop height

Figure F.1 — Test fixture for corrugated fibreboard penetrometer test

Annex G
(normative)

Target elevation areas

G.1 Lower elevation target

The lower elevation target shall be the area between the base and the 300 mm line.

G.2 Middle elevation target

The middle elevation target shall be the area between the 300 mm and the 450 mm lines.

G.3 Top elevation target

The top elevation target shall be the area above the 450 mm line to the top of the 900 mm target.

G.4 Operator target area

The width of the operator target area shall be as specified in 6.2.2.3.1.1 and the height extend from the base to the top of the 2 000 mm high Kraft paper target.

Annex H
(normative)

Test enclosure

H.1 Base

The test fixture base shall consist of 19 mm plywood covered with 500 mm squares of coconut matting nailed to the plywood with nails spaced as shown in Figure H.1 (see also Figure H.2).

NOTE Squares are used so that, should wear develop, the worn area can be replaced without replacing the entire test surface.

The minimum base size shall be a square 1,5 m larger than the cutting width.

The coconut matting shall have approximately 20 mm high fibres embedded in a PVC base weighing approximately 7 000 g/m^2.

H.2 Target composition

A single target panel (see Figure H.2) can be of any of the following, that meet penetration tests specified in annex F:

a) a single sheet of corrugated fibreboard ;

b) a single sheet of corrugated fibreboard with extra sheets of Kraft paper added in front of the target face ;

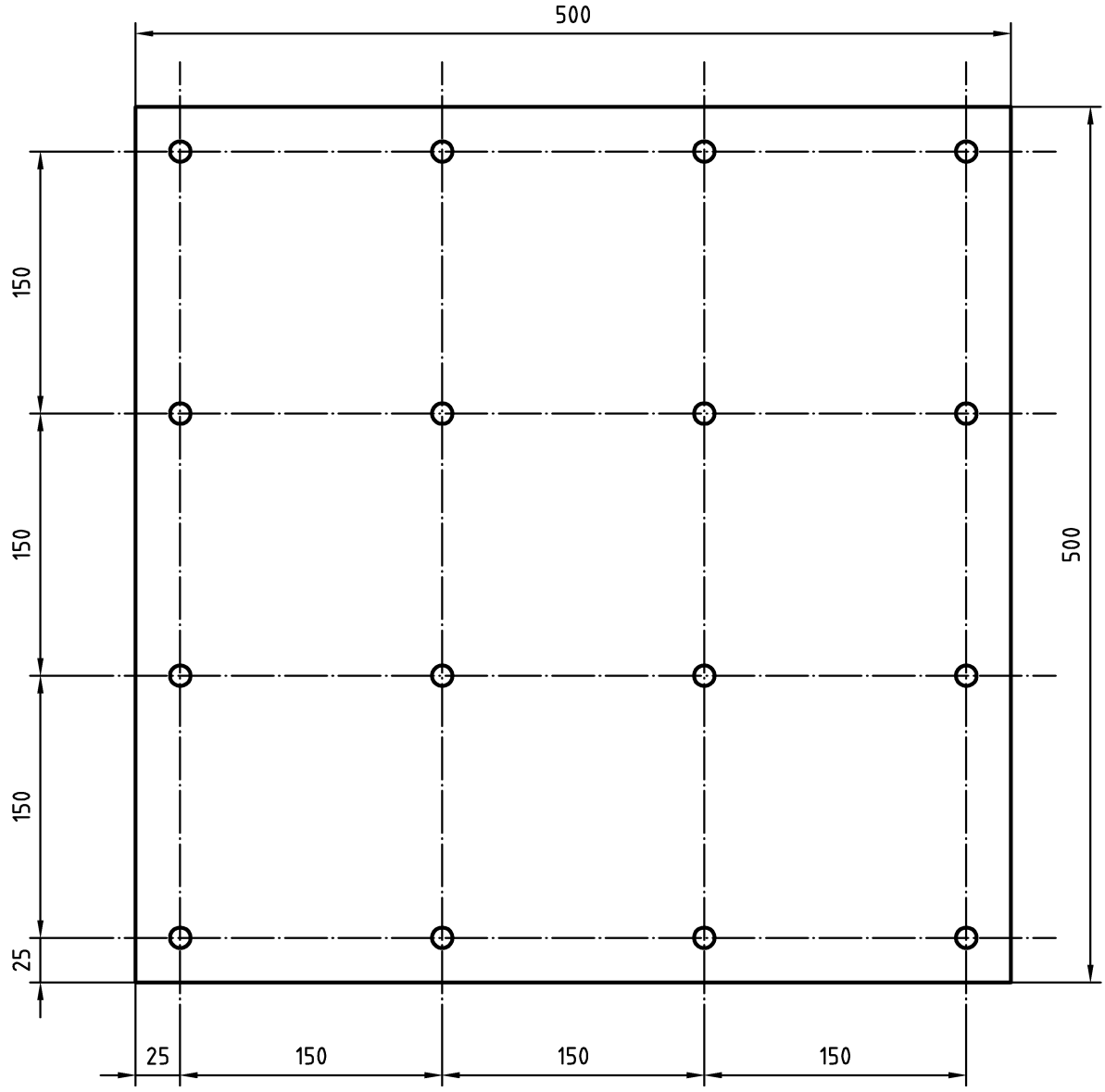
c) two sheets of corrugated fibreboard stacked together.

The fibreboard construction may have two or three liners and have one or two flutes.

The kraft paper shall be of nominal 225 g/m^2 construction which conforms to ISO 2758:1983.

NOTE The 900 mm to 2 000 mm high panel in the top operator target area for pedestrian-controlled machines comprises only a single thickness of Kraft paper.

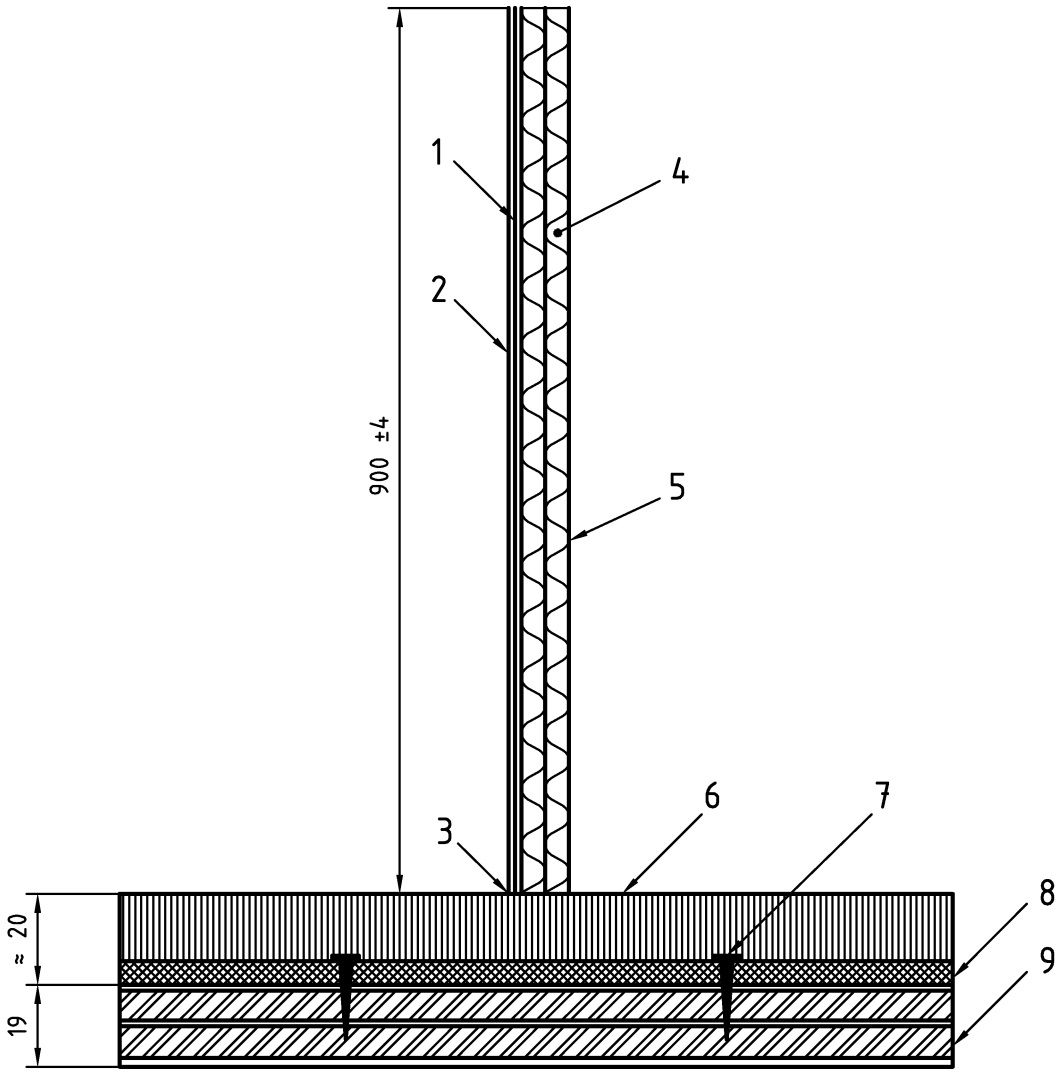
Dimensions in millimetres



NOTE Dimensions shown are approximate

Figure H.1 — Nail plan of test fixture base

Dimensions in millimetres



Key

1 Kraft paper, used as necessary
2 Inside of test enclosure
3 Target panel edges fit snugly to coconut matting surface to prevent balls from escaping from test enclosure
4 Corrugated fibreboard, one or two layers as necessary
5 Outside of test enclosure
6 Coconut matting
7 Nail
8 PVC
9 Plywood base

Figure H.2 — Test enclosure walls and base

Annex I
(normative)

Thrown object test for flail mower

I.1 Principle

The impact profile on pure sodium kraft paper stretched across a series of frames arranged around the machine as it operates over a sand/gravel mixture is used to determine whether the level of protection offered by the cutting blade protective casing is adequate.

I.2 Test installation

I.2.1 Working surface

The test shall be carried out on solid and level ground.

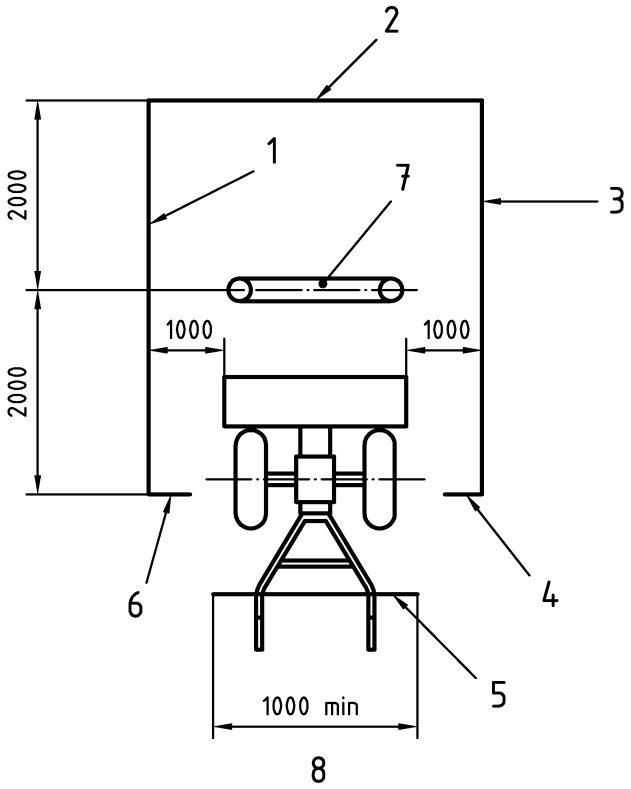
I.2.2 Panels

The test installation is composed of six panels (see Figure I.1). Panels 1 to 6 are 2 000 mm high frames over which 120 g/m^2 pure sodium kraft paper is totally stretched, without any reinforcing slats or any overlapping of paper. Except for panel 5, for which the kraft paper shall extend over the whole of the panel, the kraft paper needs only to extend from the top edge of the panel as far as a line parallel to the ground, 200 mm above the ground.

Side panels 1 and 3 shall be 4 000 mm long. Panel 5 shall have the same length as the working width of the machine, but shall be at least 1 000 mm long. Panel 5 shall be attached to the handlebars of the machine at 90° to the direction of operation of the machine, and shall extend downwards to the ground. Panel 2 shall be so long that it extends 1 000 mm perpendicular to the direction of operation of the machine beyond both sides of the cutting blade tip circle of the machine.

Panels 1 and 3 join the ends of panel 2 at one of its ends at 90°. Panels 4 and 6 join panels 3 and 1 respectively at their other end at 90°. The lengths of panels 4 and 6 shall be such that panel 5 mounted on the machine handlebars can just fit through the gap between their ends without disturbing the set-up of the panels.

Dimensions in millimetres



Key

1to 6	Panels
7	Test material
8	Working width

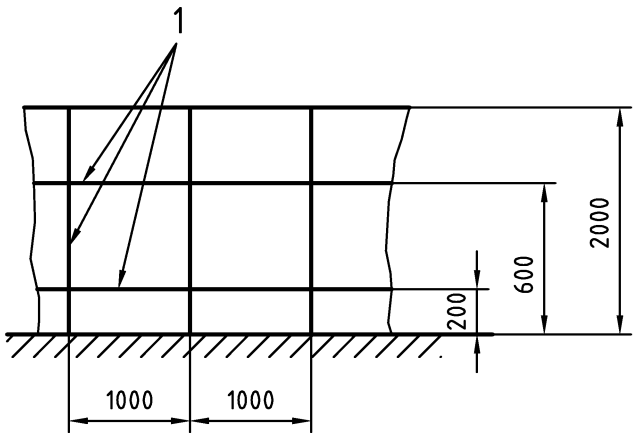
Figure I.1 — Test installation

I.2.3 Impact zones

For panels 1, 2, 3, 4 and 6, horizontal reference lines shall be drawn across the panels at 200 mm and 600 mm above ground level (see Figure I.2 a)). The zone between the two lines shall be known as the middle zone, and that between the upper line and the top edge of the panel shall be known as the upper zone.

For panel 5, two vertical reference lines shall be drawn, each one 400 mm from the centre vertical of the panel, to define the central operator zone. A further horizontal reference line 300 mm above ground level shall be drawn across the panel (see Figure I.2 b)). The portion of the central operator zone above this horizontal line shall be known as the upper zone and the portion of the central operator zone below it shall be known as the lower zone.

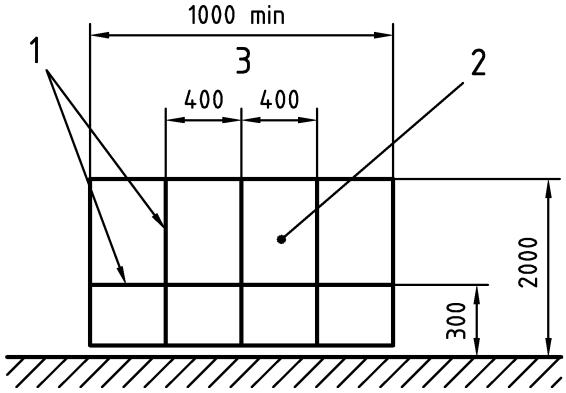
Dimensions in millimetres



Key

1 Reference lines

a) Panels 1, 2, 3, 4 and 6



Key

1 Reference lines
2 Operator zone
3 Working width

b) Panel 5

Figure I.2 — Reference lines

I.2.4 Test material

The mixture used as projection material shall be made up by volume of :

— 1/2 sand ;

— 1/4 gravel of grain size 8 mm to 16 mm (excluded) ;

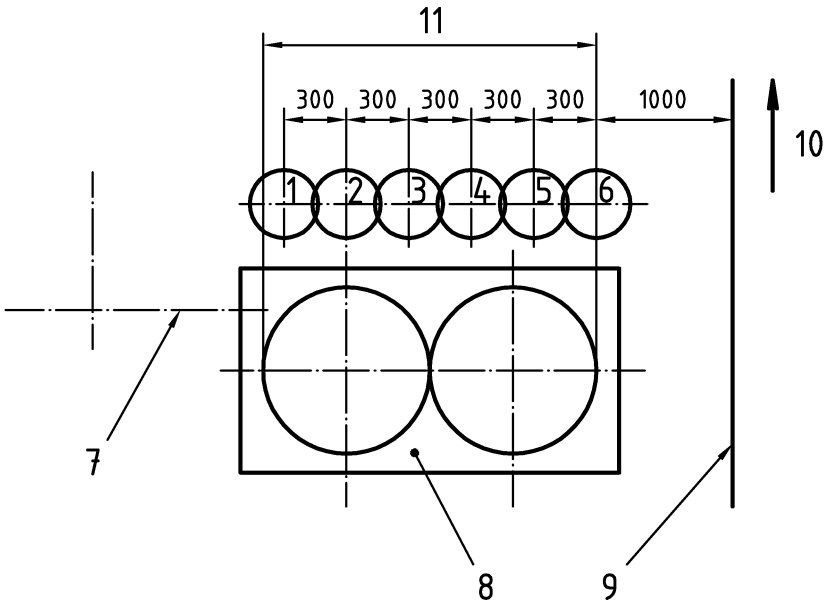
— 1/4 gravel of grain size 16 mm to 31,5 mm (excluded).

Sand shall be humidified to reach saturation point and be kept damp during the test. The mixture shall be homogeneous.

I.3 Test procedure

On the line joining the midpoints of the long sides of panels 1 and 3, pour 10 l of the test material out into a series of conical piles (150 ± 5) mm high with their centres 300 mm apart (see Figure I.3). Use enough piles so that the width of the row of piles is at least as wide as the cutting blade width.

Dimensions in millimetres



Key

1 to 6 Test material
7 Attachment axis
8 Upper cover
9 Panel
10 Direction
11 Cutting width

Figure I.3 — Arrangement of test material

Adjust the cutting blade height to 50 mm, or where this is not possible, to the nearest available cutting height. The test shall be carried out by selecting the gear which gives an operating speed most close to 1,0 m/s (approx. 3,6 km/h). Adjustable devices shall be in their most disadvantageous settings with regard to degree of protection from projected objects.

Operate the machine in a straight line towards the test enclosure and over the row of piles of test material, stopping just before reaching panel 2. Record the number of holes which arise due to projection of the test material in the upper and lower zones of the panels.

Repeat the test, but this time pour the test material out into a series of piles which are displaced some 300 mm laterally with respect to those in the first test, i.e. if the first test had piles at positions 1, 3, 5, etc. in Figure I.3, then the second test would have piles at positions 2, 4, 6, etc.

I.4 Test result

An impact is defined as a hole in the kraft paper or a tear with a deformation of the paper towards the exterior. If a stone is lodged in the paper, it shall be registered only if it is situated in the upper zone or in the operator's zone.

Holes located on a reference line shall be counted in the zone beneath this line.

The results of one test are considered to be positive when the following four conditions are satisfied :

a) in the lower zone of panel 5, there shall be no more than two impacts ;

b) in the upper zone of panel 5, there shall be no impact ;

c) in the middle zones of panels 1, 2, 3, 4 and 6 together, there shall be no more than two impacts per m^2 ;

d) in the upper zones of panels 1, 2, 3, 4 and 6, there shall be no impact.

I.5 Acceptance criteria

When the results of the two tests are positive, the machine is considered to have fulfilled the thrown object test.

When the results of the two tests are different, a third test is to be carried out. If the result is positive, the machine is considered to have fulfilled the thrown object test, if not the machine does not comply with the test.

Annex J
(normative)

Thrown object test for scrub clearing machines

J.1 Test equipment

J.1.1 Test surface

The scrub clearing machine shall be tested on a coconut matting and plywood base as specified in Figures H.1 and H.2.

J.1.2 Target

The target is located on the rear of the machine in the positions defined in Figure J.1.

The top elevation area (from 0,9 m to 2 m) comprises only a single thickness of Kraft paper of nominal 225 g/m^2 construction. The lower elevation area (from 0 to 0,9 m) in corrugated fibreboard shall comply with requirements of annex F and of the penetration test as indicated in H.2.

J.1.3 Balls

6,35 mm diameter balls of hardened steel 45 HRC minimum (e.g. balls used as ball bearings).

J.1.4 Injection point

An injection point shall be provided for each blade of a multi-spindle scrub clearing machine.

Each point shall be located on the horizontal line passing by the rotation axis of the blade and by the edge limiting the side enclosure; it shall be located (25 ± 5) mm inside the blade tip circle of this blade.

According to the direction of the rotation of the blades, the injection point is located either on the left or on the right side of the machine. It shall be on the side allowing balls to be directed towards the driving area.

J.1.5 Injection tube

The injection tube shall flush with the upper surface of the plywood base (see Figure H.2), the device shall be so arranged that the balls can be ejected with variable velocity.

J.1.6 Preliminary adjustments of the velocity

Adjust the velocity with which the balls are ejected so that the balls rise not less than 40 mm above the surface of the coconut matting.

J.2 Test method

J.2.1 The scrub clearing machine on the test surface shall be adjusted to its maximum cutting height, with the engine working at its maximum speed specified by the manufacturer; the target is located according to figure 6 or Figure J.1 if a transversal setting of the handlebar is possible.

J.2.2 Balls velocity

The velocity is increased until each ball is hit by the blade (balls may only be recycled if they have not been damaged).

J.2.3 Test procedure

Inject 500 balls into each injection point and register for each 100 projectiles the number of hits on the data sheet proposed in J.3 (the hits are defined as the mark of the projectiles going through the target).

If the test is carried out again, the blade of the scrub clearing machine shall be replaced ; not more than 500 balls for one blade are accepted.

J.2.4 Test result and acceptance

For each test (500 balls), there shall be no hit in the top elevation target (from 0,45 m to 2 m) and not more than 5 balls shall hit the target panels in the lower elevation target (from 0 m to 0,45 m).

In the event of a failure, two additional scrub clearing machines shall be tested ; if either of these additional machines fails a test, the model shall have failed the requirements of the test.

J.3 Data sheet - Thrown object test for scrub clearing machine

Manufacturer : .....

.....

.....

Machinery: .....

Brand: .....

Model: .....

Serial number: .....

Rotational speed of the engine: .....**r/min**

Rotational speed of the blade: .....**r/min**

Cutting width: .....

1st test	**Number of hits for 100 projectiles**					**Total of hits**
	100	100	100	100	100	
Operator target area < 450 mm						
Operator target area > 450 mm						

2nd test	**Number of hits for 100 projectiles**					**Total of hits**
	100	100	100	100	100	
Operator target area < 450 mm						
Operator target area > 450 mm						

3rd test	**Number of hits for 100 projectiles**					**Total of hits**
	100	100	100	100	100	
Operator target area < 450 mm						
Operator target area > 450 mm						

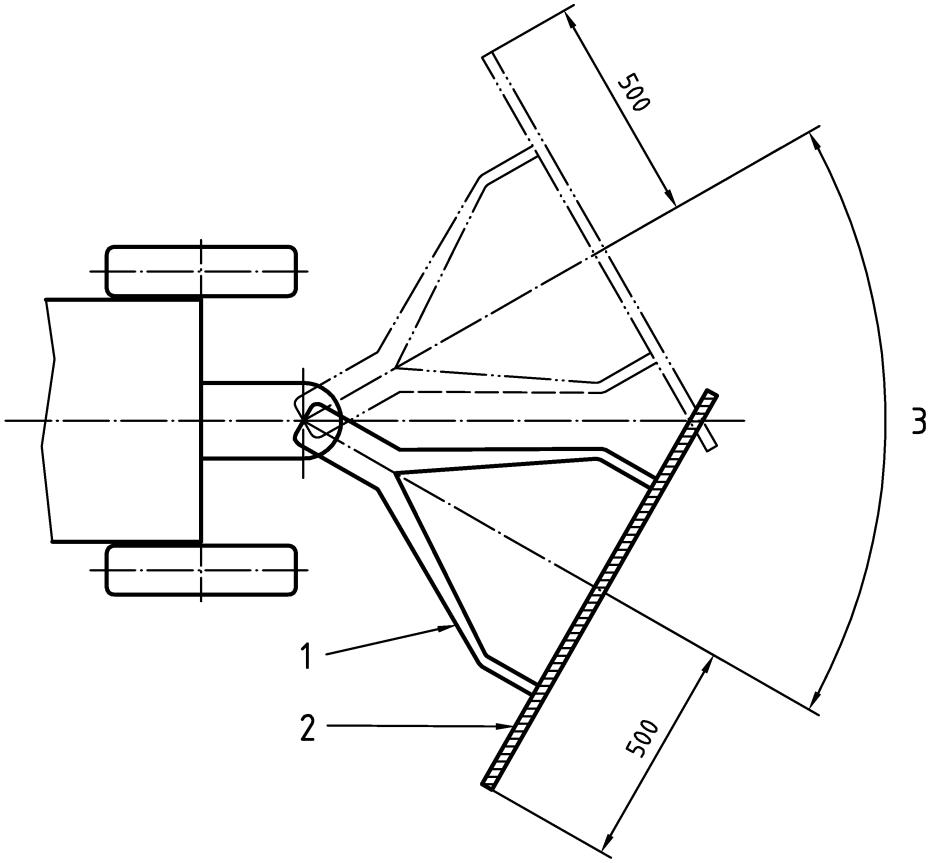
Observations: .....

.....

.....

.....

Dimensions in millimetres



Key

1 Handlebars
2 Panel
3 Maximum side adjustable angle

Figure J.1 — Position of the panel with adjustable handlebars

Annex K
(informative)

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

K.1 Material

Mineral fibre, 20 mm thick, having an airflow resistance of 11 kN.s/m^4 and a density of 25 kg/m^3.

K.2 Construction

As is shown in figure K.1, the artificial flooring of the measurement site is sub-divided into nine joint planes, each of 1,20 m x 1,20 m. The backing layer (a) of the construction as shown in Figure K.1 consists of chipboard, 19 mm thick, coated with a plastics material on both sides. Such boards are used, for example, for the construction of kitchen furniture. The cut edges of the chipboards should be protected against moisture by applying a coat of plastic paint. The outsides of the flooring are bordered by a two-legged aluminium section (d), its leg height being 20 mm. Sections of this profile material are also screwed to the edges of the joint planes where they serve as spacers and attachment points.

On the middle joint plane on which the machine is placed during measurement as well as on two other joint planes over which mower is driven or which have to be stood on in order to carry out speed measurements, etc., aluminium T-sections (c) with a leg length of 20 mm are mounted as spacers. These sections also provide exact markings which facilitate the alignment of the machine in the middle of the measurement site. The prepared boards are then covered with the insulating felt material (b) cut to size.

The felt flooring of the joint planes which are neither stood on nor driven over (type A surface in Figure K.1) are covered with a simple wire mesh fastened to the edge strips and to the attachment points; for this purpose, the sections should be provided with holes. Thus, the material is adequately attached, but it remains possible to replace the felt material should it become soiled. As a wire mesh, a so-called aviary wire (e) with a mesh width of 10 mm and a wire diameter of 0,8 mm has proved to be suitable. This wire appears to protect the surface adequacy without affecting the acoustic conditions.

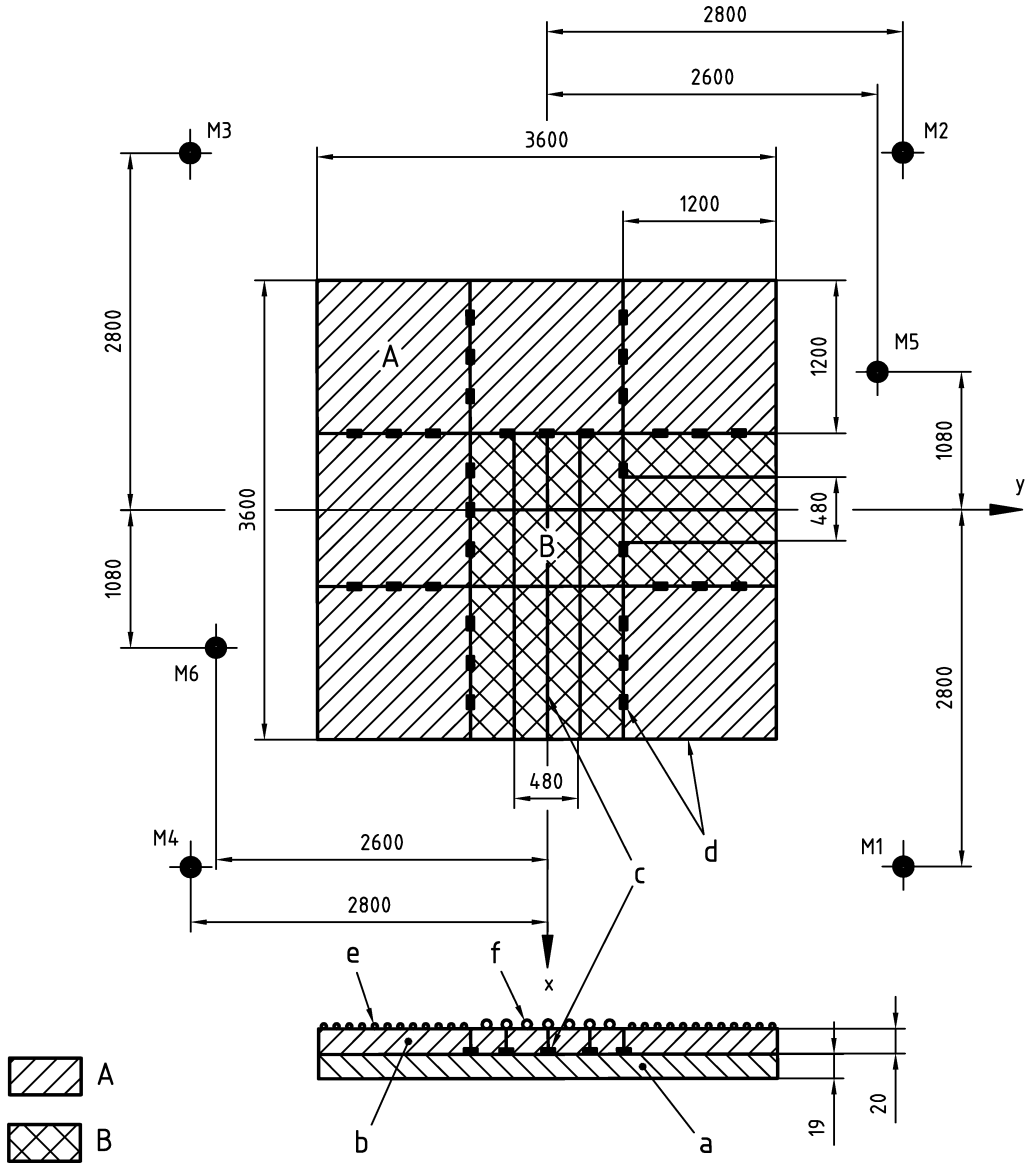
Protection by simple wire mesh is not, however, sufficient in the area subjected to traffic (type B surface in Figure K.1). For these surfaces, the use of wire grating of corrugated steel wire (f) with a diameter of 3,1 mm and a mesh width of 30 mm has proved to be suitable.

The construction of the measurement site as described above offers two advantages: it can be prepared without much time and effort, and all the materials are easily obtainable.

The fact that the microphone positions (M) are not situated directly above the flooring of the measurement site allows the microphones to be easily mounted on stands, assuming that the ground is even and hard as, for example, an asphalt or concrete site.

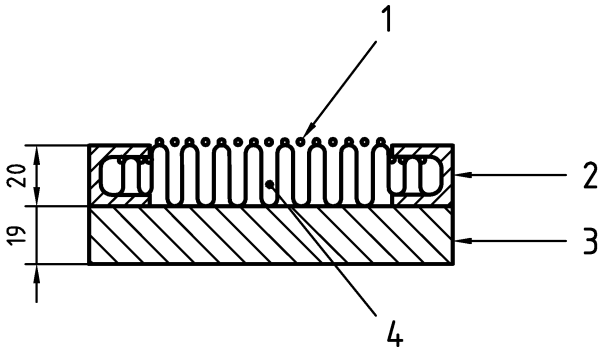
When arranging the microphones, account has to be taken of the fact that the height of the microphones has to be determined in relation to the surface of the flooring of the measurement site. It shall, therefore, be 40 mm higher when measuring from the ground under the microphone.

Dimensions in millimetres



Key

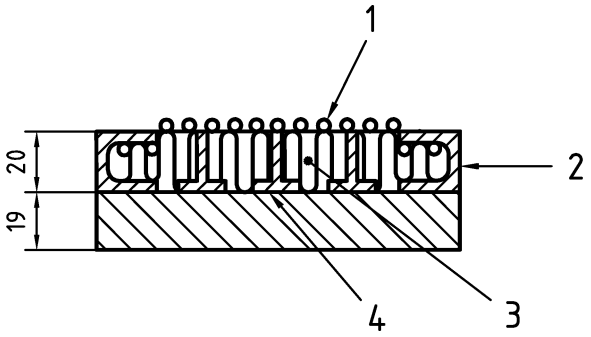
A Type A surface
B Type B surface
a Backing layer
b Insulating felt material
c Aluminium t-sections
d Two-legged aluminium sections
e Wire mesh
f Wire grating
M1 to M6 Microphone positions



Key

1 Wire mesh (mesh width 10; wire diameter 0,8)
2 Two-legged aluminium sections, 3 x 20
3 Plastics-coated chipboard
4 Mineral wool layer (insulating felt material)

a) Profile of type A surface: not stood on or driven over



Key

1 Wire grating (mesh width 30; wire diameter 3,1)
2 Plastic-coated chipboard
3 Mineral wool layer (insulating felt material)
4 Aluminium T-sections, 3 x 20

b) Profile of type B surface: stood on or driven over

Figure K.1 — Sketch of the measurement site covered with an artificial flooring (not to scale)

Annex L
(informative)

Examples of machines

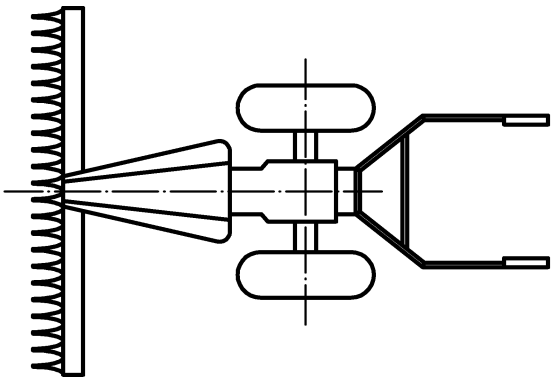


Figure L.1 — Sickle bar mower

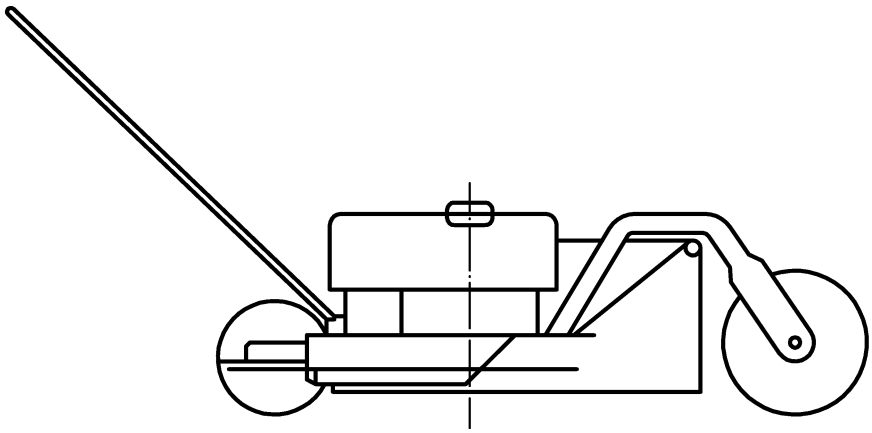


Figure L.2 — Grassland mower

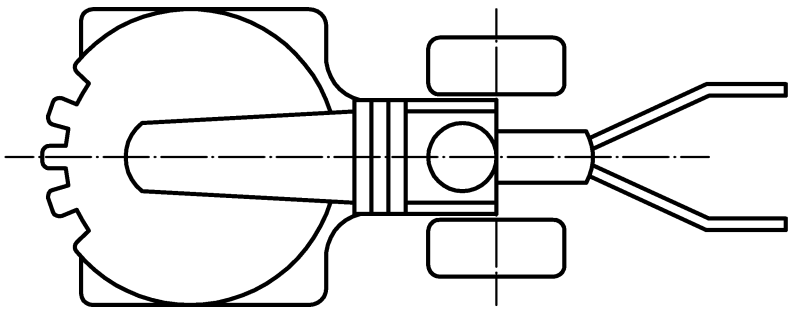


Figure L.3 — Scrub clearing machine

Annex ZA
(informative)

Clauses of this European Standard addressing essential requirements or other provisions of EU Directives.

This European standard 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 :

— Machinery Directive 98/37/EC amended by Directive 98/79/EC.

WARNING : Other requirements and other UE Directives <u>may</u> be applicable to the product(s) falling within the scope of this standard.

Compliance with this standard provides one means of conforming with the specific essential requirements of the Directive concerned and associated EFTA regulations.

Bibliography

[1] EN 563:1994, *Safety of machinery — Temperatures of touchable surfaces — Ergonomics data to establish temperature limit values for hot surfaces.*

[2] EN 745:1999, *Agricultural machinery — Rotary mowers and flail-mowers — Safety*

[3] EN ISO 11691:1995, *Acoustics — Measurement of insertion loss of ducted silencers without flow — Laboratory survey method (ISO 11691:1995).*

[4] EN ISO 11806:1997, Agricultural and forestry machinery — Portable hand-held combustion engine driven brush cutters and grass trimmers — Safety (ISO 11806:1997).

[5] EN ISO 11820:1996, *Acoustics — Measurements on silencers in situ (ISO 11820:1996).*

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