BS EN 60335-2-77:2010

BSI Standards Publication

Safety of household and similar appliances

Part 2-77: Particular requirements for pedestrian-controlled walk-behind electrically powered lawn mowers

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National foreword

This British Standard is the UK implementation of EN 60335-2-77:2010. It was derived by CENELEC from IEC 60335-2-77:2002. It supersedes BS EN 50338:2006 and BS EN 60335-2-77:2006, which will be withdrawn on 1 September 2013.

The UK participation in its preparation was entrusted by Technical Committee CPL/61, Safety of household and similar electrical appliances, to Subcommittee CPL/61/23, Lawnmowers.

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

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Compliance with a British Standard cannot confer immunity from legal obligations.

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(IEC 60335-2-77:2002, modified)

Appareils électrodomestiques et analogues - Sécurité - Partie 2-77: Règles particulières pour les tondeuses à gazon fonctionnant sur le réseau et à conducteur à pied (CEI 60335-2-77:2002, modifiée)

Sicherheit elektrischer Geräte für den Hausgebrauch und ähnliche Zwecke - Teil 2-77: Besondere Anforderungen für handgeführte elektrisch betriebene Rasenmäher (IEC 60335-2-77:2002, modifiziert)

CENELEC

European Committee for Electrotechnical Standardization
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Foreword

The text of the International Standard IEC 60335-2-77:2002, prepared by SC 61F, Safety of hand-held motor-operated electric tools, of IEC TC 61, Safety of household and similar electrical appliances, together with the common modifications prepared by the Technical Committee CENELEC TC 61F, Safety of hand-held and transportable motor-operated electric tools, was submitted to the CENELEC formal vote and was approved as EN 60335-2-77 on 2010-09-01.

This document supersedes EN 50338:2006 and EN 60335-2-77:2006.

The text of EN 60335-2-77:2006 has been revised by CLC/TC 116/WG 5, Garden appliances, to add the mechanical requirements and bring this standard in line with the Machinery Directive 2006/42/EC. Additionally the safety requirements for battery powered lawnmowers have been included to replace EN 50338:2006; therefore the title is renamed.

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

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2011-09-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2013-09-01

This Part 2-77 is to be used in conjunction with EN 60335-1. This Part 2-77 supplements or modifies the corresponding clauses of EN 60335-1, so as to convert it into the European Standard: Particular requirements for pedestrian-controlled walk-behind electrically powered lawn mowers.

When a particular subclause of Part 1 is not mentioned in this Part 2-77, that subclause applies as far as is reasonable. When this standard states “addition”, “modification” or “replacement”, the relevant text of Part 1 is to be adapted accordingly.

This European Standard has been prepared under Mandate M/396 given to CENELEC by the European Commission and the European Free Trade Association and covers essential requirements of EU Directive 2006/42/EC. See Annex ZZ.

There are no special national conditions causing a deviation from this European Standard, other than those listed in Annex ZA to EN 60335-1.

There are no national deviations from this European Standard, other than those listed in Annex ZB to EN 60335-1.

Other harmonised standards referred to in this European Standard are listed in Annex ZC of Part 1 and this Part 2. The annex lists the valid edition of those documents at the time of issue of this EN. All references are however to be understood as references to the latest edition.

The following numbering system is used:

– subclauses that are numbered starting from 101 are additional to those in Part 1;

– additional annexes are lettered AA, BB, etc.;

NOTE In this European Standard the following print types are used:
- requirements proper: in roman type;
- *test specifications: in italic type;*
- explanatory matter: in smaller roman type.

Contents

Figures

Tables

Introduction

This document is a C type standard as stated in EN ISO 12100-1.

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

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

1 Scope

This clause of Part 1 is replaced by the following.

This European Standard specifies safety requirements and their verification for the design and construction of pedestrian controlled walk-behind electrically powered lawnmowers. This standard applies in conjunction with EN 60335-1.

This European Standard does not apply to

– lawn trimmers, lawn edge trimmers, lawn edgers, flail mowers, scrub cutters, automatic (robot) lawn mowers, sickle-bar mowers, agricultural mowers, trailing seat/sulky units, ride-on machines or non-powered lawnmowers

– rotary lawnmowers for which the cutting means is a generally circular central drive unit on which is mounted, either one or more non-metallic filaments or one or more non-metallic, pivotally mounted cutting elements. These cutting elements rely on centrifugal force to achieve cutting, with the kinetic energy of a single cutting element not exceeding 10 J,

– battery powered lawnmowers with a rated voltage of the battery more than 42 V d.c.

Requirements for battery chargers, including those incorporated into the machine are dealt with in EN 60335-2-29.

This European Standard is not applicable to lawnmowers, which are manufactured before the date of publication of this document by CENELEC.

NOTE Combustion engine driven machines are covered by EN 836.

2 Normative references

This clause of Part 1 is applicable except as follows.

Addition:

EN 60320-2-3, Appliance couplers for household and similar general purposes – Part 2-3: Appliance couplers with a degree of protection higher than IPX0 (IEC 60320-2-3)

EN 60335-1, Household and similar electrical appliances – Safety – Part 1: General requirements (IEC 60335-1, mod.)

EN 60335-2-29, Household and similar electrical appliances – Safety – Part 2-29: Particular requirements for battery chargers (IEC 60335-2-29)

EN ISO 354:1993 [1)], Acoustics – Measurement of sound absorption in a reverberation room (ISO 354:1985)

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)

EN ISO 3767-1:1995 [2)], Tractors, machinery for agriculture and forestry, powered lawn and garden equipment – Symbols for operator controls and other displays – Part 1: Common symbols (ISO 3767-1:1991)

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

2) Superseded by EN ISO 3767-1:2000, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment - Symbols for operator controls and other displays - Part 1: Common symbols* (ISO 3767-1:1998), withdrawn.

EN ISO 3767-2:1995 [3)], Tractors, machinery for agriculture and forestry, powered lawn and garden equipment – Symbols for operator controls and other displays – Part 2: Symbols for agricultural tractors and machinery (ISO 3767-2:1991)

EN ISO 3767-3 [3)], Tractors, machinery for agriculture and forestry, powered lawn and garden equipment – Symbols for operator controls and other displays – Part 3: Symbols for powered lawn and garden equipment (ISO 3767-3)

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 12100-1:2003, Safety of machinery – Basic concepts, general principles for design – Part 1: Basic terminology, methodology (ISO 12100-1:2003)

EN ISO 12100-2:2003, Safety of machinery – Basic concepts, general principles for design – Part 2: Technical principles (ISO 12100-2:2003)

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

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

ISO 500:1991 [4)], Agricultural tractors – Rear-mounted power take-off – Types 1, 2 and 3

ISO 2758:1983 [5)], Paper – Determination of bursting strength

ISO 3304:1985, Plain end seamless precision steel tubes – Technical conditions for delivery

ISO 3305:1985, Plain end welded precision steel tubes – Technical conditions for delivery

ISO 3306:1985, Plain end as-welded and sized precision steel tubes – Technical conditions for delivery

ISO 4046:1978 [6)], Paper, board, pulp and related terms – Vocabulary

ISO 4200:1991, Plain end steel tubes, welded and seamless – General tables of dimensions and masses per unit length

ISO 11684, Tractors, machinery for agriculture and forestry, powered lawn and garden equipment – Safety signs and hazard pictorials – General principles

EN ISO 3767-5, Tractors, machinery for agriculture and forestry, powered lawn and garden equipment - Symbols for operator controls and other displays - Part 5: Symbols for manual portable forestry machinery

ISO 3864, Graphical symbols – Safety colours and safety signs

ISO 7000, Graphical symbols for use on equipment –Index and synopsis

ISO 7010, Graphical symbols – Safety colours and safety signs –Safety signs used in workplaces and public areas

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3) Withdrawn.

4) Superseded by ISO 500:2004 series, *Agricultural tractors – Rear-mounted power take-off types 1, 2 and 3.*

5) Superseded by EN ISO 2758:2003, *Paper – Determination of bursting strength* (ISO 2758:2001).

6) Superseded by ISO 4046:2002 series, *Paper, board, pulp and related terms – Vocabulary.*

3 Definitions

This clause of Part 1 is applicable except as follows.

3.1.9 *Replacement:*

3.1.9
normal operation
operation of the machine under the following conditions: the machine is operated at rated voltage with the load necessary to attain rated power input

Addition:

3.101
cutting means tip circle
path described by the outermost point of the cutting means cutting edge as it rotates about its shaft axis

3.102
braking distance
distance travelled between the point of the first application of the brake control and the point at which the machine comes to rest

3.103
braking system
combination of one or more brakes and related means of operation and control

3.104
cutting means; blade
mechanism used to provide the cutting action

3.105
cutting means enclosure
part or assembly which provides the protective means around the cutting means

3.106
cutting positions
any height setting of the cutting means designated by the manufacturer for cutting grass

3.107
cutting width
total width of cut measured across the cutting means at right angles to the direction of travel

3.108
cylinder lawnmower
powered lawnmower with one or more cutting means rotating about a horizontal axis to provide a shearing action with a fixed cutter bar or cutting means

3.109
discharge chute
extension of the cutting means enclosure from the discharge opening, generally used to control the discharge of material from the cutting means

3.110
discharge opening
gap or opening in the cutting means enclosure through which grass can be discharged

3.111
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

3.112
grass catcher
part or combination of parts which provides a means for collecting grass clippings or debris

3.113
hover lawnmower
powered lawnmower which uses a cushion of air as its ground support

3.114
lawn edger
powered machine suitable for cutting lawn and soil, usually in a vertical plane

3.115
lawn edge trimmer
grass trimming machine where the cutting means operates in a plane approximately perpendicular to the ground

3.116
lawn trimmer
grass trimming machine where the cutting means operates in a plane approximately parallel to the ground

3.117
maximum operating motor speed
highest motor speed obtainable when adjusted in accordance with the machine manufacturer's specifications and/or instructions with the cutting means engaged

3.118
mowing attachment
cutting means designed to be easily detached from the machine, generally to allow the machine to be used for other purposes

3.119
mulching lawnmower
rotary lawnmower without discharge openings in the cutting means enclosure

3.120
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

3.121
open discharge chute
discharge chute without a self closing guard or with a self closing guard which does not completely close the chute

3.122
operator control
any control requiring operator actuation to perform specific functions

3.123
operator presence control
control designed so that it will automatically interrupt power to a drive when the operator's actuating force is removed

3.124
pedestrian-controlled powered lawnmower
grass-cutting machine, either pushed or self-propelled, normally controlled by the operator walking behind the unit

3.125
powered lawnmower
grass-cutting machine or a machine with grass-cutting attachment(s) which uses the ground to determine the height of cut by means of wheels, air cushion or skids, etc., and which utilizes an electric motor for a power source

3.126
ride-on (riding) machine; lawn and garden tractor
self-propelled machine on which an operator rides and which is designed primarily for cutting grass and auxiliary garden work

NOTE The **cutting means** can be an integral part of the machine or suspended from or attached to the machine.

3.127
rotary lawnmower
powered lawnmower in which one or more cutting means, cutting by impact, rotate about an axis normal to the cutting plane

3.128
service brake system
designated primary means for decelerating and stopping a machine from its ground travel speed

3.129
sickle bar mower
mower which uses an electric power source to reciprocate a knife or knives to provide a shearing action with a stationary cutter bar or movable knife

3.130
trailing seat/sulky unit
removable, trailing device designed to carry a standing or seated operator to ride behind while controlling a self-propelled, pedestrian-controlled lawnmower or tractor

NOTE Also known as a "sulky".

3.131
automatic (robot) mower
automatic lawnmower that operates without human control. It operates only within a delimited perimeter or within a pre-programmed area

3.132
cutter unit
combination of cutting means and cutting means enclosure

3.133
disabling device
part which is removable from the lawnmower, such as for example a key, which prevents operation of the lawnmower when it is removed

3.134
removable battery
battery that is removable without tools

4 General requirement

This clause of Part 1 is applicable.

5 General conditions for the tests

This clause of Part 1 is applicable except as follows:

5.2 Addition:

A new machine shall be used for each of the tests of Clause 21.

5.5 Addition:

During the tests the cutting means are adjusted and lubricated in accordance with the manufacturer's instructions specific to the test.

NOTE For example, cylinder mower cutting means may not be able to run for extended periods at normal adjustment because of lack of lubrication etc. normally provided by the grass.

5.6 Addition:

Electronic speed control devices are set for the highest speed.

5.8.1 Replacement:

Unless otherwise specified, a fully charged battery shall be used for each test. Where for consecutive tests the same battery is specified there shall be a minimum of 1 min rest time between tests.

6 Classification

This clause of Part 1 is applicable except as follows.

6.1 Replacement:

Mains operated machines shall be of one of the following classes with respect to protection against electric shock:

– class II or class III.

Battery powered machines incorporating battery chargers shall be class II. Other battery-powered machines shall be class III.

Compliance is checked by inspection and by the relevant tests.

6.2 Addition:

Class II machines shall be at least IPX4. Class III machines shall be at least IPX1.

7 Marking and instructions

This clause of Part 1 is applicable except as follows.

7.1 Replacement:

The machines shall be marked with the following minimum information:

– rated voltage or rated voltage range in volts;

– symbol for nature of supply, unless the rated frequency is marked;

– symbol 5172 of IEC 60417, for class II machines only;

– IP number according to degree of protection against ingress of water, other than IPX0

– name and address of the manufacturer, and, where applicable, his authorized representative

– year of construction;

– designation of machinery. This may be achieved by a combination of letters and/or number;

– designation of series or type, allowing the technical identification of the product. This may be achieved by a combination of letters and/or numbers and may be combined with the designation of machinery;

– rated power input in Watts or rated current in Amperes for mains operated machines;

– rated power input in Watts or rated current in Amperes of the charger for battery operated machines with integrated chargers

NOTE 1 The first numeral of the IP number need not to be marked on the machine.

NOTE 2 Additional markings are allowed provided they do not give rise to misunderstanding.

NOTE 3 If components are marked separately, the marking of the machine and that of the components is to be such that there can be no doubt with regard to the marking of the machine itself.

Controls which may give rise to a hazard when operated shall be marked or so placed as to indicate clearly which part of the machine they control.

Where replaceable during normal use, the cutting means shall be marked to identify the part number(s) and the manufacturer, importer or supplier.

The substance of the following warning shall be placed in a prominent position on the machine. If a pictogram is used it shall be that shown in Annex AA. It shall be in contrasting colours to the base material. If it is embossed, stamped or cast colours are not required. Markings or symbols giving cautionary information shall be located close to the hazard.

For mains operated machines:

WARNING:
Read the instruction sheet
Keep bystanders away
Beware of sharp blades. Blades continue to rotate after the motor is switched off – Remove plug from mains before maintenance or if cord is damaged.
Keep the supply flexible cord away from the cutting blades.

For battery operated machines:

For machines with integrated chargers: The rated power input of the charger

WARNING:
Read the instruction sheet
Keep bystanders away
Beware of sharp blades. Blades continue to rotate after the motor is switched off – Remove disabling device before maintenance

For all machines:

A warning where guards, except hinged, automatically closing guards for grass discharge chutes, are designed to be opened or removed of the relevant hazard visible on the machine both when the guard is closed and when it is opened or removed.

7.12 Replacement

An instruction manual shall be supplied with the machine, giving operating, servicing, maintenance and safety instructions that comply as appropriate with clause 6 of EN ISO 12100-2: 2003. The words 'Original instructions' shall appear on the language version(s) verified by the manufacturer or his authorised representative. Where no 'Original instructions' exist in the official language(s) of the country where the tool is to be used, a translation into that/those language(s) shall be provided by the manufacturer or his authorised representative or by the person bringing the tool into the language area in question. The translations shall bear the words 'Translation of the original instructions', and they shall be accompanied by a copy of the 'Original instructions'.

The instructions shall include those operations that are meant to be performed by the user. The instructions shall be simple and clear such that they are suitable for unskilled users.

a) repeat of those warnings required to be marked on the appliance together with further explanation, where appropriate. Where safety signs are used in the marking on the appliance, their function shall be explained,

b) instructions for the proper assembly of the appliance for use, if the appliance is not supplied in a completely assembled form.

c) instructions for proper adjustment and maintenance of the appliance,

d) where parts are consumable, the part number of the replacement shall be specified,

e) instructions, clearly indentifying function and direction for the operation of all controls,

f) advice on the use and type of extension cords to be used (not lighter than required by 25.7),

g) instructions for when and how to attach and detach a collection device from the machine,

h) instructions for the safe operation, preparation, maintenance and storage of the appliance,

i) instructions and, where appropriate, drawings for the recommended replacement or repair of, or service and the specifications of the spare parts to be used, when these affect the health and safety of operators,

j) instructions and, where appropriate, drawings for the designated operating position and the correct and safe operation of the lawnmower in operations such as moving, safe positioning, handling and clearing blockages,

k) the operating method to be followed in the event of breakdown,

NOTE Examples of warning are given Annex EE.

l) designation of the machinery and series or type as required by 7.1, including description of the lawnmower.

m) mass in kilograms

n) Declaration of the noise and vibration values including the uncertainties of measurement.

8 Protection against access to live parts

8.2 Addition:

For class II rotary mowers access to the surface of basic insulation or metal parts separated from live parts by basic insulation shall be permitted when the cutting means is removed if a tool is required for its removal.

9 Starting of motor-operated appliances

This clause of Part 1 is not applicable to battery-powered machines.

For mains operated machines this clause of Part 1 is replaced by the following.

Motors shall start under all normal voltage conditions that may occur in use.

Centrifugal and other automatic starting switches shall operate reliably and without contact chattering.

Compliance is checked by starting the machine three times, at no-load, at a voltage equal to 0,85 times rated voltage or the lower limit of the rated voltage range, with any control device set at maximum speed.

For the test the cutting meanss are adjusted according to the manufacturer's instructions related to this test.

The machine shall operate in such a way that safety is not affected.

10 Power input and current

This clause of Part 1 is not applicable to battery-powered machines.

For mains operated machines this clause of Part 1 is applicable except as follows.

10.1 Not applicable.

11 Heating

This clause of Part 1 is not applicable to battery-powered machines.

For mains operated machines this clause of Part 1 is applicable except as follows.

11.5 Addition:

The machine shall be operated at rated voltage and operating temperature until the rated power input or the rated current input is reached. When steady stage is reached, the submitted torque shall be measured. When tested by 0,94 and 1,06 times rated voltage the ascertained torque shall be maintained.

12 Void

13 Leakage current and electric strength at operating temperature

This clause of Part 1 is applicable for class II machines.

14 Transient overvoltages

This clause of Part 1 is applicable.

15 Moisture resistance

This clause of Part 1 is applicable except as follows.

15.1.2 Modification:

The machine shall be rotated during the test along its vertical axis. The rate of rotation shall be 12 ± 2 revolutions per minute.

15.2 Addition:

Machines fitted with an appliance inlet or cable coupler shall be tested with the appropriate mating connector in place.

Air filters are not removed.

16 Leakage current and electric strength

This clause of Part 1 is applicable for class II machines.

17 Overload protection of transformers and associated circuits

This clause of Part 1 is applicable.

18 Endurance

This clause of Part 1 is not applicable to battery-powered machines.

For mains operated machines this clause of Part 1 is applicable except as follows.

18.101 Machines shall be so constructed that, in normal use; there will be no electrical or mechanical failure that might impair compliance with this standard. The insulation shall not be damaged, and contacts and connections shall not have worked loose as a result of heating, vibration, etc.

Moreover, overload devices shall not operate under normal running conditions.

Compliance is checked by the tests of 18.102.

18.102 *The machine is operated at no load, series motors being supplied at a voltage such that the rotating speed is the same as that obtained at rated voltage and under normal operation. The machine is operated for 48 h, reduced by the running time necessary for the tests of Clauses 11 and 13.*

Machines are operated continuously, or for a corresponding number of periods, each period being not less than 8 h.

During the test, replacement of carbon brushes is allowed and the machine is lubricated as in normal use.

18.103 During the tests of 18.102, overload protective devices shall not operate.

After the tests of 18.102 the machine shall withstand the tests of Clause 16. Connections, handles, guards, brush-caps and other fittings or components shall not have worked loose, and there shall be no deterioration impairing safety.

19 Abnormal operation

For mains operated machines this clause of Part 1 is applicable except as follows:

19.7 Addition:

This test is not made on machines with flexible or freely pivoting cutting means mounted on a generally circular drive unit.

19.9 Not applicable

20 Stability and mechanical hazards

This clause of Part 1 is applicable except as follows.

20.2 Not applicable.

20.101 Power driven components

All power driven components except the cutting means and the ground-contacting parts of pedestrian-controlled self-propelled machines shall be guarded to prevent contact with these parts during normal operation.

All openings and safety distances shall conform to 4.5.2 and 4.5.3 of EN ISO 13857:2008 unless otherwise specified in this standard.

Guards shall be provided to prevent accidental contact with hazardous servicing points when the machine is serviced.

20.102 Guard attachment

All guards shall be permanently attached to the machine and shall not be detachable without the use of tools and shall withstand a force of 75 N in any direction.

The opening of guards, except for the following, shall require the use of a tool:

a) the opening of removable interlocked guards which disable the protected moving parts;

b) the opening of hinged, automatically closing guards for grass discharge chutes.

Compliance to be checked by inspection and functional test.

20.103 Controls

20.103.1 General

For operator controls other than those for:

– height of cut setting;

– cutting means setting or adjustment on cylinder machines;

– grass catcher discharge arrangements.

The location and range of movement of operator controls shall remain within anthropometric dimensions given in Figure 1. The operating range of operator controls, which do not require sustained activation, may be extended by allowing the operator's trunk, when standing with both feet on the ground, to articulate within the confines of the operator zone (e.g. lean forward until contacting the handle in any of the operating positions).

It shall not be possible to sustain a motor speed greater than the maximum operating speed (see 3.117) by use of any control or by simple adjustments made by using standard tools.

For machines with traction drive the drive shall automatically stop or disengage when the operator leaves the normal operating position.

On self-propelled machines it shall be possible to engage or disengage the traction drive when the cutting means is operating.

Controls shall have the function, direction and/or method of operation identified.

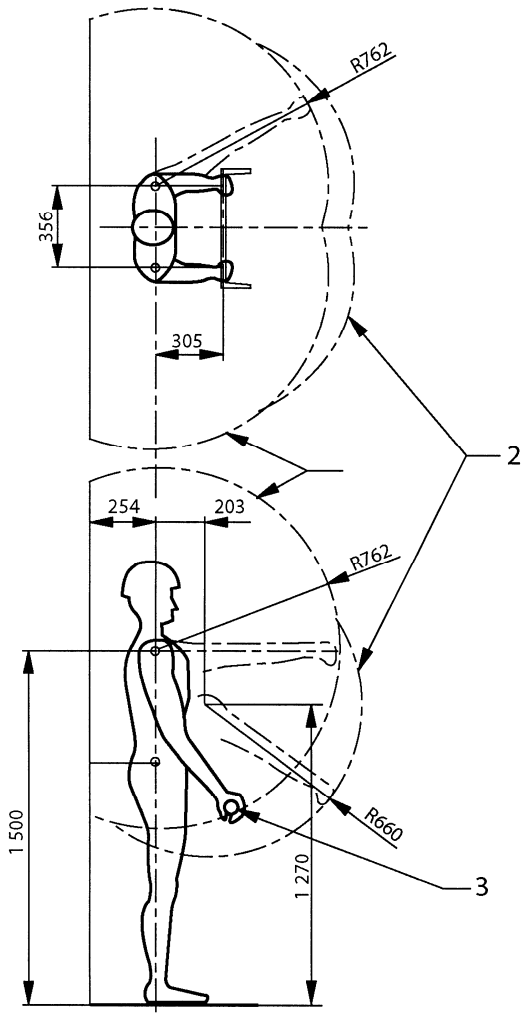
Controls which may give rise to a hazard when operated shall be marked or so placed as to indicate clearly which part of the machine they control.

20.103.2 Operator presence control

Machines shall be fitted with a device on the control handle, which will automatically stop cutting means rotation when the operator's hands are removed from the handle. This may be accomplished, for example, either by stopping the drive motor or by an intermediate cutting means brake/clutch mechanism.

For restarting cutting means rotation the control shall require two separate actions. If these actions are to be carried out by using the same hand then the actions shall be totally distinct thus to prevent accidental "switch on".

Dimensions in millimetres



Key

1 Operator zone

2 Lower forward zone

3 Handle

NOTE 1 The operator zone is the area into which the extremities of a 95th percentile male can reach from the normal operator position.

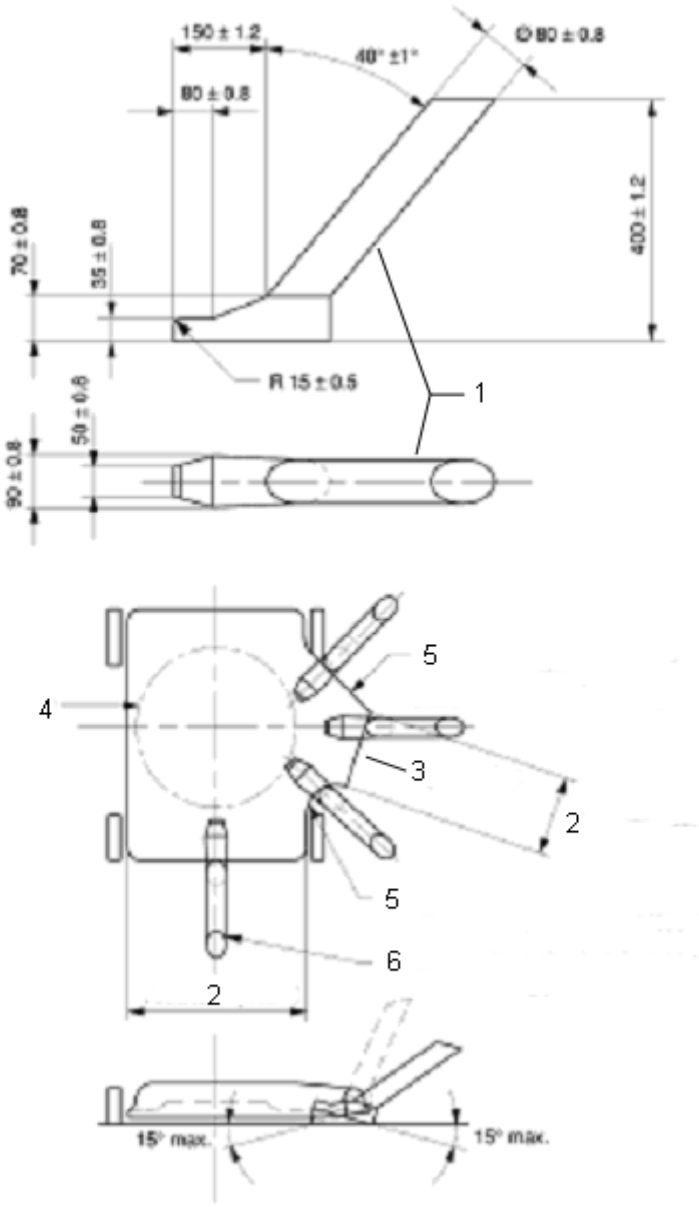
NOTE 2 The lower forward zone is the area into which a 5th percentile male or a 50th percentile female can reach when against the handle. This zone can also be reached by a 95th percentile leaning forward against the handle.

NOTE 3 All barriers (handles) within the operator zone will reduce the zone by the space occupies and protected by the barrier.

NOTE 4 The operator zone includes the maximum range of movement of all frequently used operator controls but is not intended to represent preferred operator control positions.

Figure 1 – Operator zone – Pedestrian controlled lawn mower (see 20.103)

Linear dimensions in millimetres



Key

1 Foot probe

2 Areas to be probed

3 Discharge opening

4 Cutting means tip circle

5 Side of discharge chute probed if less than 3 mm below plane of cutting means tip circle

6 Foot probe (also probe deck from any designated starting position)

Figure 2 – Foot probe test (see 20.101)

20.104 Brake requirements and test method

20.104.1 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 or below the centre of gravity and directly up the slope and parallel to it, is required to hold the machine on a 16,7° (30 %) slope.

Machines requiring additional braking means (e.g. service or parking brake system) shall be tested in accordance with 20.104.2 and 20.104.3. The machine shall be equipped with the tyres offered 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.

20.104.2 Service brake

20.104.2.1 Performance

The machine shall be equipped with a means capable of stopping its motion in both directions in a braking distance of 0,19 m for each 1 km/h.

20.104.2.2 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 directions at the maximum ground speed attainable.

20.104.3 Parking brake

20.104.3.1 General

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

The parking brake may be in combination with the service brake.

An automatic parking brake, when provided, shall be activated when the operator presence control is released.

20.104.3.2 Performance

The parking brake shall hold the machine stationary on a 16,7° (30 %) slope when tested in accordance with 20.104.3.5. The force required to engage and unlock this means shall not exceed 220 N.

20.104.3.3 Brake test equipment

A 16,7° (30 %) slope with a coefficient of friction such that the machine does not slide down the slope.

20.104.3.4 Brake test conditions

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

20.104.3.5 Brake 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.

20.104.3.6 Brake test acceptance

The machine shall not move.

20.105 Vibration

20.105.1 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 the:

– oscillating forces from the motor;

– 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.

NOTE 1 CR 1030-1:1995 gives general technical information on widely recognized technical rules and means to be followed in the design of machines for low hand-arm vibration solutions.

NOTE 2 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.

20.105.2 Reduction by information

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

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

– the wearing of personal protection equipment (PPE).

20.105.3 Vibration measurement

For the measurement of hand-arm vibration the methods given in Annex FF shall be used.

20.106 Noise

20.106.1 Reduction as a safety requirement

20.106.1.1 Reduction at source by design and by protective measures

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

– air intake system;

– cutting system;

– vibrating surfaces.

EN ISO 11688-1:1998 gives general technical information on widely recognized technical rules and means to be followed in the design of low-noise machines.

NOTE EN ISO 11691:1995 and EN ISO 11820:1996 can be used for the testing of the silencer.

20.106.1.2 Reduction by information

If after taking all possible technical measures for reducing noise at the design stage a manufacturer considers that further protection of the operator is necessary, then the instruction handbook shall:

– recommend the use of low-noise operating modes, and/or limited time of operation;

– give a warning of the actual noise level and recommend the use of ear protection if appropriate.

20.106.2 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 noise test code given in Annex GG.

20.107 Specific requirements for rotary lawnmowers

20.107.1 General construction of rotary lawnmowers

20.107.1.1 Cutting means enclosure

20.107.1.1.1 General

The cutting means enclosure shall extend at least 3 mm below the plane of the cutting means tip circle, except as allowed in 20.107.1.1.2 and at the grass discharge opening. If the bolt heads of cutting means securing screws extend below the cutting means enclosure these shall be located within the inner 50 % cutting means tip circle diameter.

Any extension of the wall(s) of the cutting means enclosure adjacent to the discharge opening, including walls of the discharge chute, not meeting this requirement shall be considered as part of the discharge opening. The walls shall satisfy the foot probe test (see 20.107.5) and conform to all the other relevant requirements of this standard.

The rear wall of the cutting means enclosure or a fixed barrier shall extend at least 120 mm from the nearest point of the cutting means tip circle and rise by an angle of not more than 5° from the horizontal (see Figure 5). The self closing guard for the discharge chute shall not be considered as forming any part of the barrier.

20.107.1.1.2 Front opening

Machines may be provided with a front opening in the front wall of maximum width as shown in Figure 6 and Figure 7 in which case the following two conditions shall be fulfilled:

– they shall satisfy the foot probe test given in 20.107.5;

– they satisfy the thrown object test given in 20.107.4.

NOTE Figure 4, 5 and 6 shows an example of a structure meeting this requirement.

Linear dimensions in millimetres

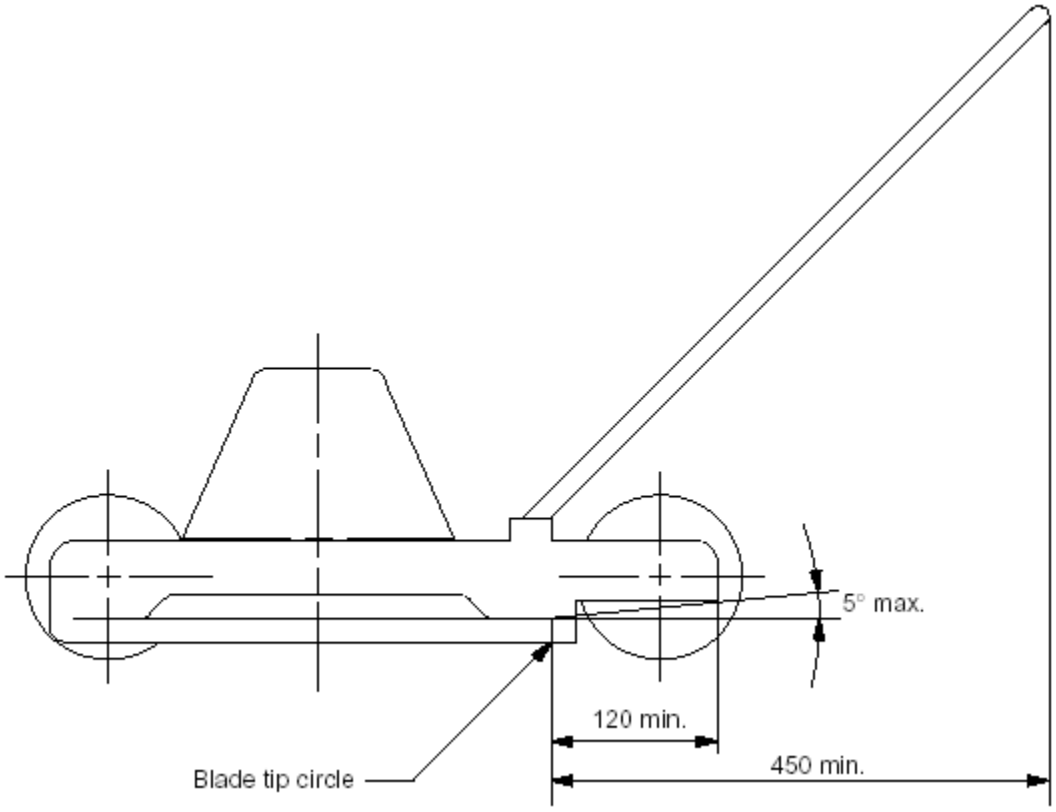


Figure 3 – Handle distance (see 20.107.6.1) and rear cutting means enclosure (see 20.107.1.1)

20.107.1.2 Guards and grass catchers

Swinging guards or guards that have to be displaced in order to fit the grass catcher shall automatically return to the operating position when the grass catcher is removed. These guards shall be considered as forming part of the cutting means enclosure for the purposes of 20.107.1.1.

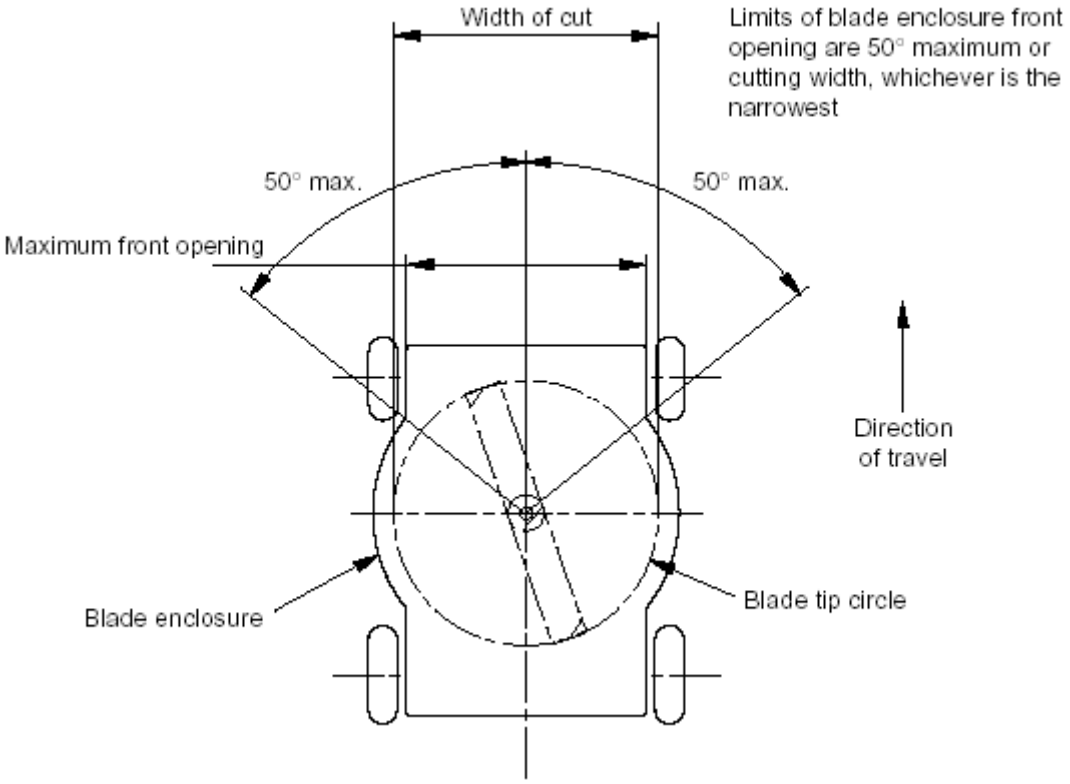


Figure 4 – Front opening restrictions for single spindle lawnmowers (see 20.107.1.1.2)

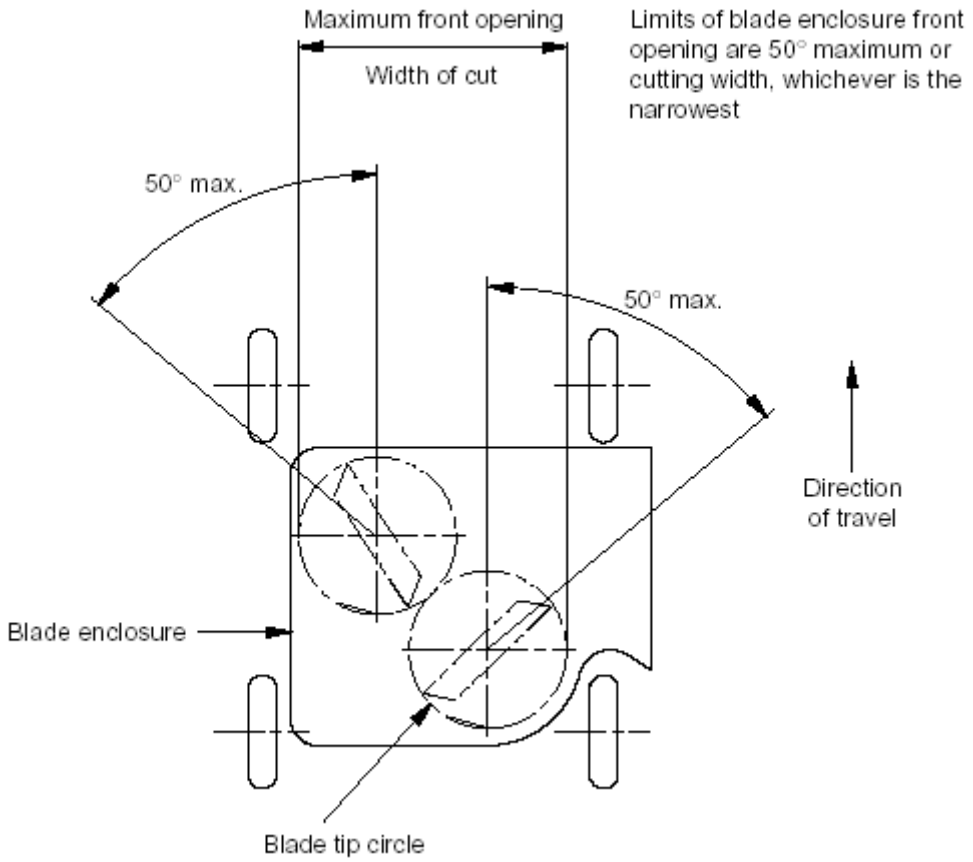


Figure 5 – Front opening restrictions for multi-spindle lawnmowers (see 20.107.1.1.2)

Dimensions in millimetres

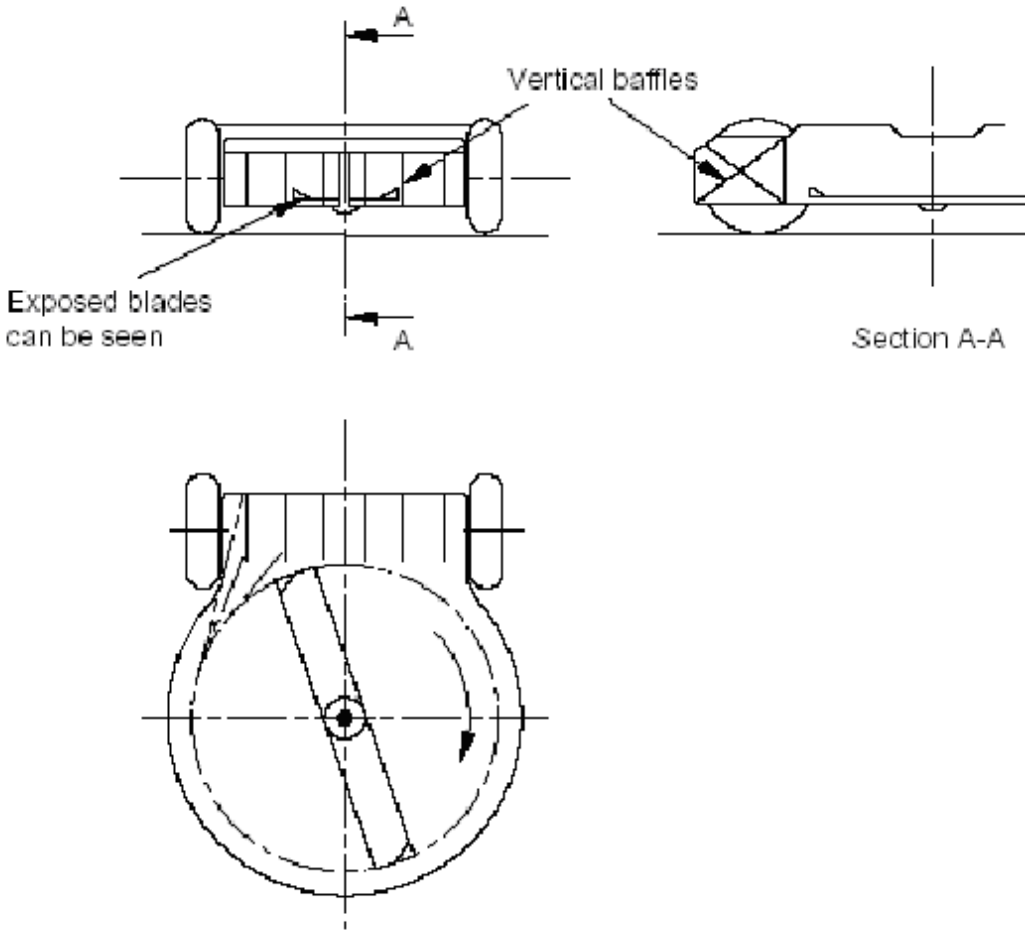


Figure 6 – Construction for front opening (see 20.107.1.1.2)

20.107.2 Cutting means stopping time

The following cutting means stopping times shall apply:

a) cutting width up to and including 600 mm: the cutting means shall stop from their maximum rotational speed within 3 s after the operator releases the controls that govern the operation of the cutting means;

b) cutting width greater than 600 mm: the cutting means shall stop from their maximum rotational speed within 5 s after the operator releases the controls that govern the operation of the cutting means.

20.107.2.1 Measurement of cutting means stopping time

Prior to the test the machine shall be assembled and adjusted according to the instruction manual. There shall be no run-in period but the cutting means control shall be operated 10 times before commencing the test. Battery powered machines shall be powered from an external power source to simulate a fully charged battery.

The machine shall be mounted and instrumented in such a manner that the results of the test are not affected. A device shall be provided to detect the moment of release of the cutting means operator presence control and another to detect movement of the cutting means.

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

The means of operating the machine during the test shall be such that the operator presence control for the cutting means 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 cutting means operator presence control until the last time a cutting means passes the sensing device.

The machine shall be subjected to a series of 5 000 stop/start cycles. The 5 000 test cycles are not required to be continuous and the machine shall be maintained and adjusted during the test in accordance with the instruction manual. There shall be no maintenance or adjustment after 4 500 cycles have been completed.

Figure 9 gives a schematic representation of two cycles. Each cycle shall consist of the following sequence:

– accelerate the cutting means from rest to the maximum operating 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 cutting means and allow the cutting means to come to rest (time = t_b);

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

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 cutting means 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 first 5 cycles of each 500 cycles of operation; and

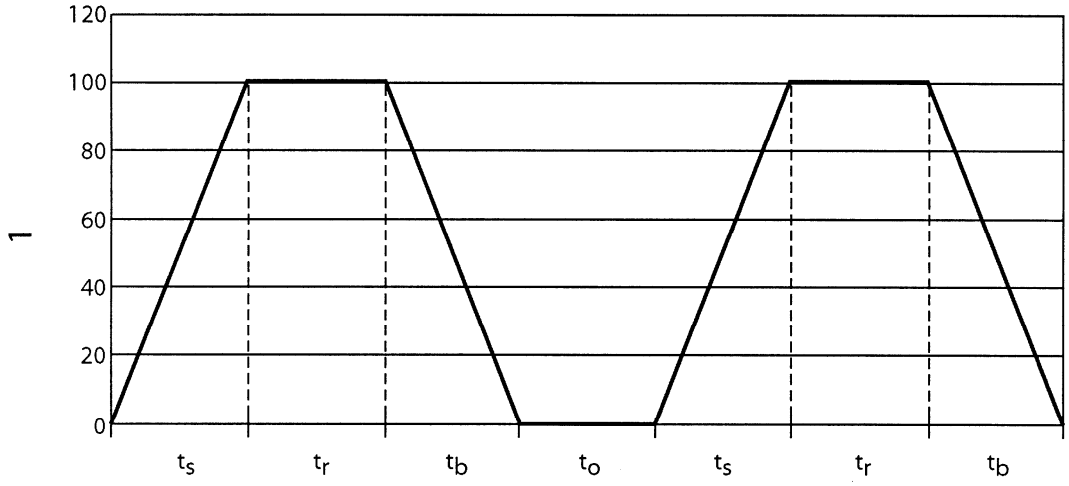
– each of the last five cycles prior to any brake maintenance or adjustment carried out during the test; and

– 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 requirements of 20.107.2 a) or 20.107.2 b).

If the test machine 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 machine may be tested which shall then comply fully with the requirements.



Key

1 Cutting means speed (% of *m*)

Figure 7 – Example of test cycle (see 20.107.2.1)

20.107.3 Verification of the safety requirements and/or measures

20.107.3.1 General

This clause specifies the tests for rotary lawnmowers.

NOTE All tests of 20.107.3 which are conducted with the motor running are dangerous. Test personnel should be adequately protected.

20.107.3.2 General test conditions

Where it is specified that the machine shall run during the tests it shall be operated at the maximum operating motor speed (3.117). Sealed adjustments shall not be moved when checking the maximum operating speed.

Machines may be elastically restrained at the handle to limit horizontal movement during the tests. The method of restraint shall not affect the test results.

For the thrown object test 20.107.4, the machine shall be tested in all operational configurations (e.g. both with and without attachments and accessories such as grass catchers or mulching parts). A new machine shall be used for testing each configuration.

20.107.3.3 Test enclosure and target arrangements for tests 20.107.4, 21.101.2 and 21.101.3

20.107.3.3.1 The test enclosure required for the thrown object, imbalance and impact tests shall be constructed generally as shown in Figure 10. Variations to accommodate different machine types are shown in Figure 11, Figure 12, Figure 13, Figure 14 and Figure 15.

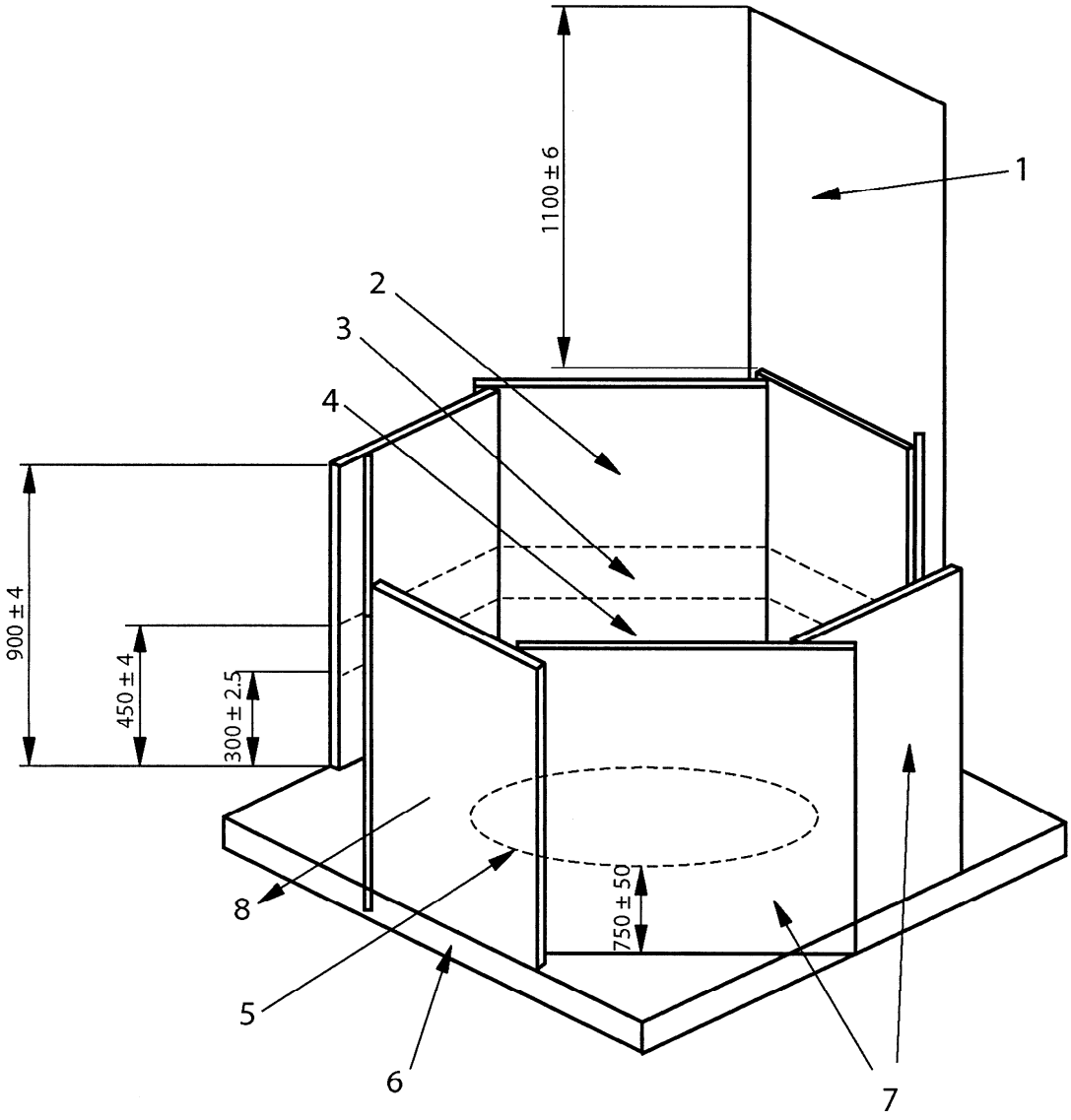
20.107.3.3.2 The walls shall consist of eight target panel areas, each 900 mm high, perpendicular to the base of the test enclosure so as to form an octagon. The test enclosure target panel composition shall meet the material specification of Annex BB. The flutes of the corrugated fibreboard target panels shall be vertical.

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

The target panels shall be located perpendicular to a radial line extending 750 mm ± 50 mm from the cutting means tip circle of single spindle machines, or to the nearest cutting means tip circle of multi-spindled machines (Figure 11, Figure 12, Figure 13, Figure 14 and Figure 15). If a target panel interferes with a part of the machine such as grass catcher, handle, or wheel, the target panel shall be moved back to avoid such interference.

The target panels shall be divided into elevation zones by horizontal lines as indicated in Figure 10 and described in Annex CC. The target panel in the operator target area of a pedestrian-controlled machine above 900 mm shall consist of a single sheet of Kraft paper rising to a height of 2 000 mm.

Dimensions in millimetres



Key

1	Top operator target area (single thickness Kraft paper target panel for pedestrian lawn mowers only)	5	Cutting means tip circle
2	Top target area	6	Base (see Figures DD.2 and DD3)
3	Middle target area	7	Eight corrugated fibreboard target panels with flutes vertical (see Figure DD.3 and Annex BB)
4	Lower target area	8	Machine front

Figure 8 – Thrown object test fixture – General layout (see 20.107.3.3 and 20.107.4.1.3)

20.107.4 Thrown object test

20.107.4.1 Test equipment

20.107.4.1.1 The machine shall be tested in the test enclosure described in 20.107.3.3 and shall be placed on coconut matting/plywood base as specified in Annex DD (see Figure DD.2 and Figure DD.3).

The operator target area is determined by the intersection of lines extending from centre A of the cutting means tip circle for single spindle machines (see Figure 9) or from the centre B of a line through the centres of the outer cutting means tip circles for multi-spindled machines (see Figure 10) and tangent to the 1 000 mm diameter operator area. 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 centres A or B – through the centre of the handgrip part of the handle (see Figure 9 and Figure 10). The target panel surface between the intersection of the two tangents and the target panel is the operator target area.

For machines with moveable offset handles, the handle 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.

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

20.107.4.1.3 Injection points shall be provided at the 12 o'clock position as in Figure 9 and Figure 10 and located 25 mm ± 5 mm inside the cutting means tip circle for injection of balls. An injection point shall be provided for each cutting means of a multi-spindle machine.

The injection tube outlets shall be fixed and flush with, or below, the upper surface of the coconut mat (see Figure DD.2) and the system shall be so arranged that the ball can be ejected with variable velocity.

20.107.4.2 Test method

The machine cutting means shall be adjusted to a 30 mm cut height or the next higher cutting position when set on a hard level surface. Machines with a maximum height setting of 30 mm or less shall be set at their maximum height setting.

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 30 mm above the surface of the coconut matting and within an angle of 10° of the vertical axis. Then with the machine in place and operating at maximum engine speed as defined in 3.117, allow balls one at a time into the machine.

Increase the velocity of the balls in small increments until each ball is hit by the machine cutting means.

NOTE 1 This procedure is intended to ensure that the ball rise height is as low as possible consistent with regular cutting means impact.

Start the test when this minimum velocity is established. Chipped or damaged balls shall be replaced. Inject 500 balls into each injection point for each test. On multi-spindle machines, the test shall be run for each spindle with the results evaluated for each test. A full set of new cutting means shall be fitted before each spindle is tested.

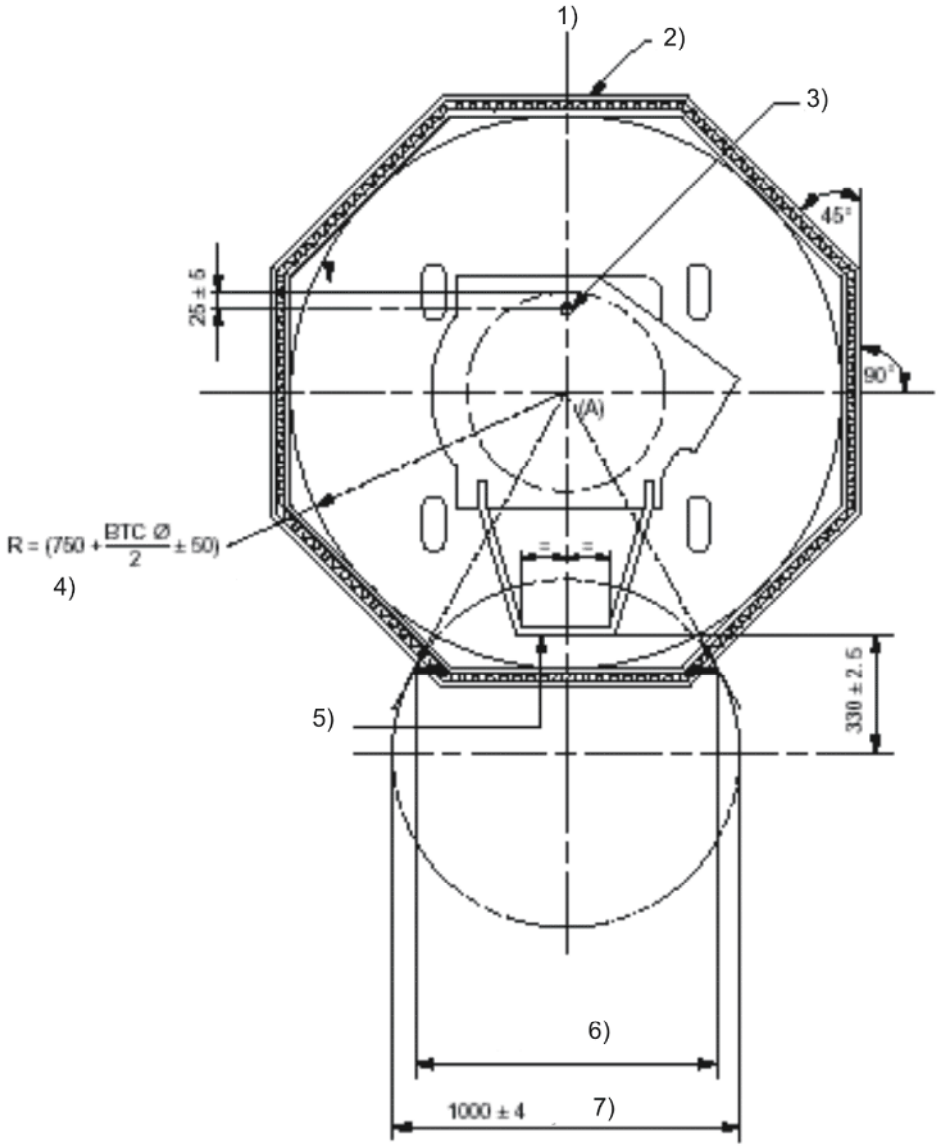
During any of the tests, in the event of excessive hits in a localized area, it may be necessary to repair or replace the target panel before continuing with the tests. Replace the target panels if hits from previous tests leave holes that cannot be covered by a 40 mm square gummed label. Not more than one thickness of gummed labels (patch) shall be placed over any one area. Balls remaining within the test enclosure (on test surface) may be removed at the option of the tester to minimize ricochet hits.

NOTE 2 The test does not require that the machine has to be suitable for use after test.

20.107.4.3 Test results

Only test balls passing completely through all layers of the target panel material shall be regarded as hits. Count and record the hits (e.g. on the data sheet provided, see Annex CC). Balls that hit the centreline of the target area height line shall be scored with the target area below that line.

Linear dimensions in millimetres

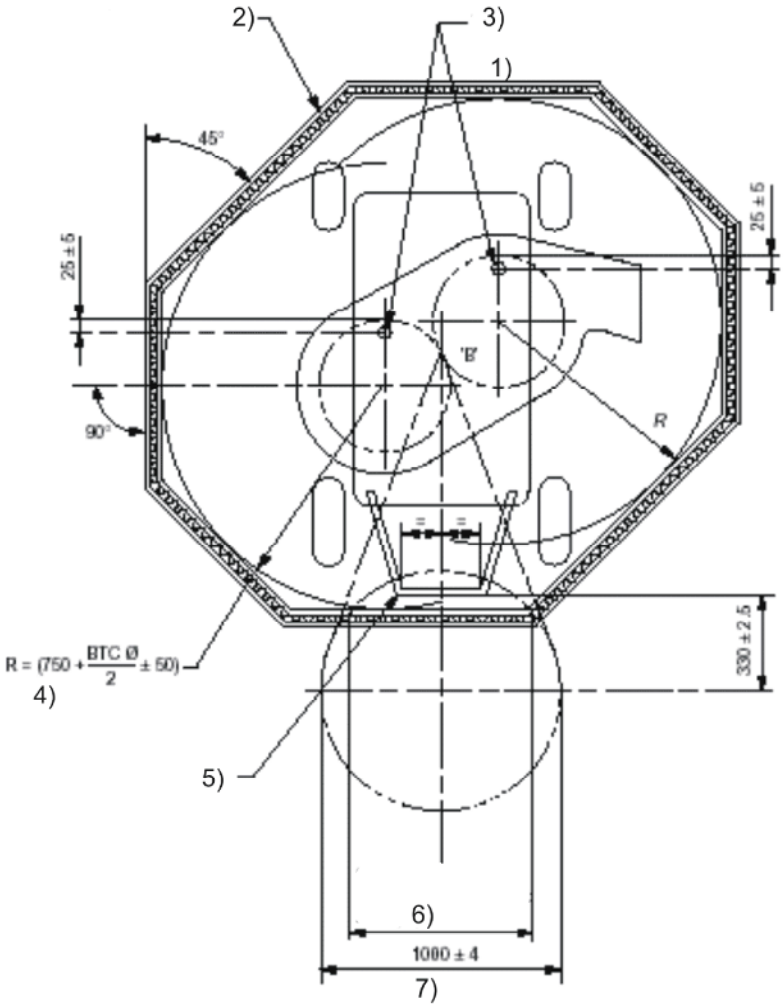


Key

1	Front	5	Handle against upper stop
2	Eight target panels, fibreboard, 900 mm high (see Figure DD.3)	6	Operator target area, 900 mm to 2 000 mm high target Kraft paper
3	Injection point	7	Operator area
4	BTC ∅ = Cutting means tip circle diameter		

Figure 9 – Single spindle lawnmower – Test enclosure (see 20.107.4)

Linear dimensions in millimetres



Key

1	Front	5	Handle against upper stop
2	Eight target panels, fibreboard, 900 mm high (see Figure DD.3)	6	Operator target area, 900 mm to 2 000 mm high target Kraft paper
3	Injection points (2) places	7	Operator area
4	BTC ∅ = Cutting means tip circle diameter		

Figure 10 – Multi-spindle lawnmower – Test enclosure (see 20.107.4)

20.107.4.4 Test acceptance (pass/fail criteria)

20.107.4.4.1 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 panels between the base and the 450 mm line (lower and middle elevation area) of which not more than six may hit the target panels between the 300 mm line and the 450 mm line (middle elevation area). There shall be no hits above the 450 mm line (top elevation area).

There shall be not more than two hits allowed in the operator target area between the base and the 450 mm line.

20.107.4.4.2 Additional testing

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

20.107.5 Foot probe test

20.107.5.1 Test equipment

The test fixture shall be a foot probe as illustrated in Figure 2.

20.107.5.2 Test method

The machine shall be placed on a hard flat surface. The guards or deflectors, or both, shall be in the normal operating position on the cutting means enclosure and the machine support members shall be in contact with the supporting surface. Hover machines shall be supported in the highest position they can reach under their normal working conditions.

Components such as wheels and frames, shall be considered as part of the cutting means enclosure for the purpose of this test. The test shall be conducted with the machine and the cutting means stationary.

The tests shall be made with the cutting means in the highest and lowest cutting positions. If the cutting means path height is different at different cutting means speeds, the test shall be conducted so as to include the two extremes of cutting means 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 cutting means enclosure lifts from the 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 means tip circle.

The probe shall be applied to the operating side of all lawnmowers and to front openings if any.

20.107.5.3 Test acceptance

The test probe shall not enter the path of the cutting means.

20.107.6 Pedestrian-controlled rotary lawnmowers – Additional requirements

20.107.6.1 Handle construction

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

20.107.6.1.1 Handle latches and handle length

Except in the handle park position (a temporary resting position for a freely pivoting handle which is usually just forward of the vertical), a positive means (latch or upper stop) shall be provided which cannot be unintentionally disengaged during normal operation of the machine, and shall not allow the end of the handle adjacent to the operator to come nearer than 450 mm horizontally behind the nearest path of the machine cutting means(s) during normal operation (see Figure 3).

For a freely pivoting handle, if a handle park position is provided, the handle shall automatically lock back into an operating position when the handle is moved into this position.

20.108 Specific requirements for cylinder lawnmowers

20.108.1 General construction – Guarding

20.108.1.1 Cutting cylinders shall be guarded on both sides and from front and rear, so that it is not possible for a vertical test rod 50 mm in diameter and 500 mm in length, with its lower end in contact with the ground (supporting surface), to approach any portion of the cylinder cutting means within 10 mm when any grass catcher has been removed (see Figure 11).

Compliance is checked by inspection and functional test.

20.108.1.2 Cutting cylinders shall be covered at the sides with guards extending at least as shown in Figure 12.

Compliance is checked by inspection.

20.108.1.3 Cutting cylinders of free discharge and of rear discharge machines shall be covered from above with a guard that extends so that its projection on the horizontal plane covers at least the projection of the cutting cylinder on the same horizontal plane, when any grass catcher has been removed (see Figure 13).

Compliance is checked by inspection.

Dimensions in millimetres

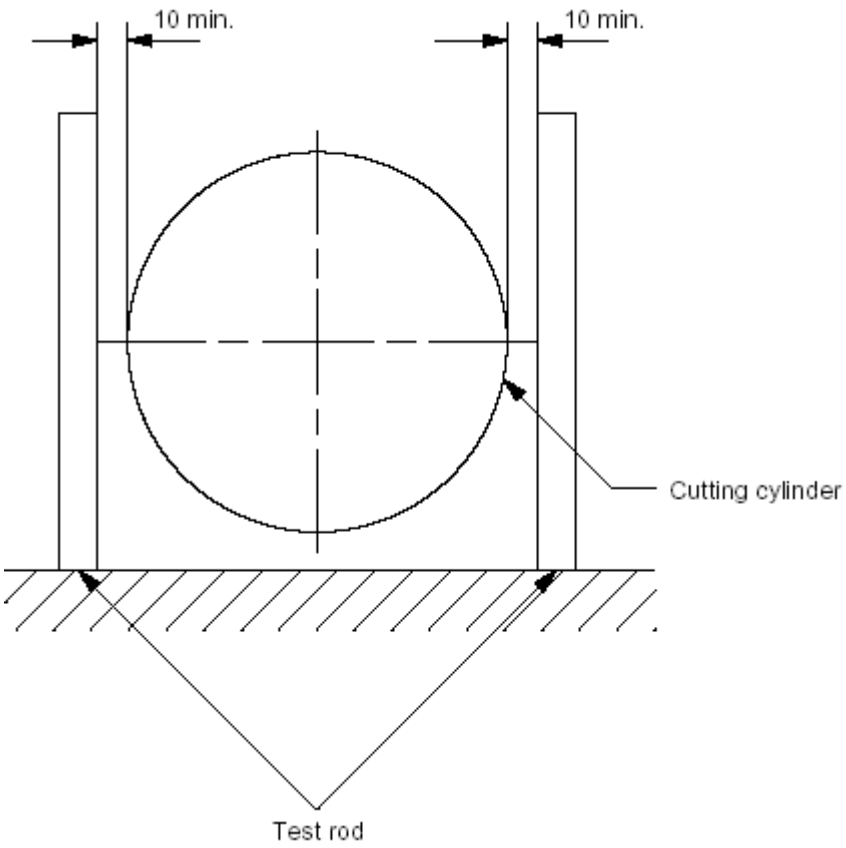


Figure 11 – Test of cutting cylinder guarding (see 20.108.1.1)

Dimensions in millimetres

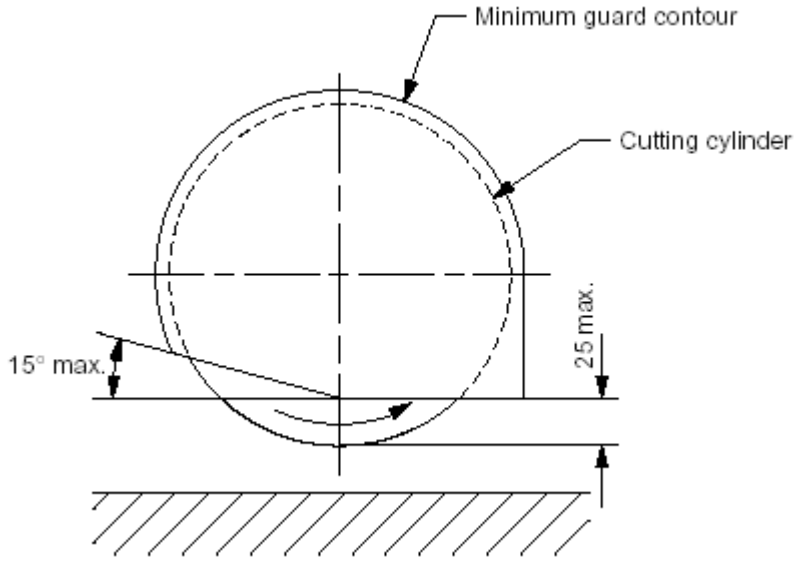


Figure 12 – Side coverage of cutting cylinders (see 20.108.1.2)

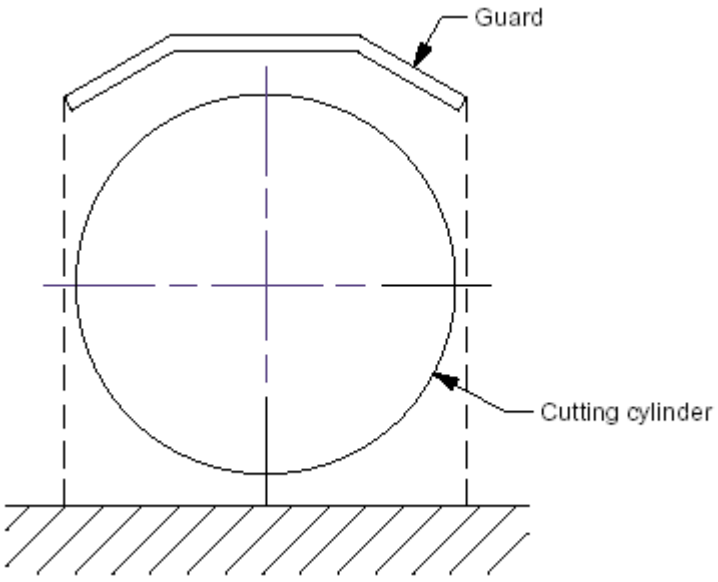


Figure 13 – Top coverage of cutting cylinders (see 20.108.1.3)

20.108.1.4 Cutting cylinders of front discharge machines shall be covered from the rear with a guard that extends so that its projection on the vertical plane covers from the top of the cutting cylinder to not more than 25 mm from the bottom (see Figure 14).

Compliance is checked by inspection and measurement.

NOTE 1 Free discharge denotes throwing out grass clippings without guiding or collecting.

NOTE 2 Rear discharge denotes throwing out grass clippings so that they will be collected in a grass catcher which is located behind the cutting cylinder.

NOTE 3 Front discharge denotes throwing out grass clippings so that they will be collected in a grass catcher which is located in front of the cutting cylinder.

Dimensions in millimetres

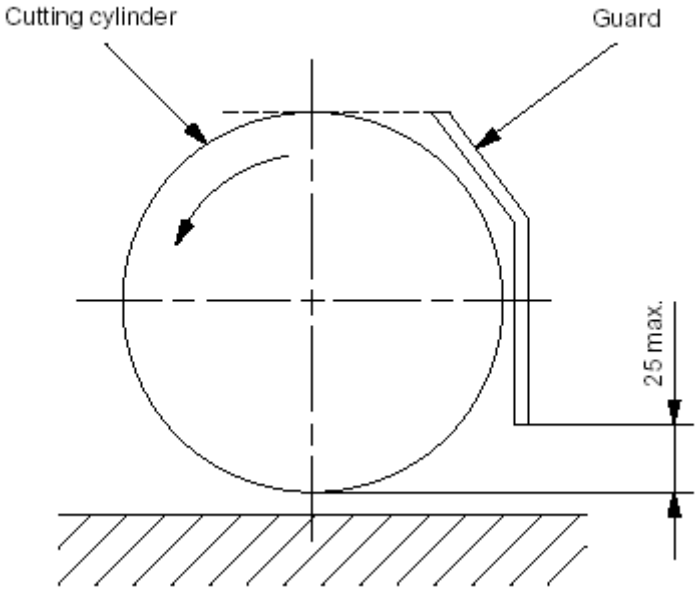


Figure 14 – Rear coverage of cutting cylinders (see 20.108.1.4)

20.108.2 Thrown grass, thrown objects, operator safety

This requirement is not applicable to front discharge machines.

Rear discharge and free discharge machines shall be fitted with a non-detachable guard which limits the throw line to a maximum height of 1 m in the vertical plane of the handle grips (see Figure 15). The throw line shall be the steepest line in a vertical plane, tangential to the periphery of the cutting cylinder in the direction of rotation of the cutting cylinder which does not intersect a guard or other part of the machine.

Measurements shall be taken at the most unfavourable height of cut setting.

Compliance is checked by inspection and measurement.

20.108.3 Handle structure

20.108.3.1 The end of the handle adjacent to the operator shall be either at least 450 mm horizontally behind the rear vertical tangent of the cutting cylinder, or the foot probe test of 20.107.5 applies.

20.108.3.2 If the end of the handle adjacent to the operator is less than 450 mm horizontally behind the rear vertical tangent of the cutting cylinder, the requirements of a foot probe test shall be fulfilled.

The foot probe (see Figure 2) shall be applied from the operating position side only, with the sole of probe held horizontally at any height and then tilted forward or backward up to 15° from the horizontal. The foot probe shall not contact the cutting cylinder.

Compliance is checked by inspection and functional test.

Dimensions in millimetres

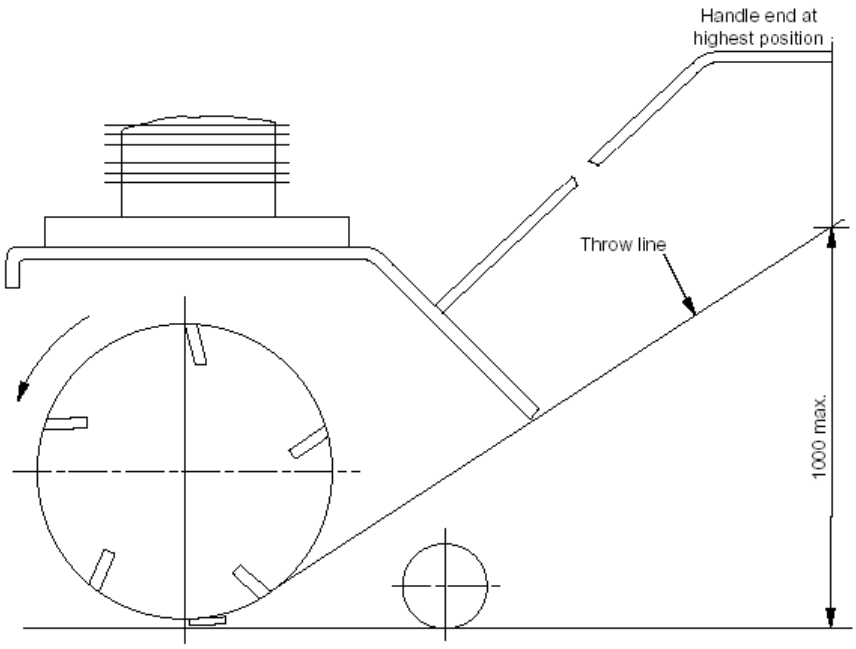


Figure 15 – Cylinder mower – Throw line (see 20.108.2)

21 Mechanical strength

This clause of Part 1 is applicable except as follows.

Modification:

The impact energy shall be 1,0 J ± 0,05 J.

21.101 Requirements for rotary lawnmowers

21.101.1 General

This clause specifies the tests for rotary lawnmowers.

NOTE All tests of 21.101 which are conducted with the motor running are dangerous. Test personnel should be adequately protected.

21.101.1.2 General test conditions

Where it is specified that the machine shall run during the tests it shall be operated at the maximum operating motor speed (see 3.117). Sealed adjustments shall not be moved when checking the maximum operating speed.

Machines may be elastically restrained at the handle to limit horizontal movement during the tests. The method of restraint shall not affect the test results.

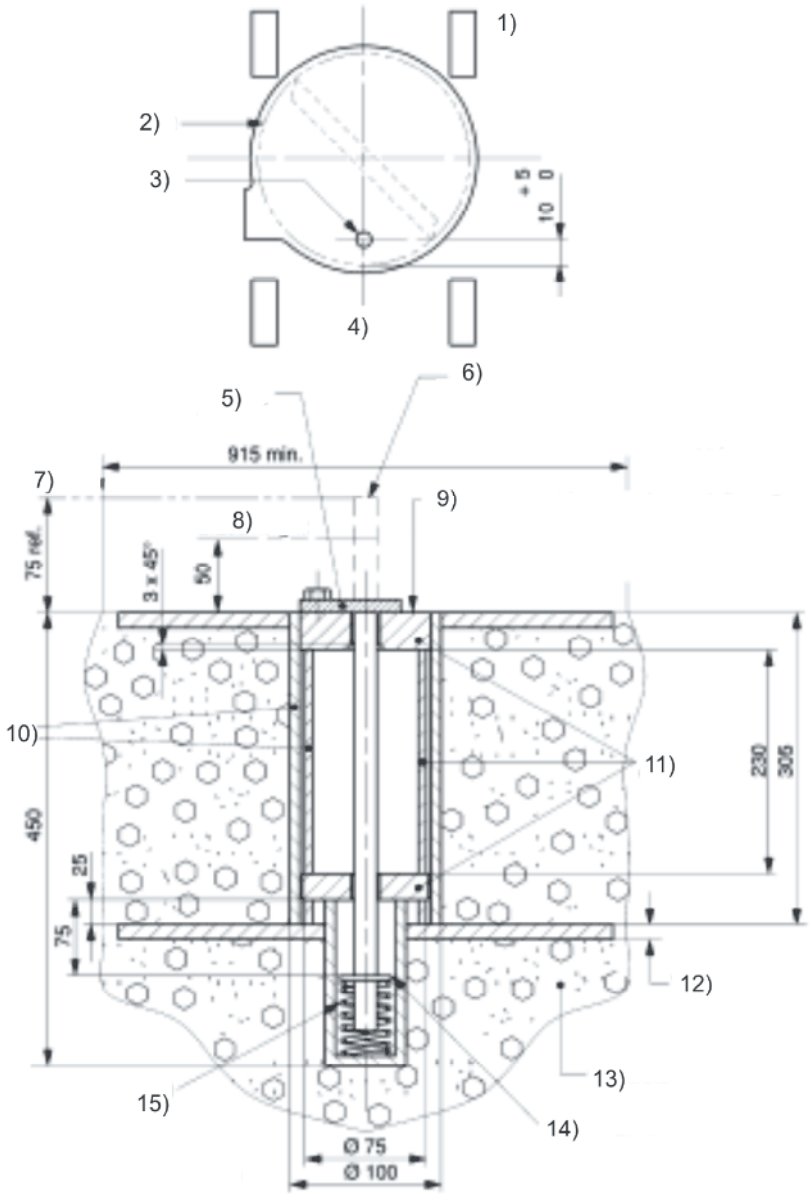
For the structural integrity test (see 21.101.4), the machine shall be tested in all operational configurations (e.g. both with and without attachments and accessories such as grass catchers or mulching parts). A new machine shall be used for testing each configuration.

21.101.2 Impact test

21.101.2.1 Test equipment

The machine shall be tested in the test enclosure described in 20.107.3 but without the operator target area. An example of a suitable impact test fixture is shown in Figure 16.

Linear dimensions in millimetres



Key

1	Schematic view from above	10	Standard pipe
2	Cutting means tip circle	11	Removable cylinder
3	Steel tube ∅ 30 mm x 3 mm	12	12,5 mm plates x 2
4	Front	14	Pin or washer welded to tube
5	Remove control actuating lever metal plate	15	Compression spring Dimensions Free length: 165 mm Wire ∅: 3,2 mm Total number of coils: 11,75 Mean ∅: 36 mm Spring rate: 2,27 N/mm Ends ground and squared
6	Welded or seamless steel tube ∅ 30 mm x 3 mm (see ISO 4200), grade R28 in accordance with ISO 3304, ISO 3305 or ISO 3306		
7	Released position		
8	Cutting means height		
9	∅ 33 mm end fittings in internal ∅ 100 mm standard pipe with 1,52 mm to 3,04 mm clearance – identical parts both ends 25 mm thick – hardness 350 HB to 400 HB with central hole		

Figure 16 – Example of suitable impact test fixture (see 20.101.2.1)

21.101.2.2 Test method

The machine shall be positioned over a 30 mm × 3 mm (nominal) welded or seamless steel tube that has been placed in the test fixture (see Figure 16). The cutting means of the test machine shall be adjusted to the cutting height closest to 50 mm and shall be so positioned that when the tube is inserted into the path of the rotating cutting means, the cutting means will strike the exposed portion of the tube within 10 mm to 15 mm of the cutting means tip circle (see Figure 16). The tube shall be inserted once into the path of each cutting means assembly. A new piece of tube shall be used for each test.

The machine shall be run for 15 s, or until the impacted cutter stops or until the tube is severed.

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

21.101.2.3 Test acceptance

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

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

21.101.3 Imbalance test

21.101.3.1 Test equipment

The machine shall be tested in the test enclosure described in 20.107.3 but without the operator target area. The test shall be conducted on a smooth hard level surface. Hover machines shall be tested on grass or a synthetic material equivalent to grass.

21.101.3.2 Test method

The cutting means imbalance shall first be determined by the formula:

$$I = 0{,}024\ L^3$$

where

I is the cutting means imbalance, in Kilogram metres;

L is the diameter of the cutting means tip circle, in metres.

The calculated imbalance shall be created by removing material from, or adding it to, the cutting means until the desired imbalance is obtained.

The test shall be run for 1 h in the test enclosure for each cutting means assembly.

All cutting means assemblies of a multi-spindle machine shall be tested. All cutting means assemblies of a multi-spindle machine may be tested simultaneously or singly at the discretion of the manufacturer. A new machine may be used for each test.

21.101.3.3 Test acceptance

The machine under test shall not lose any component necessary for compliance with the requirements of this standard nor shall any component or part of the machine pass through all layers of the wall of the fibreboard enclosure. If the test machine fails to complete the 1 h run but otherwise meets the requirements of this clause, the machine may be repaired to complete the test run.

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

21.101.4 Structural integrity test for cutting means enclosure, guards and grass catcher (see 20.107.1.1 and 20.107.1.2)

21.101.4.1 Test equipment

21.101.4.1.1 Test fixture (see Figure 17)

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 cutting means enclosure of the machine.

An air inlet hole shall be provided that is concentric with each cutting means tip circle with an approximate diameter, as given in Table 1.

Table 1 – Sizing of test fixture air inlet holes

Lawnmower type	Cutting means tip circle diameter (BTCD)	Air inlet diameter
Non-mulching	All	0,3 x BTCD
Mulching	< 635 mm	BTCD – 127 mm
Mulching	≥ 635 mm	0,8 x BTCD

The machine shall be constrained in a suitable manner 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.

21.101.4.1.2 Injection points

The location of one injection point B shall be, for mulching machines at the 12 o'clock position as detailed in 20.107.4.1.3, and for non-mulching machines 25 mm inside the cutting means tip circle on a line BC which is 45° from a line AC, in a direction counter to the direction of cutting means rotation, where A is the centre of the discharge chute exit and C is the centre of the cutting means tip circle.

Ten injection points shall be equally spaced apart starting from point B on the circle with centre C. The injection points of approximately 15 mm diameter shall be used for the introduction of balls (see 21.101.4.2).

Alternatively, instead of using ten injection points the machine may be rotated in 36° increments from injection point B.

The injection tubes shall not protrude above the steel plate.

21.101.4.1.3 Test balls

One hundred hardened (12,75 ± 0,25) mm diameter balls of steel, 45 HRC minimum (e.g. balls used as ball bearings) shall be used.

21.101.4.1.4 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 cutting means.

21.101.4.2 Test method

The machine to be tested shall be positioned on the steel plate with the cutting means axis C over the centre of the test fixture base. The cutting means shall be set at the lowest adjustable cutting height but not less than 30 mm. If the maximum height of cut is less than 30 mm then the machine shall be tested when adjusted to its maximum height.

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

The test shall be conducted once for each cutting means.

A new machine housing may be used for each test of a multi-spindle machine. A full set of new cutting means shall be fitted before each spindle is tested.

21.101.4.3 Test acceptance

The cutting means enclosure, guard or grass catcher shall be considered to have failed the test if any of the following occurs:

a) a hole in the cutting means enclosure, guard(s) or grass catcher(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 cutting means enclosure, guard(s) or grass catcher into the path of the cutting means;

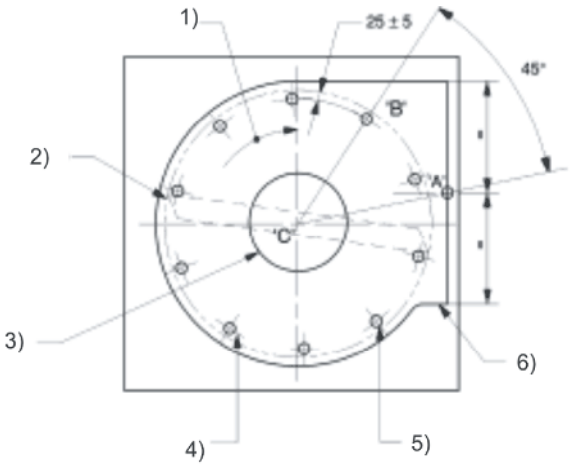
c) the dislodging of the grass catcher or guard from its adapter;

d) the grass catcher or guard falling from its normal operating position.

In the event of a test failure, two additional identical machines shall be tested. If either of the additional machines 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.

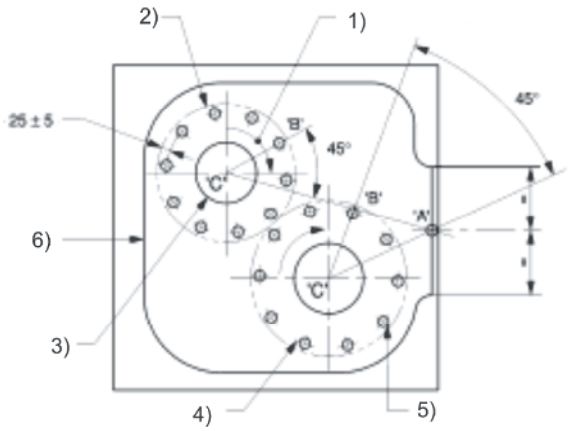
Linear dimensions in millimetres



Key

1 Direction of rotation
2 Cutting means tip circle
3 Air inlet hole
4 Injection hole centreline
5 10 x ∅ 15 mm injection points equally spaced
6 Cutting means enclosure

a) Single cutting means



Key

1 Direction of rotation
2 Cutting means tip circle
3 Air inlet hole
4 Injection hole centreline
5 10 x ∅ 15 mm injection points equally spaced each spindle
6 Cutting means enclosure

b) Twin cutting means

Figure 17 – Structural integrity tests (see 21.101.4.1.1)

22 Construction

This clause of Part 1 is applicable except as follows.

22.6 Addition:

Any drain holes provided to prevent accumulation of water in an enclosure shall be at least 5 mm in diameter or 20 mm² in area with a width of at least 3 mm.

Compliance is checked by inspection.

22.18 Addition:

Battery powered lawn mowers shall be equipped with batteries that will not leak when stored in any position.

22.35 Replacement:

For mains operated class II machines:

Handles and operator controls which are held when operating the machine shall either be of insulating material or covered by insulating material having a thickness of at least 1 mm, or separated by insulation equivalent to supplementary insulation from other accessible metal parts.

Handle shafts shall be

a) of insulating material, or

b) if not of insulating material, covered with insulating material having a thickness of at least 1 mm which extends for a distance of 150 mm from handles and handle mounted operator controls and by insulation equivalent to supplementary insulation from other accessible metal parts which are within 75 mm of the ground measured as a clearance or from accessible metal parts connected to such parts.

Cable restraints/guides are not considered to be operator controls**.**

For rotary mowers, the cutting means shall be insulated from other parts, which are accessible when the machine is in its normal position of use, by insulating material equivalent to supplementary insulation.

Compliance is checked by inspection, by measurement and, for the covering of insulating material on handles, operator controls and handle shafts, by the following tests.

A sample of the covered part is conditioned at a temperature of (70 ± 2) °C for 7 days (168 h). After conditioning, the sample is allowed to attain approximately room temperature.

Inspection shall show that the covering has not shrunk to such an extent that the required length of 150 mm or the required insulation is no longer given, or that the covering has not peeled off and that it may move longitudinally.

After this, the sample is maintained for 4 h at a temperature of (-10 ± 2) °C.

While still at this temperature, the sample is then subjected to impact by means of the apparatus shown in Figure 18. The weight A having a mass of 300 g falls from a height of 350 mm onto the chisel B of hardened steel, the edge of which is placed on the sample.

One impact is applied to each place where the covering is likely to be weak or damaged in intended use, the distance between the points of impact being at least 10 mm.

After this test, inspection shall show that the covering has not peeled off and an electric strength test is made between metal parts and metal foil wrapped round the covering in the area required to be insulated.

The test voltage of 1 750 V is applied for 1 min.

During this test, no flashover or breakdown shall occur.

Dimensions in millimetres

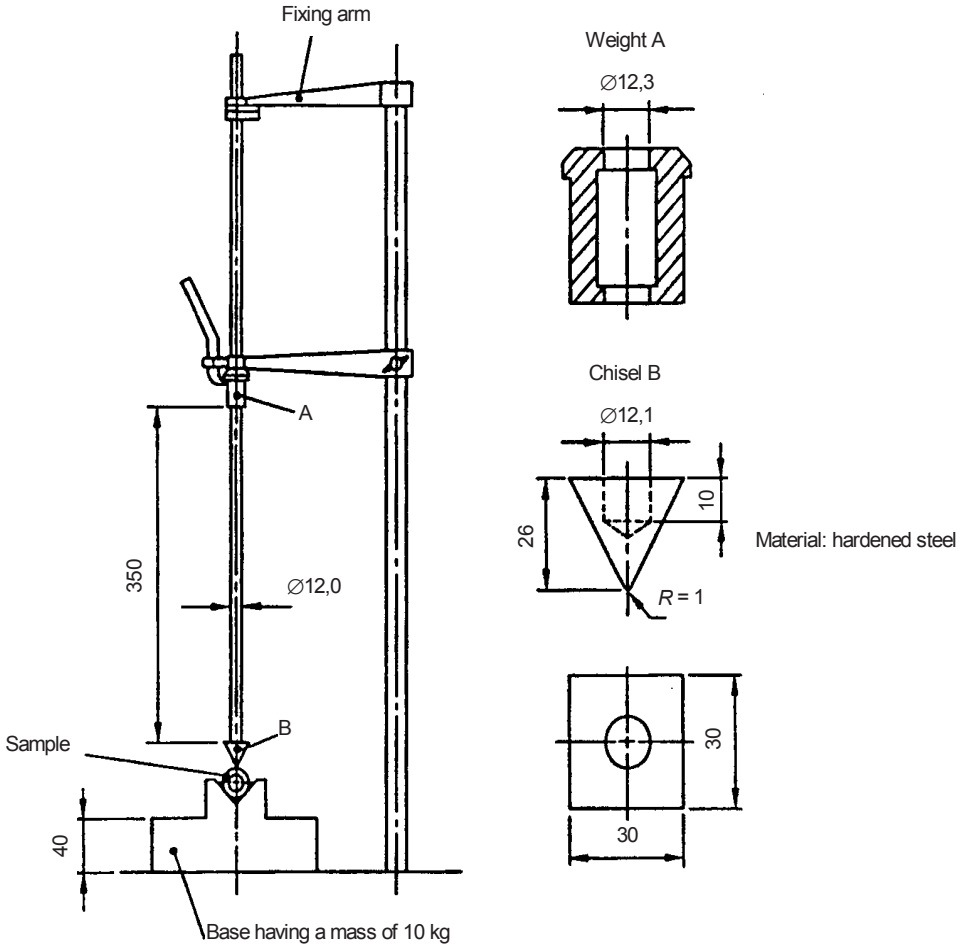


Figure 18 – Impact test fixture for handle insulation

22.36 This subclause does not apply.

22.101 Mains operated machines shall be provided with a means such that damage to the supply cable due to movement of the machine is prevented as far as possible. The means provided shall be re-usable.

This requirement is considered to be met by, for example,

– a cable-retaining device to keep the cable out of the vicinity of the cutting means**,** to which the cable may be adequately fastened, or

– the supply cable entry or attachment being at least 0,6 m from the nearest point of the cutting means.

Compliance is checked by inspection and by the following test procedure, except for automatic cord reel-in devices.

The supply cable as delivered with the machine is attached to the device in accordance with the instruction manual. The supply cord is then subjected 10 times to a pull of 100 N, the pull being applied in the most unfavourable direction, without jerks, for 1 s.

After the test the power supply cord shall show no damage within the meaning of this standard and it shall not have been displaced longitudinally, in the device, by more than 2 mm.

22.102 Air filters which can be removed for cleaning purposes shall be so designed that they are unlikely to come off during use.

This requirement is met if, for example, the air filter

– can only be removed with the aid of a tool, or

– is provided with a spring that prevents it from falling away, during use, due to vibration, or

– needs a deliberate action of the user for its removal.

Compliance is checked by inspection.

22.103 Additional requirements for battery operated machines.

22.103.1 It shall not be possible to operate the machine whilst the battery is being charged.

22.103.2 A disabling device shall be provided which shall prevent operation of the machine when it is removed. When the disabling device is removed it shall not be possible for the cutting means to be powered when the operator presence control is actuated. The disabling device shall not be in any control circuit and shall not easily be over ridden. A removable battery is not considered to be a disabling device.

With the disabling device removed compliance is checked by the following tests, without applying undue force:

a) the operator presence control is operated, if possible;

b) an appropriately sized flat metal bar is used to try to over ride the function of the disabling device.

23 Internal wiring

This clause of Part 1 is applicable.

24 Components

This clause of Part 1 is applicable except as follows.

24.1.3 Addition:

Switches for mains operated machines shall have a contact separation in all poles and shall have a contact separation of at least 3 mm.

Switches shall have been satisfactorily tested for at least 50 000 operations.

25 Supply connection and external flexible cords

This clause of Part 1 is applicable except as follows.

25.1 Replacement for mains operated machines:

Machines shall be provided with a supply cord or an appliance inlet.

Appliance inlets shall not allow the introduction of a connector complying with the standard sheets of EN 60320 except EN 60320-2-3.

25.5 Replacement for mains operated machines:

Machines shall be provided with one of the following:

– a supply cord not less than 10 m in length with type X attachment, or

– a supply cord of length not exceeding 0,5 m with type X or Y attachment and terminating in a cable coupler or,

– an appliance inlet.

25.7 Modification for mains operated machines:

Replace the first paragraph by the following:

Supply cords shall not be lighter than

– if rubber insulated, ordinary polychloroprene sheathed flexible cord (code designation H05 RN-F)

– if polyvinyl chloride insulated, ordinary polyvinyl chloride sheathed flexible cord (code designation H05 VV-F);

25.14 Addition:

This requirement also applies to external cables or cords where, because of the design of the machine, there is relative movement of more than 45° of the cable or cord at its point of entry into an enclosure.

25.15 Addition:

This requirement applies to all accessible cables or cords.

Modification:

The test is modified as follows:

The pull force on all accessible cords shall be 150 N.

25.101 If the machine is delivered with an extension cord, which can also be used with other machines, the extension cord shall be marked with the maximum rated current or power.

26 Terminals for external conductors

This clause of Part 1 is applicable.

27 Provision for earthing

This clause of Part 1 is applicable.

28 Screws and connections

This clause of Part 1 is applicable.

29 Clearances, creepage distances and solid insulation

This clause of Part 1 is applicable except as follows.

29.2 Addition:

Pollution degree 3 applies to this machine.

30 Resistance to heat and fire

This clause of Part 1 is applicable except as follows.

30.2.2 Not applicable for battery operated machines.

30.2.3 Not applicable for battery operated machines.

31 Resistance to rusting

This clause of Part 1 is applicable.

32 Radiation, toxicity and similar hazards

This clause of Part 1 is not applicable.

Annexes

The annexes of Part 1 are applicable except as follows:

Annex B
(normative)

Appliances powered by rechargeable batteries

Not applicable for mains operated machines.

This annex of Part 1 is applicable except as follows:

19.102 Not valid.

19.103 Not valid.

Annex AA
(normative)

Safety signs and symbols

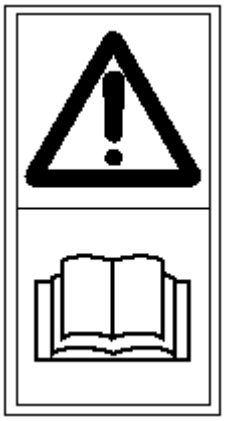
AA.1 General

The safety signs, which are used on electrically powered lawnmowers as defined in this European Standard are presented in this annex.

The symbols should follow the conventions laid down in EN ISO 3767-1, EN ISO 3767-3, EN ISO 3767-5 and ISO 3864 while the pictograms should follow the conventions presented in ISO 11684.

The symbol or pictogram size may be modified to fit a specific machine design. The pictograms or symbols presented are not all-inclusive.

AA.2 Examples of pictograms that are used for lawnmower marking



As alternatives symbol 1641 of ISO 7000 or symbol M002 of ISO 7010 may be used in the lower panel.

Figure AA.1 – Pictogram illustrating “Read operator’s manual”

Figure AA.2 – Pictogram illustrating “Keep bystanders away”

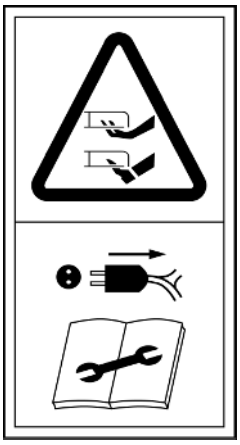


Figure AA.3 – Mains operated machines – Pictogram illustrating "Beware of sharp blades. Blades continue to rotate after the motor is switched off – Remove plug from mains before maintenance or if cord is damaged."

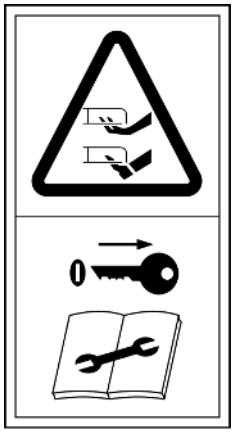


Figure AA.4 – Battery operated machines – Pictogram illustrating "Beware of sharp blades. Blades continue to rotate after the motor is switched off – Remove disabling device before maintenance"

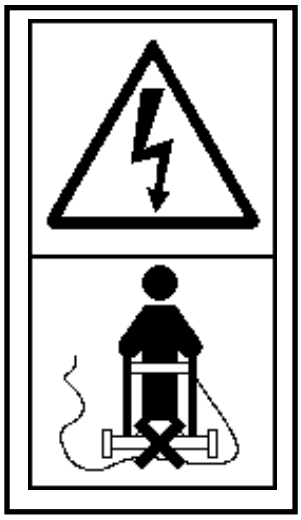


Figure AA.5 – Mains operated machines – Pictogram illustrating "Keep supply flexible cord away from cutting means"

Annex BB
(normative)

Test enclosure target panels – Corrugated fibreboard penetration test (see 20.107.3.3.2)

BB.1 Purpose

The purpose of these tests is to provide a means of selecting a uniform target panel material for thrown object tests on rotary machines.

BB.2 Test fixture

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

BB.3 Fibreboard samples

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

BB.4 Procedure

Immediately before and after the machine tests five samples of the fibreboard shall be tested and the requirements of Clause BB.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 steel 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 top plate.

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

BB.5 Acceptance criteria

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

The spherical end of the penetrator shall penetrate completely through the test sample in at least four out of five 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

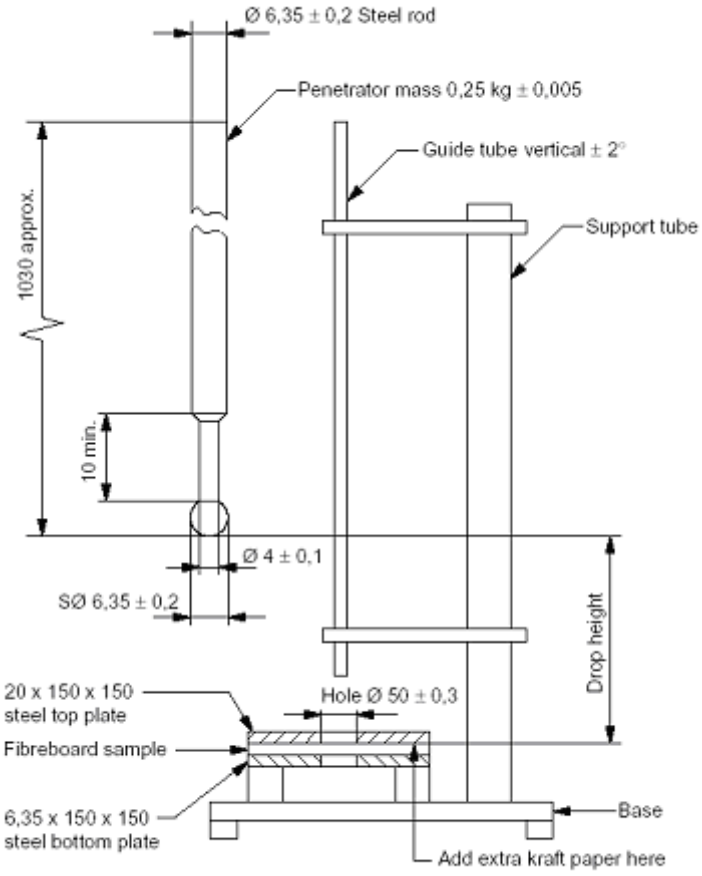


Figure BB.1 – Test fixture for corrugated fibreboard penetration test

Annex CC
(normative)

Target panel elevation areas and suggested data sheet for thrown object test
(see 20.107.3.3)

CC.1 Target elevation areas (see Figure 8)

CC.1.1 Lower elevation target

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

CC.1.2 Middle elevation target

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

CC.1.3 Top elevation target

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

CC.1.4 Operator target area (pedestrian lawnmowers only)

The width of the operator target area shall be as specified in 20.107.4.1.1 and the height extend from the base to the top of the 2 000 mm high Kraft paper target.

CC.2 Suggested data sheet

The format shown in Figure CC.1 allows for counting hits after lots of one hundred balls, and summarising the results at the bottom of the sheet. Use of lots is at the option of the tester.

Manufacturer:	Model:	Size:
Type : ride-on/pedestrian controlled: discharge location		
Cutting meanss – number:	r/min:	

Lot	Elevation area	Sector		Total hits
		Operator (Rear)	Other (Front/Sides)	
1	Top[1)]			
	Middle			
	Lower			
2	Top[1)]			
	Middle			
	Lower			
3	Top[1)]			
	Middle			
	Lower			
4	Top[1)]			
	Middle			
	Lower			
5	Top[1)]			
	Middle			
	Lower			
Test summary	Top[1)]			
	Middle			
	Lower			
	All areas			

[1)] Top includes the 900 mm to 2 000 mm high Kraft paper panel of the operator target area for pedestrian lawnmowers only.

Figure CC.1 – Example of data sheet for thrown object test

Annex DD
(normative)

Test enclosure (see 20.107.4.1)

DD.1 Base

The test enclosure 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 DD.1 (see also Figure DD.2).

Any square of coconut matting showing a worn area where there is evidence of 50 % or more reduction in the height or number of fibres shall be replaced.

The minimum base size shall be 1,5 m larger than the cutting width and 1,5 m larger than the distance between the forward edge of the leading cutting means tip circle and the rear edge of the trailing cutting means tip circle.

The coconut matting shall have approximately 20 mm high fibres embedded in a PVC base weighing approximately 7 000 g/m².

DD.2 Target composition

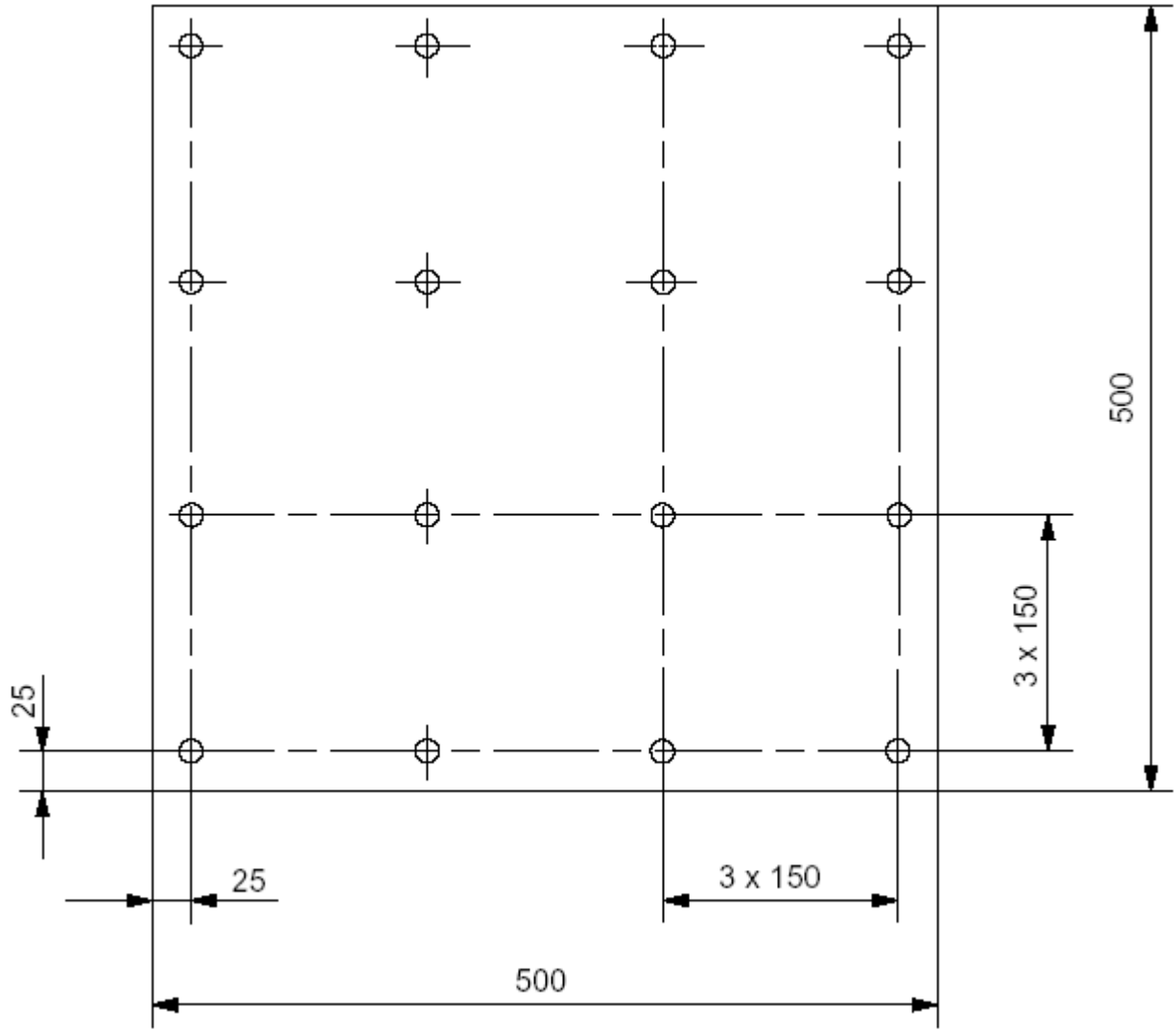
A target panel (see Figure DD.3) shall meet the tests of Annex BB and preferably be a single sheet of double flute fibreboard. If necessary a single sheet of double flute fibreboard with extra sheet(s) of Kraft paper added in front of the target face may be used but this is not recommended. The fibreboard shall be a maximum of 9 mm thickness.

NOTE 1 To obtain the most consistent results the fibreboard should be as thin as practicable consistent with the requirements for the test.

If Kraft paper is used it shall be “spot” glued to the fibreboard just sufficiently to ensure that the whole of the paper stays in close proximity to the surface of the fibreboard when it is in position in the test enclosure. The Kraft paper shall be of nominal 80 g/m² construction.

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

Dimensions in millimetres



NOTE Dimensions shown are approximate.

Figure DD.1 – Nail plan of test enclosure base

Dimensions in millimetres

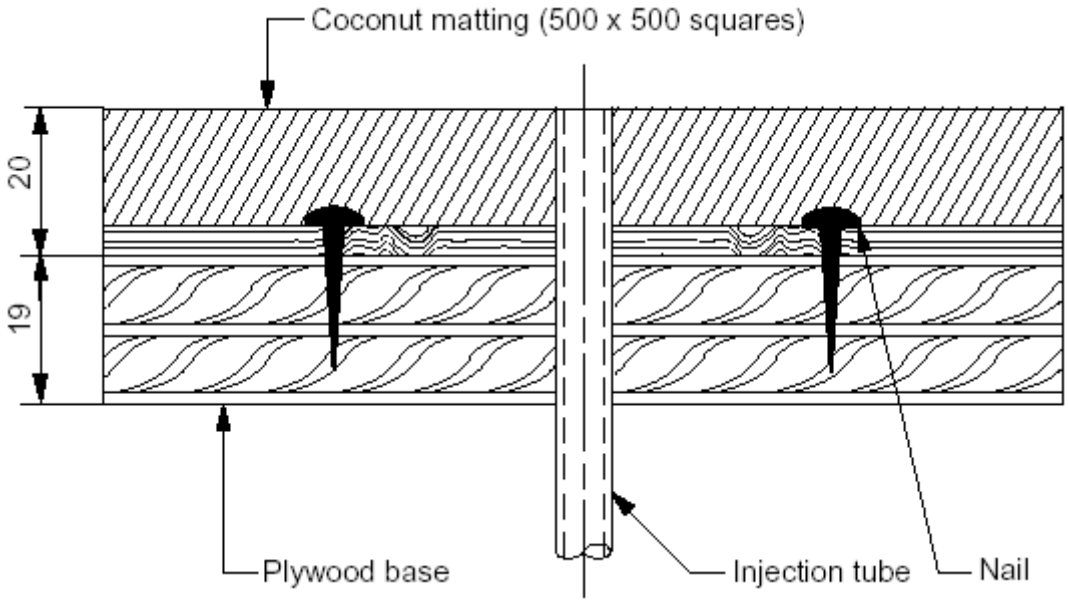
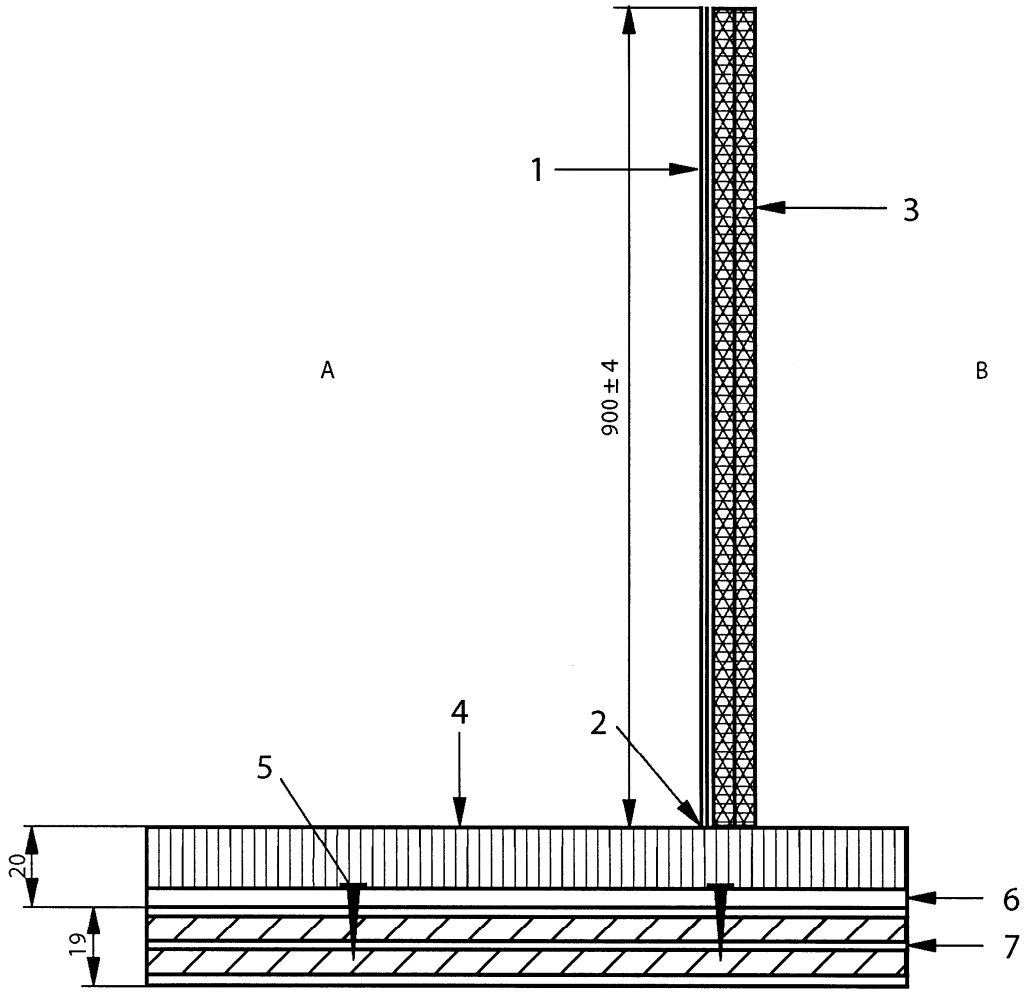


Figure DD.2 – Object test enclosure – Base detail

Dimensions in millimetres
(all dimensions are nominal unless otherwise stated)



Key

A Inside of test enclosure

B Outside of test enclosure

1 Kraft paper, used if necessary and spot glued to the inside surface of the target panels to ensure close proximity over the whole area

2 Target panels inside edges fit snugly to base surface to prevent balls from escaping from test enclosure

3 Target panels made of double flute corrugated fibreboard of 9 mm maximum thickness with flutes running vertically

4 Coconut matting

5 Nail

6 PVC base for coconut matting

7 Plywood base

Figure DD.3 – Test enclosure walls and base

Annex EE
(informative)

Safety instructions for lawnmowers

Annex EE presents safe operating practices for, electrically powered lawnmowers

These practices are not all inclusive. The substance of these requirements shall be provided with each machine as appropriate and tailored to the specific type of machine:

IMPORTANT
READ CAREFULLY BEFORE USE.
KEEP FOR FUTURE REFERENCE.

Safe operating practices for electrically powered lawnmowers

EE.1 Training

a) Read the instructions carefully. Be familiar with the controls and the correct use of the machine.

b) Never allow children or people unfamiliar with these instructions to use the machine. Local regulations can restrict the age of the operator.

c) Never operate the machine while people, especially children, or pets are nearby.

d) Keep in mind that the operator or user is responsible for accidents or hazards occurring to other people or their property.

EE.2 Preparation

a) While operating the machine always wear substantial footwear and long trousers. Do not operate the machine when barefoot or wearing open sandals. Avoid wearing clothing that is loose fitting or that has hanging cords or ties.

b) Thoroughly inspect the area where the machine is to be used and remove all objects which can be thrown by the machine.

c) Before using, always visually inspect to see that the blade, blade bolt and the blade assembly are not worn or damaged. Replace worn or damaged components in sets to preserve balance. Replace damaged or unreadable labels.

d) Before use check the supply and extension cord for signs of damage or aging. If the cord becomes damaged during use, disconnect the cord from the supply immediately. DO NOT TOUCH THE CORD BEFORE DISCONNECTING THE SUPPLY. Do not use the machine if the cord is damaged or worn.

EE.3 Operation

a) Operate the machine only in daylight or in good artificial light.

b) Avoid operating the machine in wet grass.

c) Always be sure of your footing on slopes.

d) Walk, never run.

e) Mow across the face of slopes, never up and down.

f) Exercise extreme caution when changing direction on slopes.

g) Do not mow excessively steep slopes.

h) Use extreme caution when reversing or pulling the machine towards you.

i) Stop the blade(s) if the machine has to be tilted for transportation when crossing surfaces other than grass, and when transporting the machine to and from the area to be used.

j) Never operate the machine with defective guards or shields, or without safety devices, for example deflectors and/or grass collector, in place.

k) Switch on the motor carefully according to instructions and with feet well away from the blade(s).

l) Do not tilt the machine when switching on the motor, except if the machine has to be tilted for starting. In this case, do not tilt it more than absolutely necessary and lift only the part, which is away from the operator.

m) Do not start the machine when standing in front of the discharge opening.

n) Do not put hands or feet near or under rotating parts. Keep clear of the discharge opening at all times.

o) Do not transport the machine while the power source is running.

p_1) Stop the machine, and remove plug from the socket. Make sure that all moving parts have come to a complete stop.

p_2) Stop the machine, and remove the disabling device. Make sure that all moving parts have come to a complete stop

- whenever you leave the machine,
- before clearing blockages or unclogging chute,
- before checking, cleaning or working on the machine,
- after striking a foreign object. Inspect the machine for damage and make repairs before restarting and operating the machine;

if the machine starts to vibrate abnormally (check immediately)

- inspect for damage,
- replace or repair any damaged parts,
- check for and tighten any loose parts.

EE.4 Maintenance and storage

a) Keep all nuts, bolts and screws tight to be sure the machine is in safe working condition.

b) Check the grass collector frequently for wear or deterioration.

d) On machines with multi blade, take care as rotating one blade can cause other blades to rotate

e) Be careful during adjustment of the machine to prevent entrapment of the fingers between moving blades and fixed parts of the machine.

f) Always allow the machine to cool down before storing

g) When servicing the blades be aware that, even though the power source is switched off, the blades can still be moved.

h) Replace worn or damaged parts for safety. Use only genuine replacement parts and accessories.

EE.5 Recommendation for class II machine

The machine should be supplied via a residual current device (RCD) with a tripping current of not more than 30 mA.

Annex FF
(normative)

Vibration

FF.1 Quantities to be measured

The values measured shall be

– weighted r.m.s. acceleration according to 3.1 of EN ISO 20643:2005 for hand-arm vibration and 4.3,

– maximum operating motor speed obtainable (see 3.117). Sealed adjustments shall not be moved when checking the maximum operating speed.

FF.2 Instrumentation

FF.2.1 General

Tachometers shall have an accuracy of ± 2,5 %. For specification of other instrumentation see Clause 4 of EN ISO 20643:2005 for the hand-arm vibration measurement.

FF.2.2 Fastening of transducer

For fastening the transducer, 4.2 of EN ISO 20643:2005 shall apply. If a resilient coating is being used between the hand and vibration structure (for example, a cushioned handle), 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.

FF.2.3 Calibration

Calibration shall be in accordance to 4.7 of EN ISO 20643:2005 for the hand-arm vibration.

FF.3 Measurement direction and measurement location

FF.3.1 Measurement direction

Measurements shall be made simultaneously for the three (3) directions x, y and z (see Figure FF.1).

FF.3.2 Measurement location

A maximum of two transducers shall be used for hand-arm vibration. The transducer(s) for the hand-arm vibration measurements shall be placed where an operator holds the steering device(s) according to Figure FF.1 or Figure FF.2.

FF.4 Test procedure

FF.4.1 Determination of working procedure

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

The machine shall be maintained and serviced in accordance with the instruction manual. Before the test is commenced the engine shall be run with the cutting means engaged until stable conditions are reached.

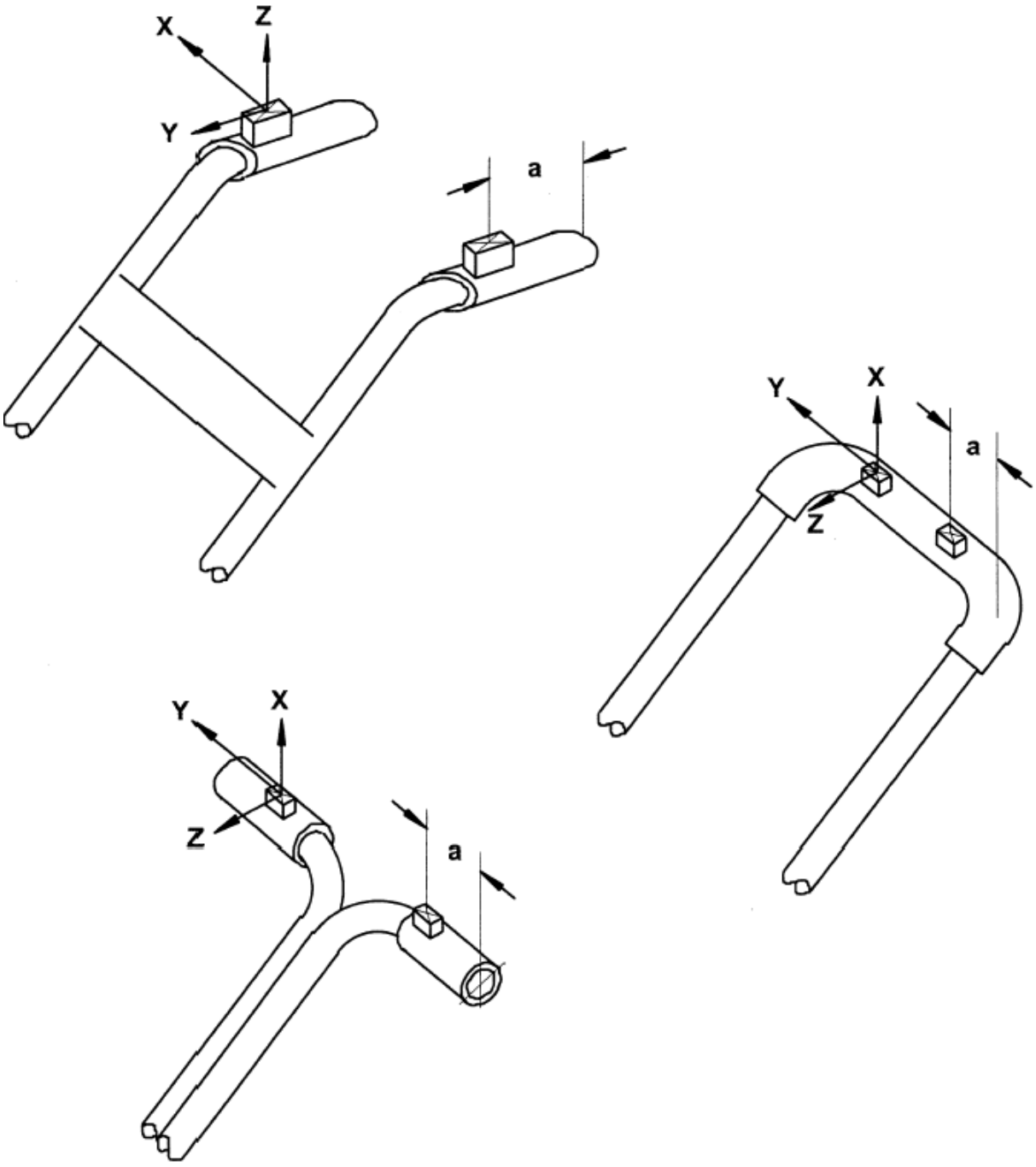
The rated voltage or the upper limit of the rated voltage range and/or frequency shall be maintained during the test at 0,98 to 1,02 times the stated values. The supply voltage of mains powered machines is measured at the plug of the cable or cord supplied, not at the plug of any extension cable or cord. Battery powered machines shall be powered by an external power source maintained at the nominal voltage of the battery.

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 instruction manual. When the machine is designed to be operated with a grass catcher, the measurement shall be carried out with this configuration. The grass catcher shall be empty. The machine shall be tested with all attachments provided for by the manufacturer.

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

NOTE The vibration measurements are influenced by the operator. They should therefore be familiar with the normal operation of the machine.

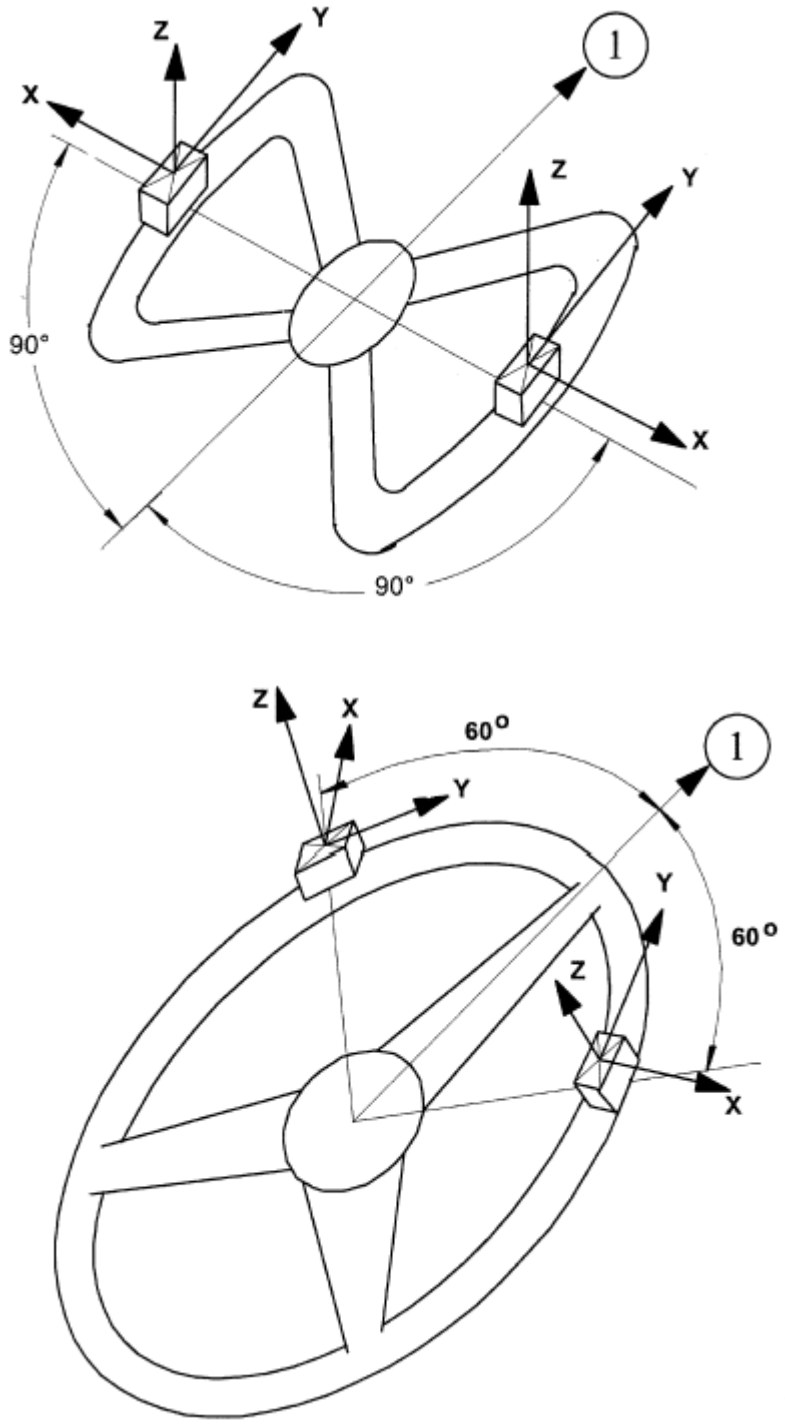
Dimensions in millimetres



Key

a = 100

Figure FF.1 – Examples of transducer location/orientation (pedestrian controlled machines)



Key

1 Machine front

Figure FF.2 – Examples of transducer location/orientation for hand-arm vibration

FF.4.2 Hand-arm vibration

Testing shall be carried out with the machine stationary and at the maximum operating motor speed.

FF.4.2.1 Machines

Adjustable handles of machines shall be set to suit the operator. The cutting height shall be set to 30 mm or the next higher cutting position when set on a hard level surface. Machines with a maximum cutting height setting of 30 mm or less shall be set at their maximum height setting. Measurements shall be carried out on a surface in accordance with Annex HH.

FF.5 Measurement procedure

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

NOTE 1 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 2 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.

FF.6 Determination of the measurement result

FF.6.1 Hand-arm

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.

Annex GG
(normative)

Noise test code – Engineering method (grade 2)

GG.0 Scope

This noise test code specifies the information necessary to carry out efficiently and under standardized conditions the determination of the noise emission characteristics of lawnmowers.

Noise emission characteristics include the emission sound pressure level at the operator position 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 give results with grade 2 of accuracy.

GG.1 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 or by natural grass which complies with Clause GG.3. Reproducibility of results using natural grass is likely to be lower than that required for grade 2 of accuracy. In the case of dispute, measurements shall be carried out in the open air and on the artificial surface;

– the measurement surface shall be a hemisphere with a radius, r, which depends on the width of cut of the machine under test and which shall be:

  a) r = 4 m for machines with a width of cut up to 1,2 m;

  b) r = 10 m for machines with a width of cut exceeding 1,2 m;

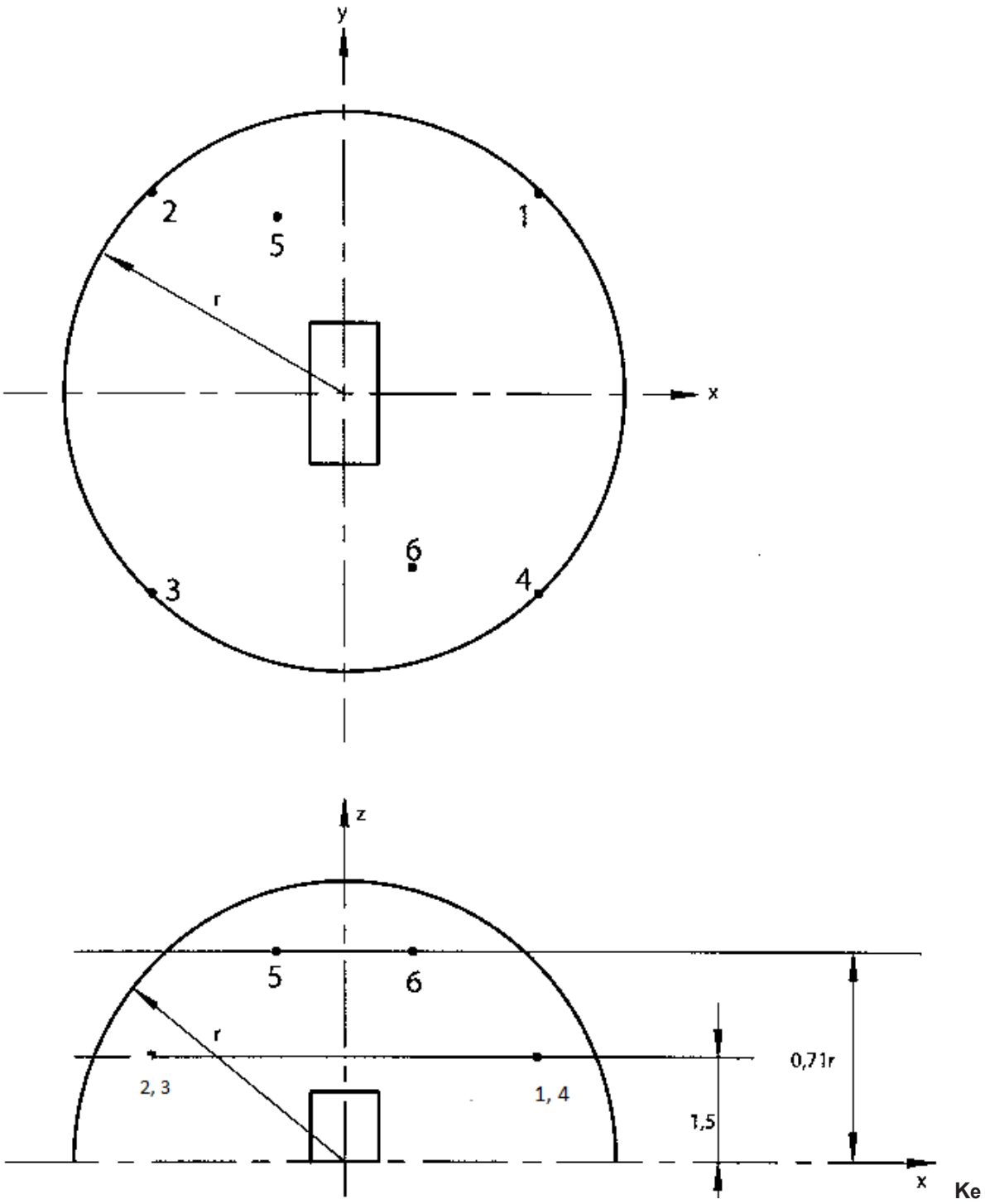
– the microphone array shall be six microphone positions as defined in Figure GG.1 and Table GG.1;

– 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 8 m/s and preferably less than 5 m/s;

– for measurements in the open air K_{2A} = 0;

– for measurements indoors the value of K_{2A}, determined without artificial surface and in accordance with Annex A of EN ISO 3744:1995, shall be ≤ 2 dB, in which case K_{2A} shall be disregarded.

Dimensions in metres



r = radius of hemisphere

Figure GG.1 – Microphone positions on the hemisphere (see Table GG.1)

Table GG.1 – Co-ordinates 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*

GG.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 or by natural grass which complies with Clause GG.3. Reproducibility of results using natural grass is likely to be lower than that required for grade 2 of accuracy. In the case of dispute, measurements shall be carried out in the open air and on the artificial surface;

– 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 8 m/s and preferably less than 5 m/s;

– the microphone shall be head mounted 200 mm ± 20 mm from the median plane of the head on the louder side and in line with the eyes. The operator shall stand or sit upright and look straight ahead. The microphone shall be aimed with its axis of maximally flat response (as specified by the manufacturer) pointing forwards and at an angle of 45° downwards from the horizontal. The operator shall 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 m ± 0,05 m tall.

When measuring the emission sound pressure level at the operator position, 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 arithmetic average of these shall be the measured A-weighted emission sound pressure level of the machine.

GG.3 Requirements for test floor

GG.3.1 Artificial surface

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

Table GG.2 – Absorption coefficients

Frequencies 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 artificial surface shall be placed on a hard, reflecting surface and have a size of at least 3,6 m × 3,6 m placed at the centre of the test environment. 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 operator to avoid compression of the absorbing material.

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

GG.3.2 Natural grass

The test environment shall be covered, at least for the horizontal projection of the measurement surface used, with high-quality natural grass. Before the measurements are taken, the grass shall be cut with a mower to a height of cut as near as possible to 30 mm. The surface shall be clean of grass clippings and debris and shall be visibly free of moisture, frost or snow.

GG.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. If a grass catcher is provided or available for the machine from the manufacturer, it shall be fitted and empty.

For cylinder (reel) mowers, the rotating cutting cylinder(s) and/or the stationary cutting edge(s) shall be adjusted using one of the following two procedures, which shall be mentioned in the test report, such that:

– either a sheet of Kraft paper, as defined in ISO 4046:1978, with a grammage (substance) of 80 g/m² is cut at least along 50 % of the width of cut; or

– the gap between moving and stationary cutting meanss at standstill does not exceed 0,15 mm over the whole width of cut when checked with calibrated strip gauges.

Cutting meanss and knives of cylinder (reel) mowers shall be lubricated with SAE 20/50 grade oil.

If the maximum height of cut of the machine is greater than 30 mm, the height of cut shall be adjusted to the lowest position provided, but not lower than 30 mm. If the maximum height of cut of the machine is less than 30 mm, the height of cut shall be adjusted to the highest position provided. The height of cut shall be adjusted with the machine resting on a hard, flat surface.

NOTE For cylinder (reel) mowers, care should be taken to avoid overheating the cutting meanss by operating continuously (without cutting grass) and therefore appropriate interruptions for cooling and lubrication should be introduced.

For electric motors supplied from mains, the machine shall be run until stable conditions are reached before the test is commenced. The rated voltage or the upper limit of the rated voltage range and/or frequency shall be maintained during the test at 0,98 to 1,02 times the stated values. The supply voltage of mains powered machines is measured at the plug of the cable or cord supplied, not at the plug of any extension cable or cord.

For electric motors supplied from batteries, noise measurements shall be started with fully charged batteries as specified by the manufacturer but shall not be continued when the battery voltage under load drops to lower than 0,9 times the battery voltage under load at the beginning of the measurements for lead-acid batteries, or to lower than 0,8 times for other batteries. The battery voltage shall be measured at the battery terminals.

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

The test shall be carried out at the maximum operating motor speed (see 3.117).

A motor speed indicator shall be used to check the speed of the motor. It shall have an accuracy of ± 2,5 % of the reading. The indicator and its engagement with the machine 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, grass catcher etc.) coincides with the origin of the coordinate system of the microphone positions. If an artificial surface in accordance with Clause GG.3 is used, it 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 sound pressure level determination, adjustable features (e.g. handle height,) shall be set to suit the operator.

GG.5 Measurement uncertainty

A standard deviation of reproducibility of 0,5 to 1,5 dB is expected for the A-weighted emission sound pressure level determined according EN ISO 11201.The same applies for the sound power level determined according to EN ISO 3744.

GG.6 Information to be recorded

The information to be recorded shall cover all of the technical requirements of this noise test code). Any deviations from this noise test code or from the basic standards that have been applied are to be recorded together with the technical justification for such deviations.

GG.7 Information to be reported

The information included in the test report shall cover at least that which is required to prepare a noise declaration or to verify the declared values.
As a minimum, the following information shall be included:
- reference to the basic noise emission standards used
- description of mounting and operating conditions used
- locations of work stations and other specified positions determining L_{pA}
- noise emission values obtained

It shall be confirmed that all requirements of the noise test code according to this standard have been fulfilled, or, if this is not the case, any unfulfilled requirements shall be identified. Deviations from the requirements shall be stated and technical justification for the deviations shall be given.

GG.8 Declaration and verification of noise emission values

The declaration of the A-weighted emission sound pressure level shall be made as a dual number noise emission declaration according to EN ISO 4871: 1996. It shall declare the noise emission value L_{pA} and separately the respective uncertainty K_{pA}..

The declaration of the A-weighted sound power level L_{WA} shall be made as a single number noise emission declaration according to EN ISO 4871: 1996, thus declaring the sum of L_{WA} and the respective uncertainty K_{WA}.

The noise emission values shall be rounded to the highest decibel.

The noise declaration shall state that the noise emission values have been obtained according to this noise test code and to the basic standards EN ISO 11201:1996 and EN ISO 3744: 1995.
If this statement is not true, the noise emission declaration shall indicate clearly what the deviations are from this standard and/or from the basic standards.
If undertaken, verification shall be done according to EN ISO 4871: 1996 by using the same mounting, installation and operating conditions as those used for the initial determination of the noise emission values.

Annex HH
(informative)

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

HH.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.

HH.2 Construction

As is shown in Figure HH.1, the artificial flooring of the measurement site is sub-divided into nine joint planes, each of approximately 1,20 m x 1,20 m. The backing layer of the construction as shown in Figure HH.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, 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 any other place on which the operator can get to stand on, aluminium T-sections 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 cut to size.

The felt flooring of the joint planes which are neither stood on nor driven over (type A surface in Figure HH.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 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 adequately without affecting the acoustic conditions.

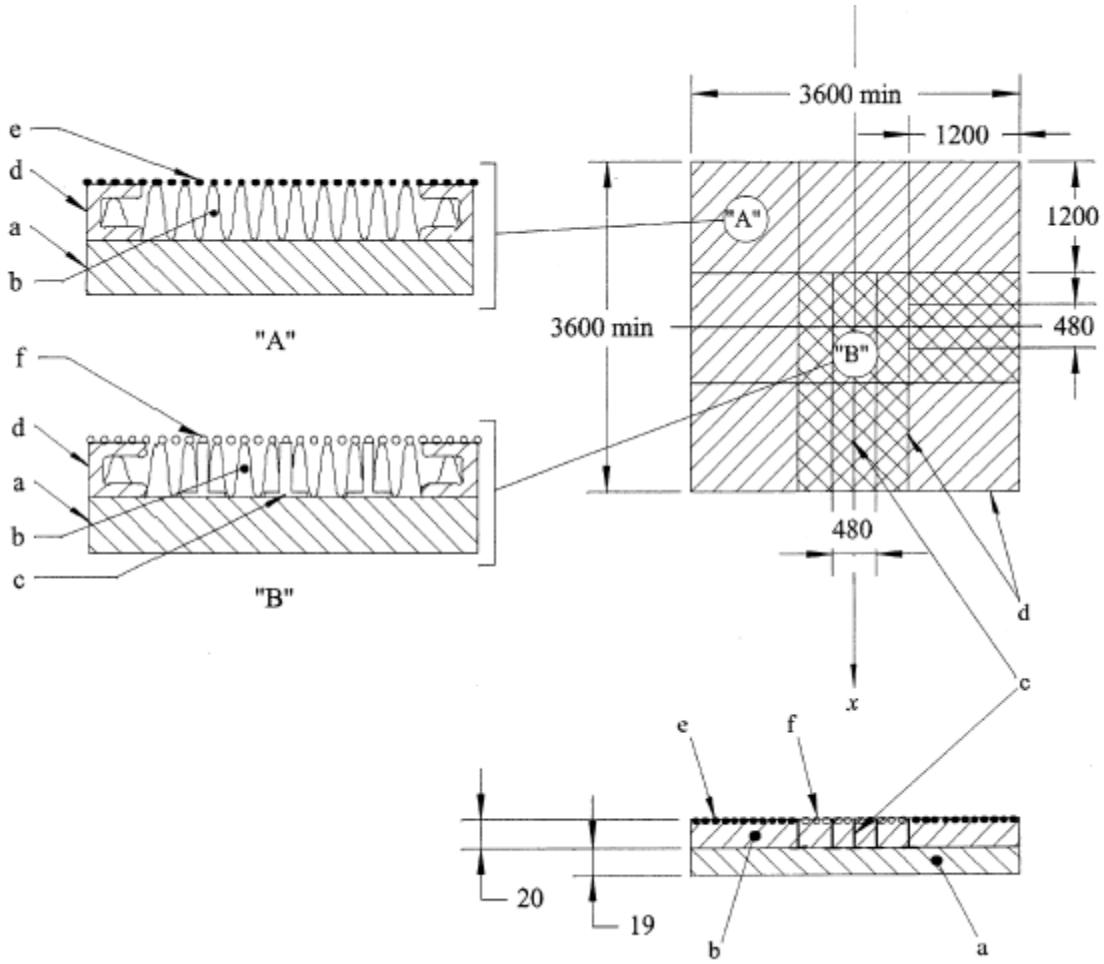
Protection by simple wire mesh is not, however, sufficient in the area subjected to traffic (type B surface in Figure HH.1). For these surfaces, the use of wire grating of corrugated steel wire with a diameter of 3,1 mm and a mesh width of 30 mm has proved to be suitable.

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 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”	This surface is not suitable to carry weight. Do not stand on or drive over
“B”	This surface is suitable to carry weight. May be stood on or driven over
a	Backing layer of plastics coated chipboard (nominally 19 mm thick)
b	Mineral wool fibre layer (nominally 20 mm thick)
c	Aluminium T-sections (nominally 3 mm thick × 20 mm high)
d	Aluminium U-sections (nominally 3 mm thick × 20 mm high)
e	Wire mesh (nominally 10 mm × 10 mm mesh made of 0,8 mm diameter steel wire)
f	Wire grating (nominally 30 mm × 30 mm mesh made of 3,1 mm diameter steel wire)

NOTE Unless otherwise stated, all dimensions are approximate.

Figure HH.1 – Sketch of the measurement surface covered with an artificial surface (not to scale)

Annex ZZ
(informative)

Coverage of Essential Requirements of EC Directives

This European Standard has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association and within its scope the standard covers all relevant essential requirements as given in EC Directive 2006/42/EC (Machinery Directive).

Compliance with this standard provides one means of conformity with the specified essential requirements of the Directive concerned.

WARNING: Other requirements and other EC Directives may be applicable to the products falling within the scope of this standard.

Bibliography

The bibliography of Part 1 is applicable.

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