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Power lawn-mowers, lawn tractors, lawn and garden tractors, professional mowers, and lawn and garden tractors with mowing attachments — Definitions, safety requirements and test procedures

Tondeuses à gazon à moteur, tracteurs de pelouse, tracteurs de jardin et de pelouse, tondeuses à usage professionnel, tracteurs de jardin et de pelouse avec équipements de tonte adaptables — Définitions, prescriptions de sécurité et modes opératoires d'essai

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Contents

		Page
Section 1	**General**	**1**
1.1	Scope	**1**
1.2	Normative references	**1**
1.3	Definitions	**2**
section 2	**Basic requirements**	**5**
2.1	Application	**5**
2.2	Safety protection	**5**
section 3	**Requirements for rotary mowers**	**10**
3.1	Application	**10**
3.2	General construction	**10**
3.3	Test procedures	**12**
3.4	Pedestrian-controlled machines: additional requirements	**22**
3.5	Ride-on (riding) machines: additional requirements	**24**
3.6	Towed units: requirements	**25**
3.7	Professional (commercial) mowers and turf care equipment: additional requirements	**26**
section 4	**Requirements for cylinder mowers**	**27**
4.1	Applications	**27**
4.2	General construction, guarding and shielding	**27**
4.3	Thrown grass, thrown objects, operator safety	**27**
4.4	Pedestrian-controlled machines: requirements	**27**
4.5	Ride-on (riding) machines: requirements	**30**
4.6	Towed units: requirements	**30**

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4.7 Professional (commercial) mowers and turf care equipment: additional requirements 30

Annexes

A Guarding principles 31

A.1 Safety distance from dangerous parts 31

A.2 Round reach 31

A.3 Reaching in and through elongated openings with parallel sides 33

A.4 Reaching in and through square or circular apertures 34

A.5 Openings of irregular shape 34

B Test enclosure 35

B.1 Base 35

B.2 Target composition 35

C Corrugated fibreboard penetration tests on rotary mowers: test enclosure wall panels 38

C.1 Purpose 38

C.2 Test fixture 38

C.3 Fibreboard samples 38

C.4 Procedure 38

C.5 Recommended acceptance criteria 38

D Specimen test report of thrown object test 40

D.1 Target elevation areas 40

D.2 Data sheet 40

D.3 Test acceptance (pass/fail criteria) 40

E Safety instructions for rotary mowers: pedestrian and ride-on, cylinder mowers: pedestrian and ride-on 42

E.1 Safe operation practices for walk-behind rotary mowers 42

E.2 Safe operation practices for ride-on (riding) rotary mowers 43

E.3 Safe operation practices for walk-behind cylinder mowers .. 44

E.4 Safe operation practice for ride-on (riding) cylinder mower machines 45

F Bibliography 46

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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

International Standard ISO 5395 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*.

This first edition cancels and replaces the previous editions of separate parts: ISO 5395-1:1984, ISO 5395-2:1981, ISO 5395-3:1985 and its Addendum 1:1986, and ISO 5395-4:1985 of all of which it constitutes a revision and combination.

Annexes A, B, C, D and E form an integral part of this International Standard. Annex F is for information only.

Power lawn-mowers, lawn tractors, lawn and garden tractors, professional mowers, and lawn and garden tractors with mowing attachments — Definitions, safety requirements and test procedures

Section 1: General

1.1 Scope

This International Standard presents definitions of terms and specifies safety requirements and test procedures applicable to powered rotary and cylinder mowers, including pedestrian-controlled and ride-on (riding) types, ride-on (riding) lawn tractors, lawn and garden tractors, and lawn and garden tractors with mowing attachments designed primarily for use at and around the home.

The additional requirements for professional (commercial) mowers and turf care equipment are also given, in clause 3.7 and clause 4.7, for these machines designed primarily as professional (commercial) mowers and turf care equipment.

This International Standard does not apply to lawn trimmers, lawn edge trimmers, and edgers, flail mowers, sickle-bar mowers, agricultural mowers, and the electrical aspects of mains-electrically driven machines.

Rotary mowers are excluded from the requirements of this International Standard if the cutting means is either one or more non-metallic filaments, or one or more non-metallic cutting elements pivotally mounted on a generally circular central drive unit, where these cutting elements rely on centrifugal force to achieve cutting, and have a kinetic energy for each single cutting means of less than 10 J. In addition for these machines, the cutting means shall not be replaceable with metallic or other rigid material equivalents supplied by the manufacturer.

1.2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 500:1979, *Agricultural tractors — Power take-off and drawbar — Specification.*

ISO 2758:1983, *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 3411:1982, *Earth-moving machinery — Human physical dimensions of operators and minimum operator space envelope.*

ISO 3416:1986, *Textile floor coverings — Determination of thickness loss after prolonged, heavy static loading.*

ISO 3600:1981, *Tractors and machinery for agriculture and forestry — Operator manuals and technical publications — Presentation.*

ISO 3767-1:1982, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Symbols for operator controls and other displays — Part 1: Common symbols.*

ISO 3767-2:1982, *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 3767-3:1988, *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 3789-1:1982, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Location and method of operation of operator controls — Part 1: Common controls.*

ISO 3789-3:1989, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Location and method of operation of operator controls — Part 3: Controls for powered lawn and garden equipment.*

ISO 4200:1990[1)], *Plain end steel tubes, welded and seamless — General tables of dimensions and masses per unit length.*

ISO 6682:1986, *Earth-moving machinery — Zones of comfort and reach for controls.*

ISO 9193:1990, *Lawn and garden ride-on (riding) tractors — Power take-off.*

IEC 335-1:1976, *Safety of household and similar electrical appliances —Part 1: General requirements.*

1.3 Definitions

For the purposes of this International Standard, the following definitions apply.

1.3.1 blade: (See 1.3.6.)

1.3.2 blade tip circle: Path described by the outermost point of the cutting means cutting edge as it rotates about its shaft axis.

1.3.3 braking distance: Distance travelled between the point of the first application of the brake control and the point at which the machine or component comes to rest.

1.3.4 braking system: Combination of one or more brakes and related means of operation and control.

1.3.5 control: Means or device which will control the operation of the mower or any specific operating function thereof.

1.3.6 cutting means: Mechanism used to provide the cutting action of a power lawn-mower.

1.3.7 cutting means enclosure [housing]: Part or assembly which provides the protective means around the cutting means.

1.3.8 cutting position: Any height setting of the cutting means designated by the manufacturer for cutting grass.

1.3.9 cutting width: Width of cut measured across the cutting means at right-angles to the direction of travel and calculated from the dimensions of the cutting means or the diameter(s) of the blade tip circle(s).

1.3.10 cylinder [reel] mower: Grass-cutting machine with one or more blades rotating about a horizontal axis to provide a shearing action with a fixed cutter bar or knife.

1.3.11 discharge chute: Extension of the cutting means enclosure from the discharge opening, generally used to control the discharge of material from the cutting means.

1.3.12 discharge opening: Gap or opening in the cutting means enclosure through which grass may be discharged.

1.3.13 durable label: Label that is considered to be virtually permanent.

1.3.14 edger: Powered machine suitable for cutting lawn and soil, usually in a vertical plane.

1.3.15 exhaust system: Means of conveying exhaust gases from the engine exhaust port to the atmosphere.

1.3.16 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.

1.3.17 grass catcher: Part or combination of parts which provides a means for collecting grass clippings or debris.

1) To be published.

1.3.18 guard; shield: Part of the mower or a component incorporated to provide protection for the operator and/or bystander.

1.3.19 hit: Test projectile passing completely through all layers of the test target material.

1.3.20 jackknifing: Movement of an articulated unit which results in

a) prevention of further operation in the reverse direction, or

b) entrapment of the operator, or

c) displacement of the operator sufficient to cause loss of control.

1.3.21 lawn edge trimmer: Powered grass-cutting machine for trimming lawn edges usually in a vertical plane.

1.3.22 lawn trimmer: Powered grass-cutting machine where the operator determines the plane of operation of the cutting means and the height of cut, possibly assisted by a wheel or skid, etc.

1.3.23 maximum operating engine [motor] speed: Highest engine/motor speed obtainable when adjusted in accordance with mower manufacturer's specifications and/or instructions with the cutting means engaged, taking into account all tolerances.

1.3.24 mowing attachment: Cutting means designed to be easily detached from the machine, generally to allow the machine to be used for other purposes.

1.3.25 mulching mower: Rotary mower without discharge openings in the mower housing.

1.3.26 normal operation: Any use of the machine which is reasonably foreseeable, as seen by the ordinary user, and which is consistent with such activities as cutting grass, starting, stopping, fuelling, or connecting to (or disconnecting from) a power source, or the mounting of, and dismounting from, ride-on machines.

1.3.27 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.

1.3.28 operator control: Any control requiring operator actuation to perform specific functions.

1.3.29 operator control position: Area or space within which all controls to be operated from the operator position shall be located. See ISO 6682.

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

1.3.31 operator target area: Operator target area for pedestrian-controlled machines as specified in 3.3.1.4.

1.3.32 operator zone — pedestrian: Operator zone for persons operating a pedestrian-controlled machine as shown in figure 2.

1.3.33 operator zone — ride-on: Operator zone for persons operating ride-on machines as described in ISO 6682.

1.3.34 parking brake: Means of preventing a stationary machine from moving that can remain applied without the operator being present.

1.3.35 pedestrian-controlled mower; walk-behind mower: Grass-cutting machine, either pushed or self-propelled, normally controlled by the operator walking behind the unit.

1.3.36 pedestrian-controlled tractor; walk-behind tractor: Machine normally controlled by an operator walking behind the unit, designed to power and propel a variety of attachments.

1.3.37 power (lawn-) mower: Grass-cutting machine where the cutting means operates in a plane approximately parallel to the ground and which uses the ground to determine the height of cut by means of wheels, air cushion or skids, etc., and which utilizes an engine or an electric motor as a power source.

1.3.38 power source: Engine or motor which provides mechanical energy for linear or rotational movement.

1.3.39 professional [commercial] mower: Machine designed for commercial application that is generally used by a paid operator.

1.3.40 ride-on [riding] machine; lawn and garden tractor; turf (riding) tractor: Self-propelled machine on which an operator rides and designed primarily for cutting grass and auxiliary garden work. The cutting means may be an integral part of the machine or suspended from or attached to the machine.

1.3.41 rotary mower: Power mower in which one or more elements, cutting by impact, rotate about an axis normal to the cutting plane.

1.3.42 service brake system: Designated primary means for decelerating and stopping a machine from its ground travel speed.

1.3.43 sickle bar mower: Lawn-mower which uses a power source to create reciprocating movement in a knife or knives to provide a shearing action with a stationary cutter bar or movable knife.

1.3.44 standard test operator: Operator weighing 75 kg ± 5 kg, and 1,75 m ± 0,05 m tall.

1.3.45 stopping time: Time elapsed between the instant at which stopping action is actuated and the instant at which the machine or component comes to a stop.

1.3.46 throw line (of cylinder mowers): Steepest line in a vertical plane, tangential to the periphery of the cutting cylinder in the direction of rotation, which does not intersect a guard or portion of the mower. See figure 18.

1.3.47 thrown object hazard: Potential for injury caused by object(s) propelled by the moving cutting means.

1.3.48 towed unit: Implement pulled from the drawbar of a propelling machine and usually equipped with wheels for transport.

1.3.49 traction drive: Means or system used to transmit power from the power source to the ground drive means.

1.3.50 trailing seat; sulky: Removable, trailing device designed to carry a seated operator to ride behind while controlling a self-propelled, walk-behind mower or tractor.

1.3.51 trailing seat unit; sulky unit: Walk-behind power lawn-mower or tractor with an optional trailer seat (sulky) attached.

1.3.52 transport position: Designated condition of the cutting means of a power lawn-mower for propelled transport.

Section 2: Basic requirements

2.1 Application

Section 2 specifies the basic requirements for powered rotary and cylinder (reel) mowers, including pedestrian-controlled and ride-on (riding) types, ride-on (riding) lawn tractors, lawn and garden tractors, professional mowers, and lawn and garden tractors with mowing attachments.

2.2 Safety protection

2.2.1 Power-driven components

2.2.1.1 Power-driven gears, chains, sprockets, belts, friction drives, pulleys, fans, fan wheels and other moving parts, whenever they create a pinch point capable of causing injury during normal operating of the machine, shall be positioned or guarded by shields or similar attachments to prevent accidental contact with these components.

Driving belts and chains having connectors which are capable of causing injury, during normal operating of the machine, shall be guarded along their whole length. Other belt or chain drives which are capable of causing injury, during normal operating of the machine, shall be guarded at least at the run-on points. Drive-shafts shall be fully guarded.

The principles set out in annex A shall be followed when developing a guarding system.

Rotating covers or discs shall have a continuous unbroken or smooth surface. Mowers shall not be equipped with a starter operated by means of a loose rope.

Guards shall be provided to prevent accidental contact with hazardous servicing points when servicing the machine as recommended by the manufacturer.

Where a guard is designed to be opened or removed and which exposes a hazard, a safety sign warning of the hazard shall be located on the guard or adjacent to the hazard.

Where a guard is so positioned that it may be used as a step, it shall withstand a force of 1 200 N.

2.2.1.2 The requirements of 2.2.1.1 do not apply to

a) the cutting means; and

b) any component part functioning in contact with the soil.

2.2.2 Guard attachment

All guards shall be permanently attached to the machine and shall not be detachable without the use of tools. The opening of guards shall require the use of a tool. Exceptions to this are the opening of or removing interlocked guards which disable the protected moving parts, the opening of hinged guards for grass discharge chutes and engine compartment access.

2.2.3 Heat protection

2.2.3.1 Requirements

A guard or shield shall be provided to prevent accidental contact with any exposed engine exhaust components greater than 10 cm^2 and with a hot surface greater than 80 °C at 20 °C ± 3 °C ambient temperature during normal operation of the machine.

2.2.3.2 Test equipment

The measuring equipment shall have an accuracy of ± 3 °C.

2.2.3.3 Test method

The test shall be conducted in the shade. The engine shall be operated at its maximum no-load speed until the surface temperature stabilizes. Temperatures are to be determined by correcting the observed temperature by the difference between the specified ambient and the test ambient temperature. Identify the hot surface area(s) on the engine exhaust system. When the distance between the identified hot area and the nearest control is in excess of 100 mm, cone A in figure 1 shall be used. For a distance less than 100 mm between the identified hot area and the nearest control, cone B in figure 1 shall be used.

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

Dimensions in millimetres

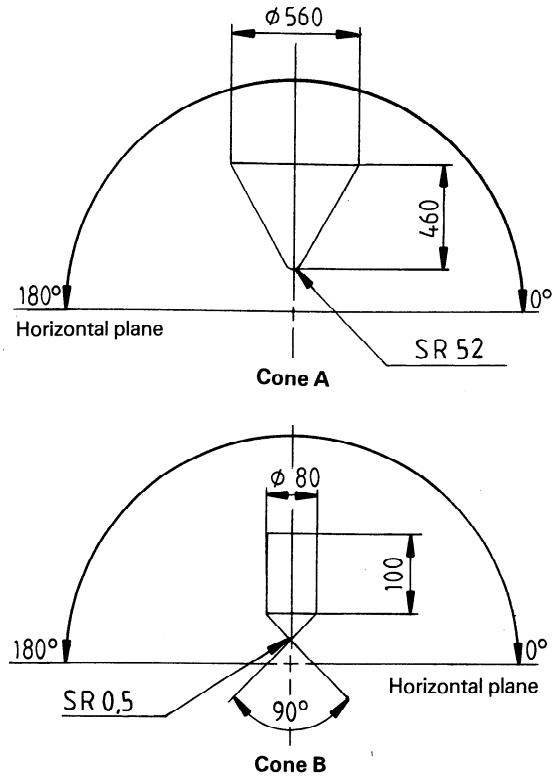


Figure 1 — Test cones

2.2.3.4 Test acceptance

The tip or conical surface of cone A or B shall not make contact with the hot surface of the exhaust system.

2.2.4 Protection from exhaust fumes

Engine exhaust, where it exists, shall not be directed towards the operator.

On machines equipped with an enclosure for the operator, the engine exhaust shall not be directed towards the enclosure or the air inlet to the enclosure.

2.2.5 Moving components

Any moving components shall not cause injury to, or unstable displacement of, the operator during normal operation.

2.2.6 Pressurized components

Pressurized hoses, lines and components shall be located or shielded so that in the event of rupture the fluid is not discharged directly on to the operator when in the operator position.

2.2.7 Liquid containers

When filled to the manufacturer's instructions, liquid containers, batteries, fuel systems, oil reservoirs, and coolant systems shall be constructed to prevent spillage for 1 min after the machine is tilted as specified in the stability test. Weeping at vent systems is not considered spillage.

2.2.8 Seats and foot-rests

Ride-on machines shall be provided with an operator seat and foot-rests of adequate strength with safe access to and from the operator position. The operator's seat shall have a buttock support at least 115 mm high at the rear above the seating surface to retain the operator, except where the operator sits astride the frame of the machine and holds the handlebars in which case the buttock support is not required.

2.2.9 Controls

2.2.9.1 All machines

Operator controls shall meet the requirements specified in ISO 3789-1 and ISO 3789-3. The controls shall also accommodate the 5th to the 95th percentile adult operator as specified in ISO 3411.

The following are not operator controls:

— height of cut setting;

— fixed blade (on-cut) setting or adjustment on cylinder mowers;

— engine starting;

— grass catcher discharge arrangements.

2.2.9.1.1 Pedestrian-controlled machines

The location and range of movement of operator controls shall be convenient to the operator and shall remain within the anthropometric dimensions given in figure 2 for walk-behind units. The operating range of less frequently used controls 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.

Engine starting controls may be outside this range if

a) starting can only be accomplished with blade drive disengaged; or

b) the mower housing can pass the foot probe test in 3.3.5 with the probe applied at the designated starting position of the mower.

The reverse function of the traction drive control(s) shall require continuous activation in the direction of travel to drive, and shall automatically return to neutral when released.

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

2.2.9.1.2 Ride-on (riding) machines

The location and range of movement of operating controls shall be convenient to the operator and shall remain within the confines of the operator zone of reach in ISO 6682. The operating range of less frequently used controls may be extended by allowing the operator's trunk, while sitting on ride-on machines, to articulate within the confines of the operator area, e.g., lean forward until contacting steering control which may be in any of the operator positions.

2.2.9.2 Identification of controls

Controls, other than those the purpose of which is obvious, shall have the function, direction and/or method of operation clearly identified by a durable label or mark.

Easily understood detailed instructions on the operation of all controls shall be provided in an operator's manual.

2.2.9.3 Operator symbols

Operator symbols shall be in accordance with ISO 3767-1, ISO 3767-2 and ISO 3767-3.

2.2.10 Machine identification

2.2.10.1 General

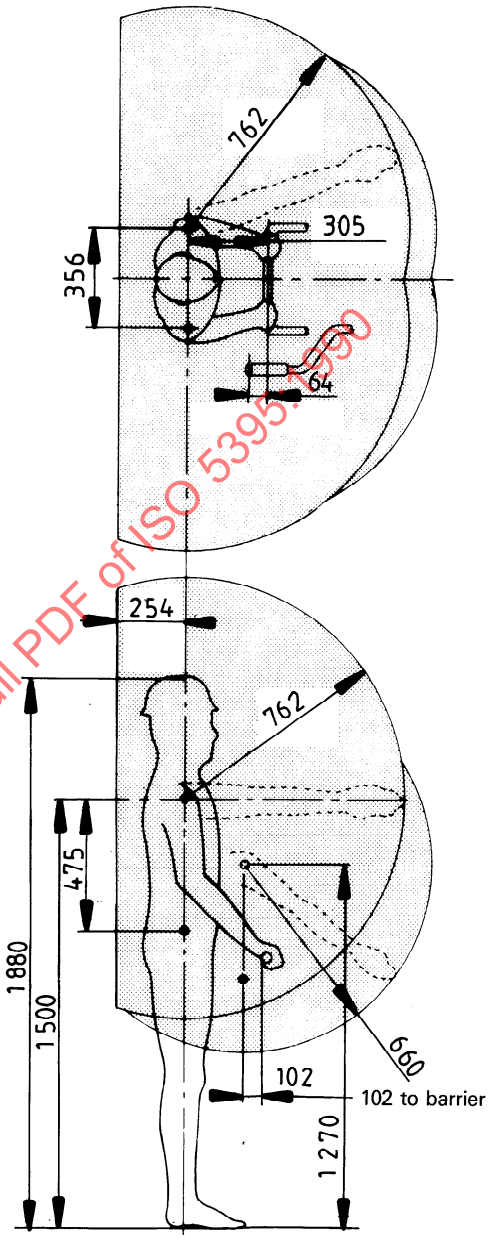
Every machine and mowing attachment shall be permanently identified indicating the manufacturer or supplier, model number and/or serial number.

2.2.10.2 Label

Labels provided for identification and directional or cautionary information shall have a reasonable life for the anticipated machine operating environment and satisfy the following requirements:

a) the label shall have a durable bond with the base material surface;

Dimensions in millimetres



NOTES

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

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 barrier. This zone can also be reached by a 95th percentile male leaning forward against the handle barrier.

3 All barriers within the operator zone will reduce the zone by the space occupied and protected by the barrier.

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

Figure 2 — Operator zone — Walk-behind pedestrian-controlled machine

b) the label shall be weather-resistant and under normal cleaning procedures shall not fade, discolour, crack, craze or blister, and shall remain legible;

c) the label shall not curl at the edges and legibility shall not be affected by spilled petrol or oil;

d) the label, other than those on electric machines, shall withstand high-pressure cold water cleaning.

Labels (danger signs) giving cautionary information shall be located close to the relevant hazard. Such danger signs and warning signs shall either be in the official language(s) of the country in which the mower is sold, or use applicable information pictorials.

2.2.11 Maintenance and operational requirements

Each mower shall be provided with a manual giving operating, servicing, and maintenance instructions, as specified in ISO 3600. The instructions should include those operations which can normally be performed by the operator.

The instructions shall include:

a) instructions for the proper assembly of the mower for use, if the mower is not supplied in a completely assembled form;

b) instructions for proper adjustment of the machine, including a warning of the danger of rotating blade(s), for example, "Caution — do not touch rotating blade";

c) instructions for machine operation and where appropriate such items as:

— instructions for de-energizing stored energy devices, such as spring-loaded mechanisms, engine cooling system and hydraulic systems including hydraulic accumulators,

— information that hydraulic fluid escaping under pressure can have sufficient force to penetrate the skin and do serious damage, and that if fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this form of injury, or gangrene may result.

2.2.12 Electrical requirements

2.2.12.1 General

These electrical requirements apply only to battery circuits of less than 42 V and are given for guidance. For the electrical requirements for mains-connected electrically driven machines, reference should be made to IEC 335-1.

2.2.12.2 Low-voltage battery circuits (not including magneto grounding circuits)

2.2.12.2.1 Electrical cables

Electrical cables shall be protected if located in potentially abrasive contact with metal surfaces.

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

2.2.12.2.2 Battery installation

The compartment for a vented storage battery shall have openings to provide ventilation and drainage. When the battery is in the operating position, acid shall not leak onto parts that would be critically affected to the extent that a hazard would be created from corrosion.

2.2.12.2.3 Overload protection

All circuits, except starter motor and high-tension ignition circuits, shall be provided with overload protection devices in the ungrounded line near the battery terminal or starter cable. The overload protection may be located in either wire of a two-wire system.

This requirement shall not, however, apply to battery-powered machines capable of passing the following test.

With the motor shaft locked to prevent rotation, connect it to its fully charged integral battery, and leave it in that condition until the battery is discharged or failure of any component takes place. The machine shall not emit flames or molten metal. Any internal explosion shall be contained so as not to cause any material to be ejected from the machine.

2.2.12.2.4 Terminals and uninsulated electrical parts

Terminals and uninsulated electrical parts, and two-wire non-grounded systems shall be protected against short-circuiting by the fuel-tank, or tools, during normal refuelling and lubrication servicing.

2.2.12.3 Ignition circuits

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

2.2.12.3.2 All high-voltage parts of the circuit including spark-plug terminals shall be electrically protected in such a manner that the operator cannot make accidental contact with them.

2.2.13 Engine stopping and starting

2.2.13.1 An engine-stopping device shall be provided. The device shall not depend on sustained manual pressure for its continued operation. This device shall require manual and intentional activation in order to restart the engine, and shall be accessible from starting and operating positions.

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

2.2.14 Transport

2.2.14.1 If movement of the cutting means towards the transport position raises any part of the cutting plane above 400 mm from the ground, then the drive shall be automatically disengaged or require manual disengagement before it can be raised above 400 mm.

2.2.14.2 When moving the cutting means from the transport position to the working position the drive to the cutting means shall not be engaged unless

a) the operator is at the operator's position;

b) all parts of the cutting plane are within 400 mm of the ground; and

c) there is a deliberate activation of the drive to the cutting means by the operator.

2.2.14.3 When there is a designated transport position, and where the height of any part of the cutting plane of a cutter unit is less than 400 mm, there shall be a means of disengaging the cutting means drive while the traction drive is engaged.

2.2.14.4 The cutter unit shall be capable of being secured in the transport position by positive means such as latches, hydraulic locks, etc.

2.2.14.5 If the cutter units have to be brought to the transport position by hand, they shall be provided with appropriate handles.

2.2.14.6 For ride-on units the operation of the cutting means shall be independent of the traction drive and shall include a separate control for engaging and disengaging the traction drive.

Section 3: Requirements for rotary mowers

3.1 Application

Section 3 specifies the safety requirements and test procedures applicable to powered rotary mowers, including pedestrian-controlled and ride-on (riding) types, ride-on (riding) lawn tractors, lawn and garden tractors, professional mowers, and lawn and garden tractors with mowing attachments.

3.2 General construction

3.2.1 Blade enclosure

3.2.1.1 General

The blade enclosure shall extend at least 3 mm below the plane of the blade tip circle, except as allowed in 3.2.1.2, and the grass discharge opening. The bolt heads of blade-securing screws may extend below the blade enclosure providing these are located within the inner 50 % blade tip circle diameter.

Any extension of the wall(s) of the blade 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 wall(s) shall be tested by the foot probe (3.3.5) and meet all the other requirements of this International Standard.

3.2.1.2 Front opening

Front openings may be provided on machines having a cutting width of 600 mm or greater.

Where provided it shall not exceed

a) the cutting width; or

b) the opening generated by two radial lines extending from the blade spindle(s) centre(s) at an angle of 50° to the direction of travel where these lines meet the enclosure, whichever is the smaller. See figure 3.

The highest point of all openings in the blade enclosure at the front, except the discharge openings, shall be limited by a vertical angle of opening of 15° and a maximum distance of 30 mm above the horizontal plane of the blade in the lowest blade position. The highest point in the openings of a front comb or rake arrangement shall be considered as a point on the bottom edge of the blade enclosure, front. See figure 3.

3.2.2 Discharge openings (chutes)

When open discharge chutes are provided, the extension of the discharge chute perimeters shall not intersect the operator target area when the mower is set at any height of cut. No tangential line from the blade tip circle shall intersect the operator target area without first contacting the blade enclosure or guard.

3.2.3 Guards and grass catchers

Swinging guards or guards which have to be displaced in order to fit the grass catcher shall automatically return to the full guard position when the grass catcher is removed. The guards shall be considered as forming part of the blade enclosure for the purposes of 3.2.1 and 3.2.2.

Instructions shall be affixed to the mower near the discharge opening and to the grass catcher adapter, if one is used, stating that the mower shall not be operated without either the entire grass catcher or the guard in place.

3.2.4 Blades

3.2.4.1 Operator presence control

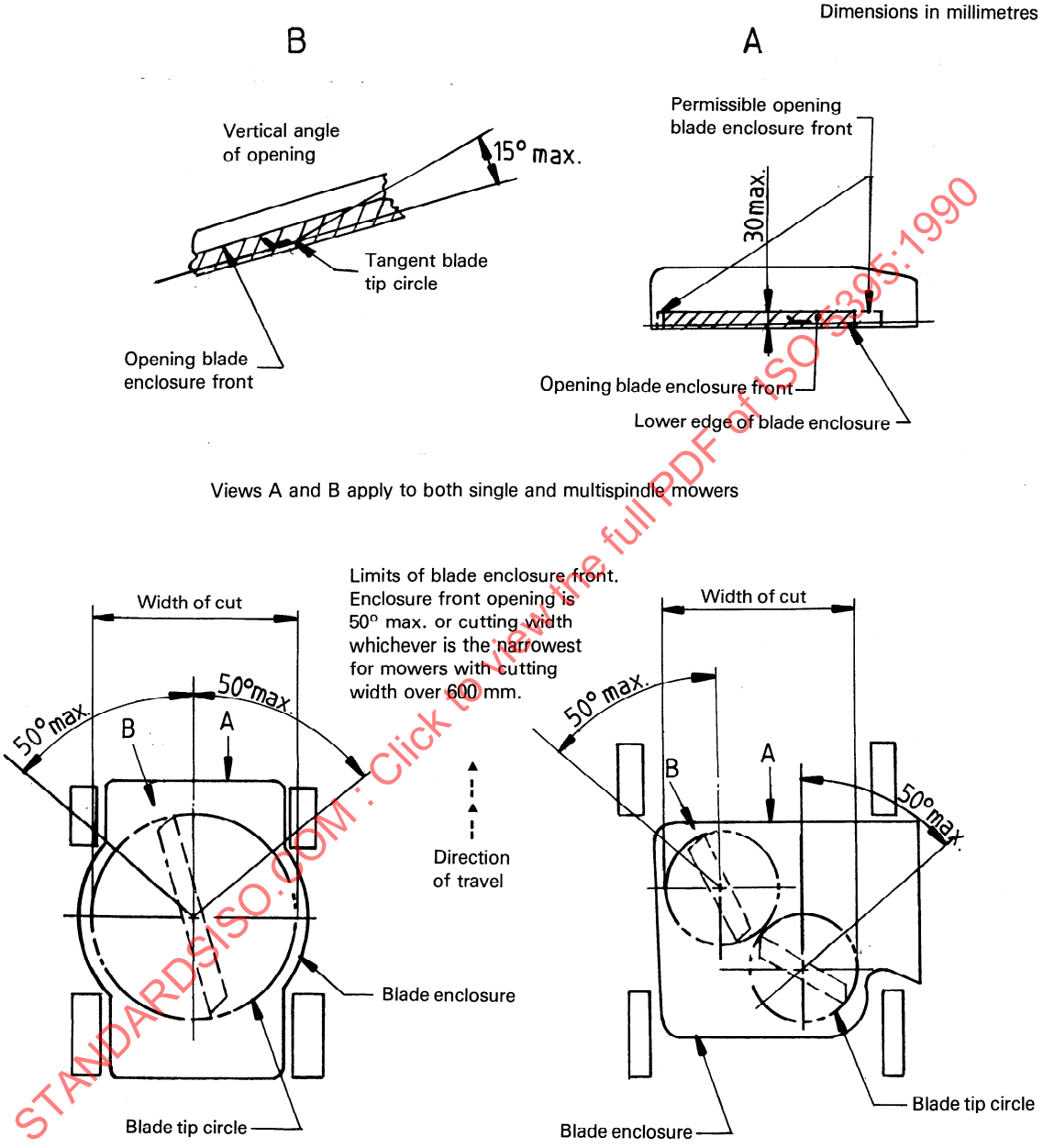
3.2.4.1.1 Pedestrian-controlled machines

Pedestrian-controlled machines shall be fitted with a device on the control handle which will automatically stop blade rotation when the operator's hands are removed from the handle: this may be accomplished either by stopping the drive motor or by an intermediate blade clutch/brake mechanism. For restarting blade rotation, the control shall require two separate actions. If these actions are to be carried out using the same hand, then the actions shall be totally distinct thereby preventing accidentally switching on.

3.2.4.1.2 Ride-on machines

Ride-on machines shall be fitted with a device which will automatically stop the blade rotation when the operator leaves the normal operating position. If the operator returns to the operator's position before the blades have stopped, the blades may automatically resume operation. Blades starting shall require intentional reactivation by a means other than the operator presence control after stopping.

Dimensions in millimetres



a) **Single spindle mowers**

b) **Multispindle mowers**

Figure 3 — Front opening restrictions

3.2.4.2 Blade-stopping time

3.2.4.2.1 Pedestrian-controlled machines

The blade(s) shall stop from their maximum rotational speed within 5 s after the operator releases the controls.

NOTE 1 This value will be reduced to 3 s three years after publication of this International Standard for machines with a total cutting width of 0 to 600 mm. For machines with a cutting width greater than 600 mm, the blade stopping time will remain 5 s.

3.2.4.2.2 Ride-on machines

Blade(s) shall stop from their maximum rotational speed within 7 s after the operator releases the controls.

NOTE 2 This value will be reduced to 5 s three years after publication of this International Standard for machines with a total cutting width up to 1 200 mm. For machines with a cutting width greater than 1 200 mm, the blade stopping time will remain 7 s.

3.2.4.2.3 Life expectancy

The blade-stopping mechanisms shall meet the life expectancy of the machine between major overhauls as recommended by the manufacturer. The manufacturer may be requested to furnish proof to the test/certification authority that the mechanism has satisfied tests to meet this requirement. Such tests shall consist of a minimum of 5 000 on-and-off cycles.

3.2.4.3 Marking

The cutting means shall be marked for identification of the part number and manufacturer, importer or supplier.

3.3 Test procedures

The clause specifies the tests for pedestrian-controlled and ride-on mowers, and has the following:

— General test conditions (3.3.1);

— Thrown object test (3.3.2);

— Impact test (3.3.3);

— Imbalance test (3.3.4);

— Foot probe test (3.3.5);

— Structural integrity test for blade enclosures, guards and grass catchers (3.3.6).

The tests may be carried out in any order unless otherwise specified.

3.3.1 General test conditions

3.3.1.1 Engine/motor speed

Where it is specified that the mower blade shall run during the tests, it shall be operated at the maximum operating engine/motor speed (see 1.3.23).

3.3.1.2 Pedestrian machine restraint

Where necessary, pedestrian-controlled machines may be elastically restrained at the handle to prevent horizontal movement during the tests.

3.3.1.3 Mower configuration/attachments

For the thrown object test (3.3.2) and the structural integrity test (3.3.6), the mower shall be tested in all operational configurations e.g. both with and without attachments and accessories such as grass collectors or mulching parts.

3.3.1.4 Test enclosure and target arrangements

3.3.1.4.1 The test enclosure required for thrown object, imbalance and impact tests shall be constructed generally as shown in figure 4: variations to accommodate different mower types are shown in figure 5 to figure 9.

3.3.1.4.2 This test has some element of risk. Test personnel must either be kept out of the test area or otherwise protected from the hazard of thrown objects.

The walls shall consist of eight panel areas, each 900 mm high, perpendicular to the base of the test fixture so as to form an octagon. The test fixture base and the target panels composition shall meet the material specification given in annex B and annex C. The target in the operator area of a pedestrian-controlled mower above 900 mm shall consist of a single sheet of kraft paper rising to a height of 2 000 mm. In order to facilitate the counting of hits, the panel supports should be designed to allow sliding in and out of at least one target panel.

Replace the targets 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, used as patches, shall be placed over any one area.

The targets shall generally be located perpendicular to a radial line extending 750 mm ± 50 mm from the blade tip circle of single spindle mowers, or to the nearest blade tip circle of multispindled mowers, as shown in figure 5 to figure 9. If a target interferes with a part of the mower such as grass box, handle or wheel, the target shall be moved back to avoid such interference.

The target shall be divided into elevation zones by horizontal lines as indicated in figure 4 and described in annex D.

The rear or operator target area (pedestrian-controlled mowers only) is determined by the intersection of lines extending from the centre A (see figure 5) of the blade tip circle for single blade mowers or from the centre B (see figure 6) of a line through the centres of the outer blade tip circles for multibladed mowers and tangent to the 1 000 mm diameter operator target area. The centre of the operator target area is located 330 mm to the rear of the handles on a line passing from centres A or B through the centre of the handgrip part of the handle. The target surface between the intersection of the two tangents and the target is the rear of the operator target area.

For mowers with movable 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.

3.3.2 Thrown object test

3.3.2.1 Test equipment

3.3.2.1.1 The mower shall be tested in the test enclosure described in 3.3.1.4 and shall be placed on coconut matting/plywood base as specified in figure B.2 and figure B.3.

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

3.3.2.1.3 Injection points shall be provided at the 12 o'clock position as shown in figure 5 to figure 9 and located at 25 mm ± 5 mm inside the blade tip circle for injection of projectiles. An injection point shall be provided for each blade of a multispindle mower.

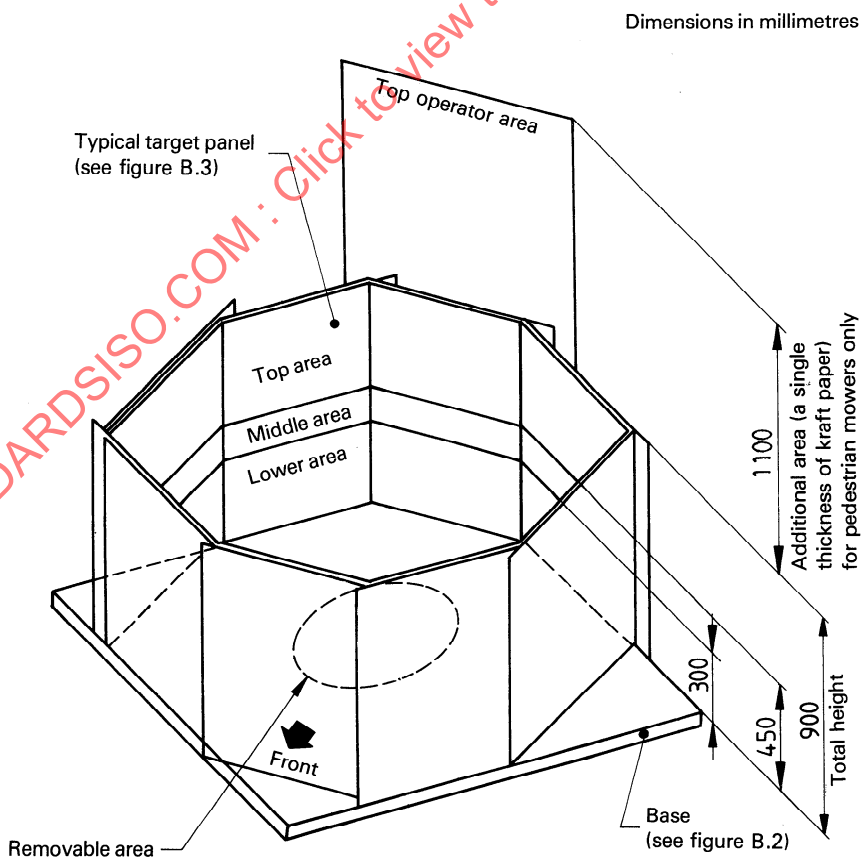
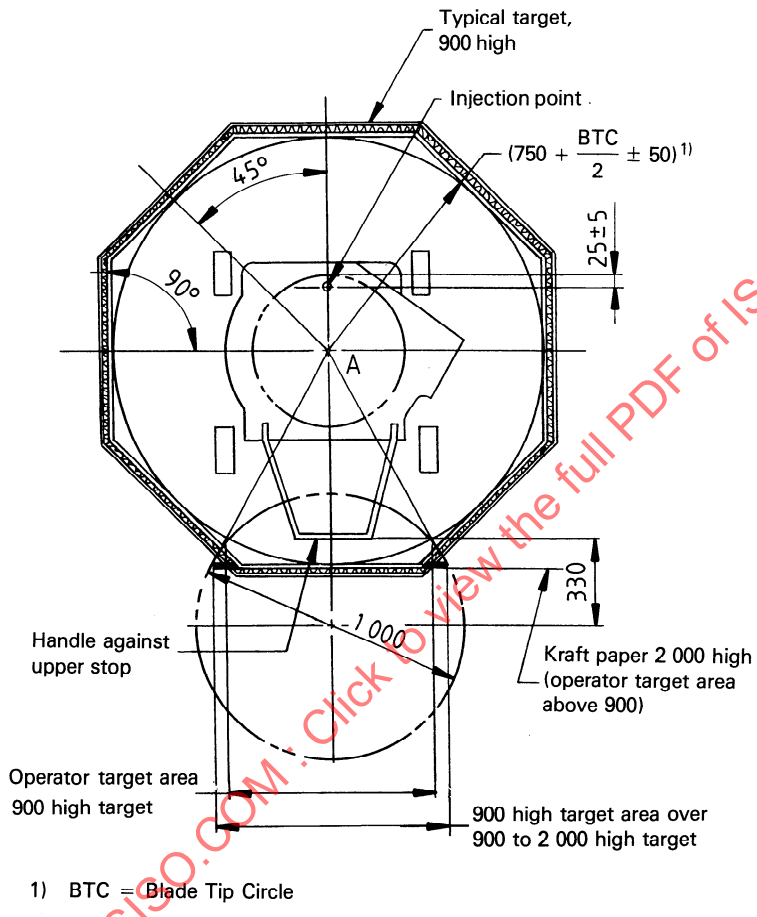


Figure 4 — Thrown object test fixture — General layout

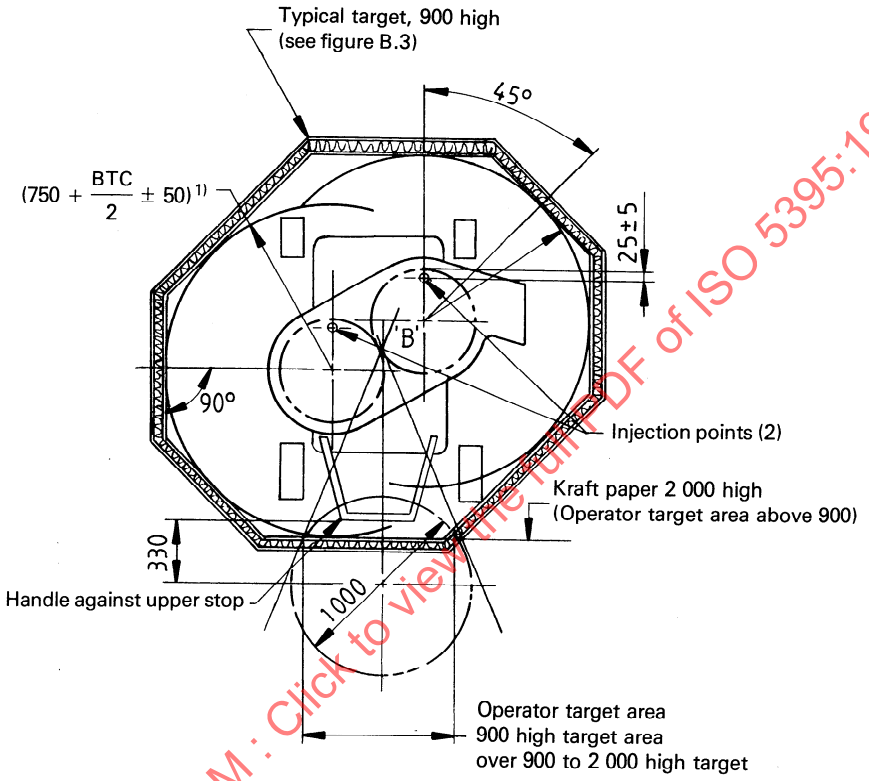
Dimensions in millimetres



1) BTC = Blade Tip Circle

Figure 5 — Single spindle pedestrian control mower — Test enclosure

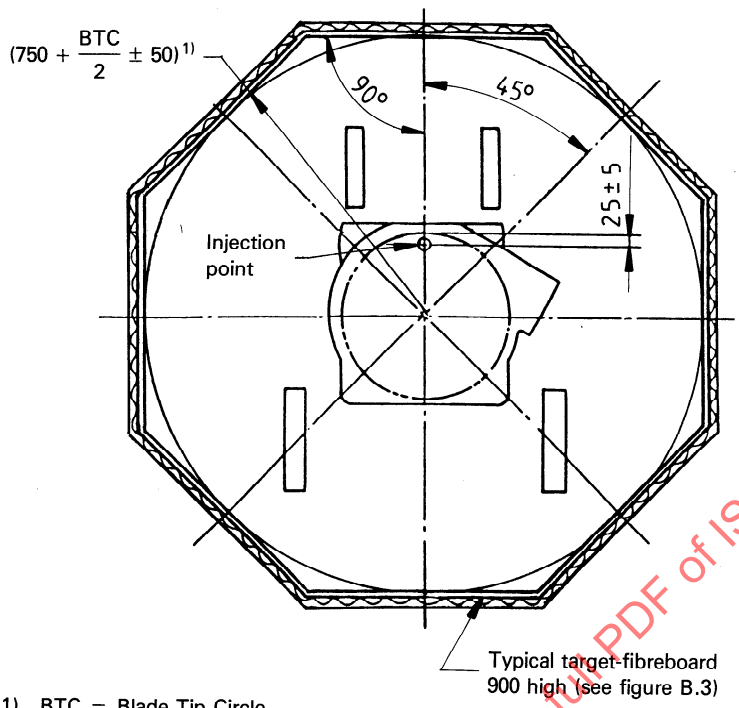
Dimensions in millimetres



1) BTC = Blade Tip Circle

Figure 6 — Two spindle ride-on mower — Test enclosure

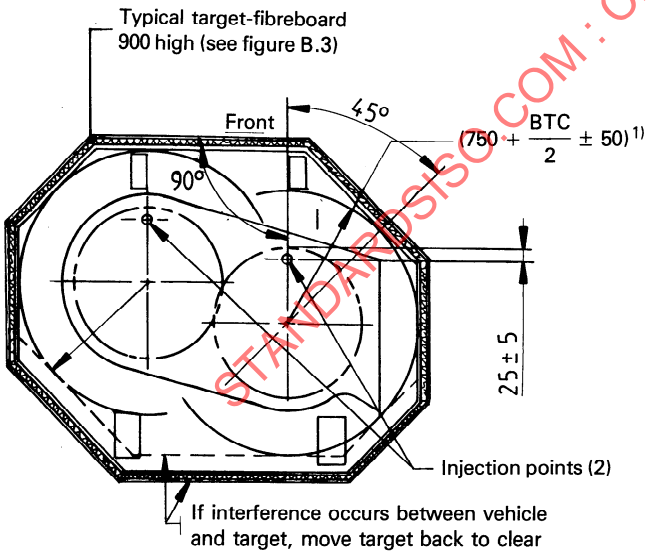
Dimensions in millimetres



1) BTC = Blade Tip Circle

Figure 7 — Single spindle ride-on mower — Test enclosure

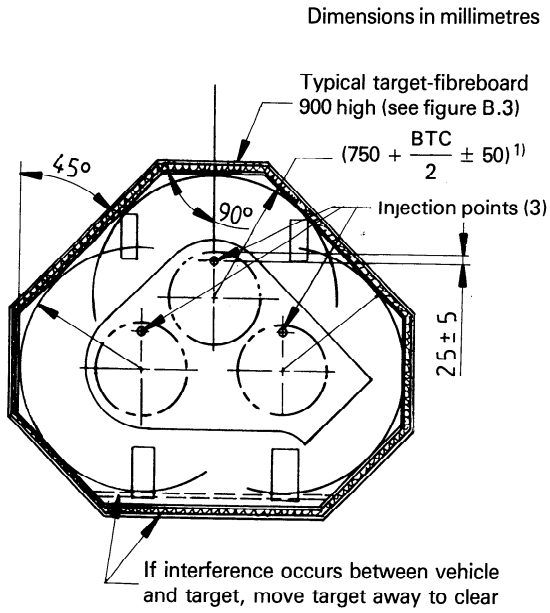
Dimensions in millimetres



1) BTC = Blade Tip Circle

Figure 8 — Two spindle ride-on mower — Test enclosure

Dimensions in millimetres



1) BTC = Blade Tip Circle

Figure 9 — Three spindle ride-on mower — Test enclosure

The injection tube outlets shall be fixed and flush with the upper surface of the coconut mat (see figure B.2) and the system shall be so arranged that the ball may be ejected with variable velocity.

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 mower in place, the blade adjusted as in 3.3.2.2 and operating at the manufacturer's specified maximum engine speed, allow balls one at a time into the mower. Increase the velocity of the balls in small increments until each ball is hit by the mower blade. Start the test when this minimum velocity is established. Chipped or damaged balls shall be replaced.

3.3.2.2 Test method

The tests shall be conducted for each blade assembly.

The mower blade 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.

Inject 500 projectiles into each injection point for each test. On multispindle mowers, the test shall be run for each spindle with the results evaluated for each test.[2)]

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 before continuing with the tests. Balls remaining within the test fixture (or on the test surface) may be removed at the option of the tester to minimize ricochet hits.

If a retest is required, a new blade shall be used for each test of 500 projectiles unless the blade is not damaged by impact with the projectiles.

NOTE 3 The test does not require that the machine is suitable for use after test.

3.3.2.3 Test results

Count and record hits on the data sheet provided (see annex D). Projectiles that hit and damage the centreline of the target area height line shall be scored with the target area below that line.

3.3.2.4 Test acceptance

See annex D.

3.3.3 Impact test

3.3.3.1 Test equipment

The mower shall be tested in the test enclosure described in 3.3.1.4. The impact test fixture shall be as shown in figure 10.

3.3.3.2 Test method

The tests shall be conducted for each blade assembly.

The mower 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 10). The blade of the test mower 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 blade, the blade will strike the exposed portion of the tube within 10 mm to 15 mm of the blade tip. The tube shall be inserted once into the path of each blade assembly. A new piece of tube shall be used for each test.

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

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

NOTE 4 The test does not require that the machine is suitable for use after test.

3.3.3.3 Test acceptance

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

3.3.4 Imbalance test

3.3.4.1 Test equipment

The mower is to be tested in the test enclosure described in 3.3.1.4. The test shall be conducted on a smooth hard level surface. Hover mowers shall be tested on grass or a synthetic material equivalent to grass.

2) Under study.

Dimensions in millimetres

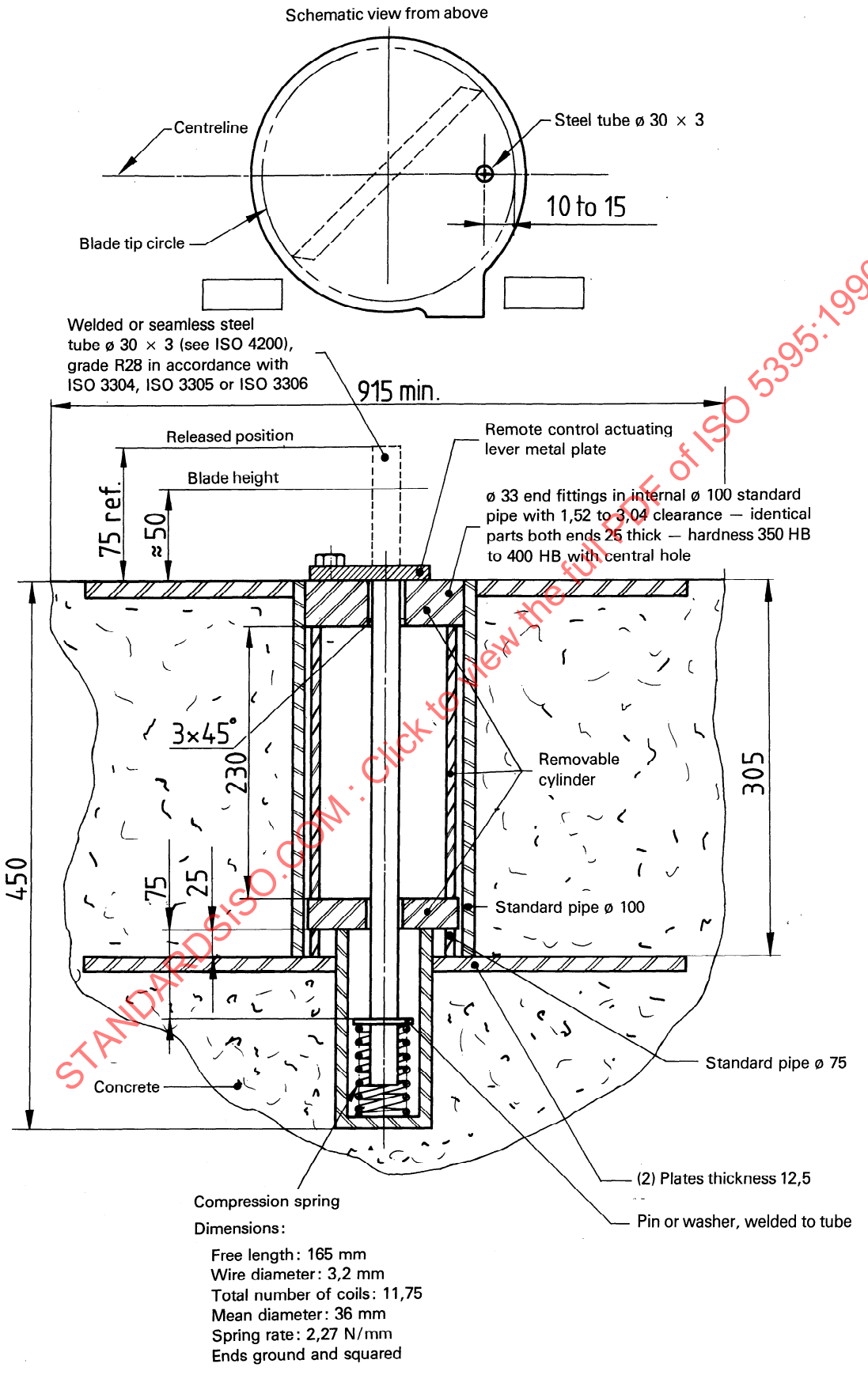


Figure 10 — Impact test fixture

3.3.4.2 Test method

The tests shall be conducted for each blade assembly.

The blade imbalance, in kilogram metres, shall first be determined by the formula

$$0{,}024d^3$$

where d is the diameter of the blade tip circle, in metres.

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

The test shall be run for 1 h in the fibreboard enclosure for each blade assembly.

All blade assemblies of a multispindle mower shall be tested singly. It is permissible to test all blade assemblies of a multispindle mower simultaneously at the discretion of the manufacturer. A new mower may be used for each test.

NOTE 5 The test does not require that the machine is suitable for use after test.

3.3.4.3 Test acceptance

The mower under test shall not lose any component necessary for compliance with the requirements of section 3 nor shall any component or part of the mower pass through all layers of the fibreboard enclosure wall.

3.3.5 Foot probe test

3.3.5.1 Test equipment

The test fixture shall be a foot probe as illustrated in figure 11.

3.3.5.2 Test method

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

Components of mowers or machines, or both, such as wheels and frames, may be considered as part of the blade enclosure for the purpose of this test. The test shall be conducted under static conditions.

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

The base of the probe shall be held horizontally at any height and then inclined up to 15° forward or backward from the horizontal (see figure 11). The probe shall be applied at any point of the discharge opening with a force of 20 N or until the blade enclosure lifts from the original position, whichever occurs first.

The probe shall be applied to the rear of all pedestrian machines. See figure 11.

The probe shall be applied to the machine from the direction of any designated starting position.

3.3.5.3 Test acceptance

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

3.3.6 Structural integrity test for blade enclosures, discharge chutes, guards and grass catchers

3.3.6.1 Test equipment

3.3.6.1.1 Test fixture

The test fixture (see figure 12) base shall consist of a steel plate of at least 1,5 mm thickness backed by a 19 mm plywood panel. The steel plate shall be large enough to extend at least 25 mm beyond the blade tip circle of the mower.

An air inlet hole shall be provided that is concentric with each blade tip circle with an approximate maximum diameter as follows:

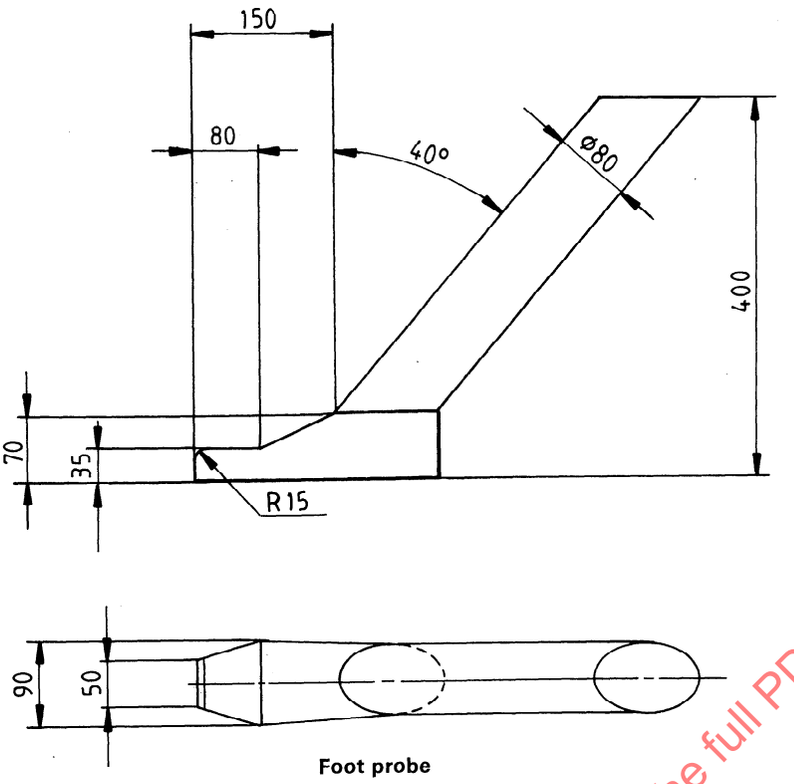
Mower type	Blade tip circle (BTC)	Air inlet diameter
Non-mulching	All BTC	0,3 × BTC
Mulching	BTC up to 635 mm	BTC − 127 mm
Mulching	BTC > 635 mm	0,8 × BTC

NOTE 6 During the tests, personnel should stand behind a shield for protection against possible thrown objects.

3.3.6.1.2 Injection points

The location of one injection point "B" shall be for mulching mowers at the 12 o'clock position as detailed in 3.3.2.1.3, for non-mulching mowers 25 mm inside the blade tip circle on a line "BC" which is 45° from a line "AC" in a direction counter to the direction of blade rotation, where "A" is the centre of the discharge chute exit and "C" is the centre of the blade axis.

Dimensions in millimetres



Foot probe

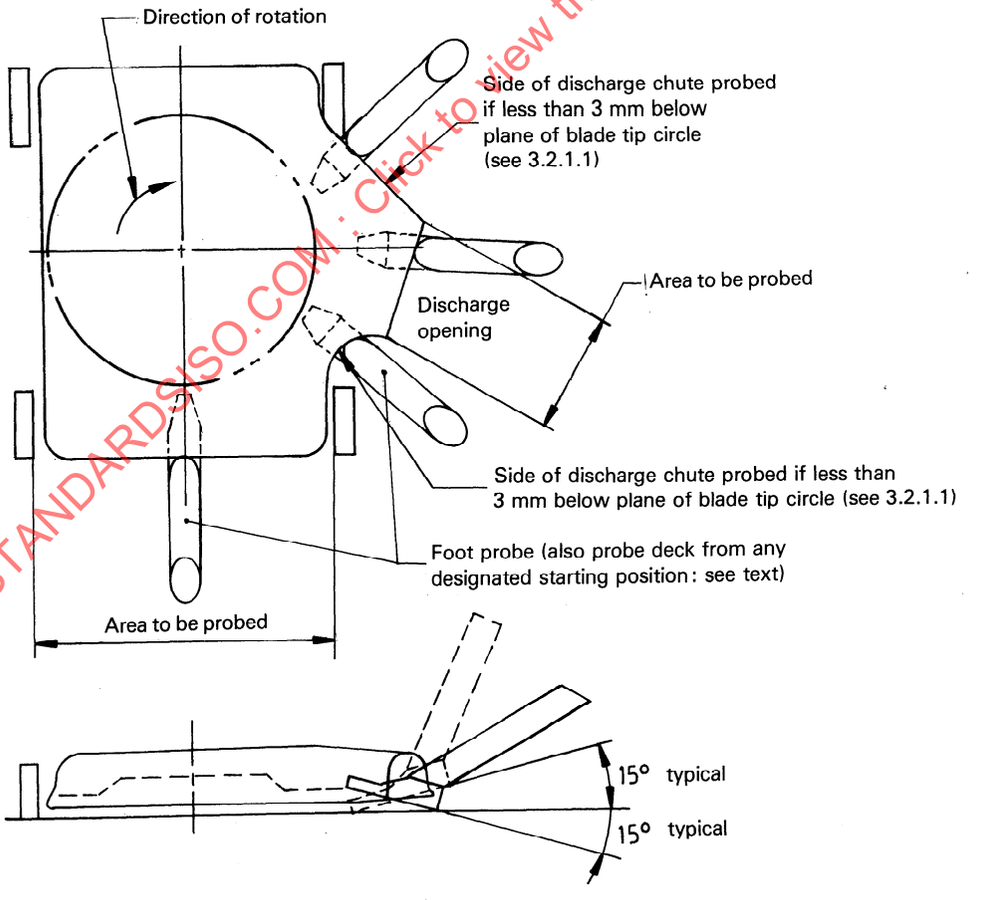


Figure 11 — Foot probe and use of foot probe

Dimensions in millimetres

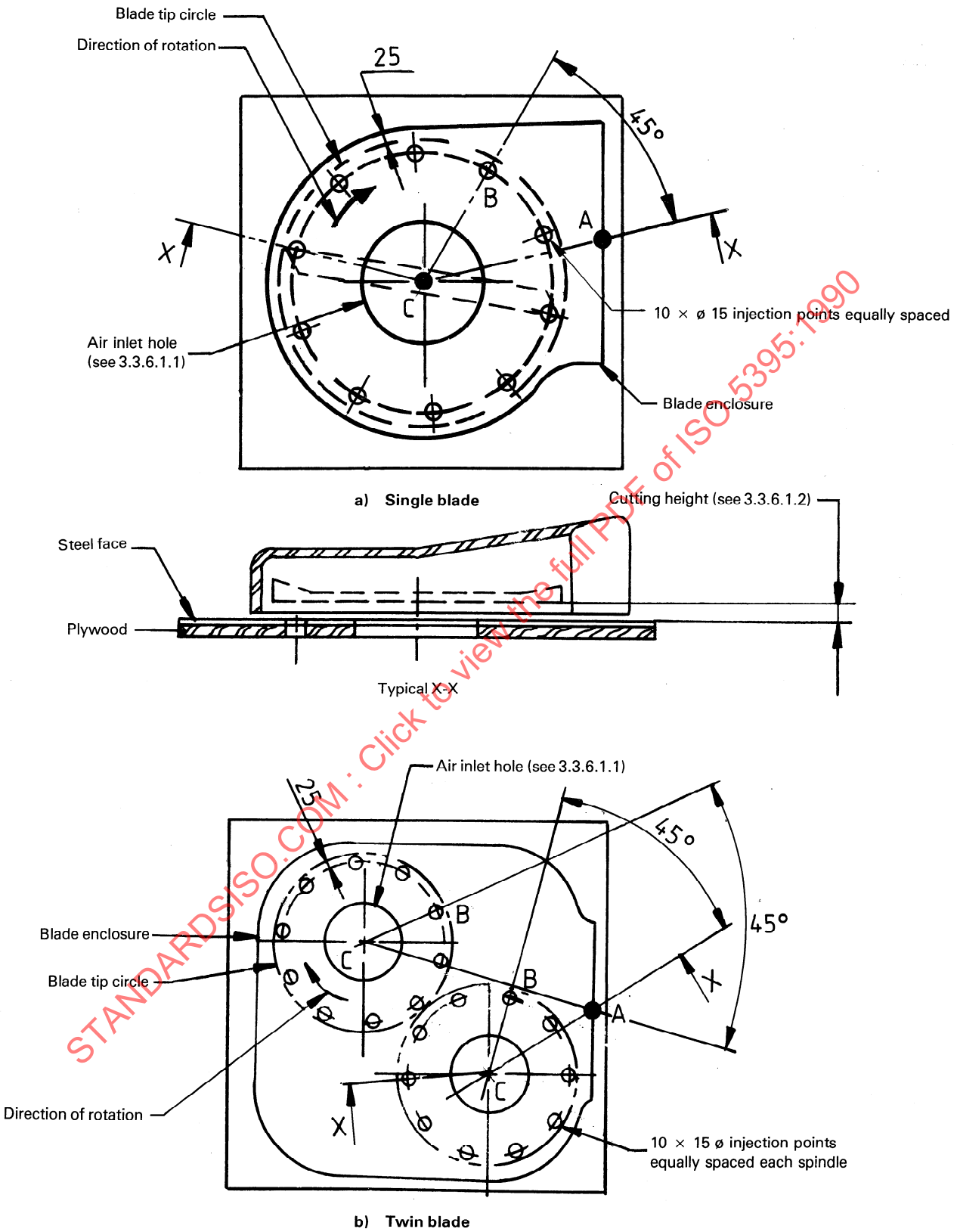


Figure 12 — Layout for structural integrity test

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

The injection tubes shall not protrude above the steel plate.

3.3.6.1.3 Projectiles

One hundred hardened 13 mm diameter steel balls, 45 HRC minimum (e.g. balls used as ball-bearings) shall be used as the projectiles.

3.3.6.1.4 Injection method

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

3.3.6.2 Test method

The tests shall be conducted for each blade assembly.

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

A new mower housing may be used for each blade of a multiblade mower.

3.3.6.3 Test acceptance

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

a) a hole in the blade enclosure, guard(s) or grass catcher(s) which allows the ball to pass through. It should be noted that a hole in a secondary enclosure, such as an internal baffle, shall not be considered a failure;

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

c) the dislodging of the grass catcher from its adaptor;

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

NOTE 7 The test does not require that the machine is suitable for use after test.

3.4 Pedestrian-controlled machines: additional requirements

3.4.1 Controls

The controls shall meet the requirements specified in ISO 3789-1 and ISO 3789-3.

3.4.2 Handle construction

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

3.4.2.1 Handle latches, handle length

A positive means (latch or upper stop) shall be provided which cannot be unintentionally disengaged during normal operation of the mower, 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 mower blade(s) during normal operation (see figure 13).

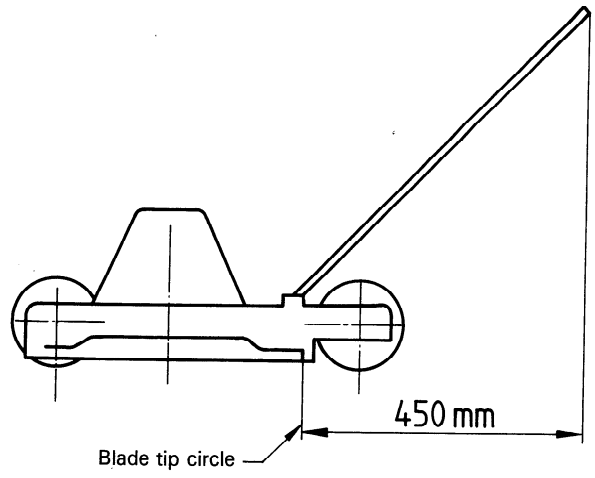


Figure 13 — Handle length

An exception to this requirement is for the handle park position. If a handle park position is provided, the handle shall automatically lock back into the operating position(s) when the handle is moved into this (these) position(s).

3.4.3 Brake requirements and test methods

3.4.3.1 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 and down the slope, is required to hold the machine on a 30 % (16,7°) slope.

For those machines requiring additional means, i.e., service or parking brake system, other than the braking provided in the drive system, they shall be tested in accordance with 3.4.3.2 and 3.4.3.3.

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.

3.4.3.2 Service brake

3.4.3.2.1 Performance requirements

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.

3.4.3.2.2 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.

3.4.3.3 Parking brake

3.4.3.3.1 General requirements

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

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

A hand-operated 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.

3.4.3.3.2 Performance requirements

The parking brake shall hold the machine stationary on a 30% (16,7°) slope when tested in accordance with 3.4.3.3.3. The force required to engage and unlock this means shall not exceed 220 N.

3.4.3.3.3 Brake tests

3.4.3.3.3.1 Test equipment

A 30 % slope with a coefficient of friction such that the machine does not slide down the slope shall be used.

3.4.3.3.3.2 Test conditions

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

3.4.3.3.3.3 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.

3.4.3.3.3.4 Test acceptance

The machine shall not move.

3.4.4 Trailing seat unit (sulky unit): steering control

3.4.4.1 If a steering-wheel is provided, clockwise rotation shall effect a right turn and counterclockwise rotation shall effect a left turn.

3.4.4.2 If a hand-controlled clutch and/or brake steering is provided, the right control shall effect a right turn and the left control shall effect a left turn.

3.4.4.3 If steering is provided by articulation,

a) it shall comply with 2.2.5 and 2.2.9 in all operating situations;

b) jackknifing shall be prevented during reverse operation of the unit and may be achieved by, for example, suitable links, stops or operator presence control on the traction drive.

3.4.4.4 The steering mechanism shall not lock in any position.

3.4.4.5 If individually controlled wheel brakes are provided to assist in steering, the brake control(s) shall meet one of the following requirements:

a) the control farthest to the right shall actuate the

right brake and the one farthest to the left shall actuate the left brake;

b) if controlled by a single control, a clockwise movement of the control about its axis shall actuate the right brake and a counterclockwise movement shall actuate the left brake.

3.4.5 Safety instructions

A manufacturer shall supply pertinent instructions with the equipment as follows:

a) for petrol-engined machines: instructions such as those presented in annex E;

b) for mains-connected electrically driven machines: instructions such as those given in annex E, revised as necessary to conform with IEC 335-1;

c) for battery-powered machines (less than 42 V): instructions such as those given in annex E.

3.5 Ride-on (riding) machines: additional requirements

3.5.1 Controls

The controls shall meet the requirements specified in ISO 3789-1 and ISO 3789-3.

3.5.2 Brake requirements and test methods

3.5.2.1 General

Braking system requirements shall apply to the machine and mower combination. All machines shall be tested with mower attachments and cutter units adjusted to the most unfavourable position allowed by the manufacturer's instructions. The machine shall be equipped with the tyres offered by the manufacturer having the least tread area in contact with the test surface.

The requirements apply to machines designed primarily for use at and around the home as well as professional mowers and lawn and garden tractors not subjected to national road regulations.

NOTE 8 The service brake system may be provided by a hydrostatic drive.

3.5.2.2 Service brake system

3.5.2.2.1 Requirements

For machines with a maximum design speed up to 13 km/h, a means capable of stopping its motion, in both directions in a braking distance of 0,19 m for each 1 km/h of the designed maximum speed, shall be provided.

For machine speeds greater than 13 km/h, use the formula

$$s = 0{,}015v^2$$

where

s is the stopping distance in metres;

v is the test speed in kilometres per hour.

These requirements shall be met with the application of a maximum force of 600 N on the pedal, or 200 N on the centre of the grip area of the hand control.

The service brake system shall not rely for effectiveness on the position of other controls (for example, gears).

3.5.2.2.2 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). The test shall be conducted three times and the mean value calculated. The test shall also be carried out at the maximum speed attainable by the machine when adjusted according to the manufacturer's specification. An operator with a minimum mass of 75 kg shall be seated on the machine during the test. The test shall be carried out in both forward and reverse directions of travel.

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

3.5.2.3 Parking brake system

3.5.2.3.1 Requirement

The machine shall be equipped with a parking brake system which will hold the machine in any direction when parked on a 30 % (16,7°) slope.

3.5.2.3.2 Test method

Test stops shall be conducted on a smooth, flat surface with a coefficient of friction such that the machine does not slide down the slope.

The transmission gear selection shall be in neutral with the engine shut off, and the slope shall be increased until an angle of 16,7° (30 %) is attained.

The tests shall be run with and without an operator, the operator having a minimum mass of 75 kg.

3.5.2.3.3 Test acceptance

The machine shall not move.

3.5.3 Stability requirements and test method

3.5.3.1 General

Stability determination and measurement shall be under static conditions with the following test requirements.

a) A mass of 75 kg secured to the seat shall be used to simulate an operator. The centre of gravity of the weight shall be 150 mm above the lowest point of the operator supporting surface of the seat and 250 mm forward of the seat back. If the seat is adjustable, it shall be positioned in the most forward position when checking forward stability and in the most rearward position when checking rearward stability.

b) A strip of steel 1 mm thick, 50 mm wide and a length sufficient to extend beyond the tyre footprint shall be placed under each (uphill) tyre of the machine being tested.

c) For the stability test, no ballast except as required by the manufacturer shall be added to the machine. Mower attachments and cutter units shall be adjusted to the most unfavourable position allowed by the manufacturer's instructions.

d) Pneumatic tyres shall be inflated to the pressure recommended in the operator's manual for normal operation.

e) All wheels shall be locked to prevent rotation about the axle, and the machine shall be loose tethered, and secured to prevent sliding or tip-over.

   Steerable wheels and articulated machines shall be held in the straight-ahead position.

f) Stability requirements shall apply for all tyre combinations on all tread (wheel-track) settings approved by the machine manufacturer.

g) For those machines which have both uphill wheels rigidly attached to the frame, if one wheel lifts off before the minimum tilt angle is reached for the test, it is allowable to place the steel strip under any one uphill tyre and repeat the test using twice the pull-out force.

3.5.3.2 Stability test procedure

Place the machine on a variable single-slope plane tilt table with the machine supported on its wheels. Sufficient friction shall be provided such that the machine does not slide down the slope.

Tilt the table until either

a) lift-off occurs: lift-off is when the steel strip can be removed from under any of the (uphill) tyres with a force of 10 N or less, or

b) the minimum angle for acceptance as specified in 3.5.3.3 is attained.

Tests shall be conducted with the machine positioned as in 3.5.3.2.1 and 3.5.3.2.2.

3.5.3.2.1 Longitudinal position

Position the machine on the table with its longitudinal centreline perpendicular to the intersection line of the lowest edge of the table and a horizontal plane with its

a) front end on the downhill side;

b) rear end on the downhill side.

3.5.3.2.2 Lateral position

Position the machine on the table with its longitudinal centreline parallel to the intersection line of the lowest edge of the table and a horizontal plane with its

a) right side on the downhill side;

b) left side on the downhill side.

3.5.3.3 Stability test acceptance

3.5.3.3.1 Lateral test acceptance

The angle of the tilt table with the machine positioned shall be a minimum of 20°, with either side downhill, before lift-off occurs.

3.5.3.3.2 Longitudinal test acceptance

The angle of the tilt table with the machine positioned shall be a minimum of 30°, with either end downhill, before lift-off occurs.

3.5.4 Safety instructions

The manufacturer shall supply with the equipment pertinent instructions such as those presented in annex E.

3.6 Towed units: requirements

3.6.1 Hitches

Suitable hitch devices with secure couplings shall be provided.

For towed units with an upward force at the hitch point, a warning label shall be placed adjacent to the hitch equipment.

3.6.2 PTO drive-shafts to power source

PTO drive-shafts for universal application shall meet the requirements of ISO 500 or ISO 9193 as applicable.

NOTE 9 A manufacturer may supply a non-standard PTO for driving an exclusive attachment providing the safety requirements of ISO 500 or ISO 9193 are met.

3.6.3 Controls

The controls shall meet the requirements specified in ISO 3789-1 and ISO 3789-3.

Controls shall be positioned on the towed implement so that when the propelling machine is turned or otherwise operated through its maximum operable limitations, the controls do not physically impinge on the operator zone in a hazardous manner.

3.7 Professional (commercial) mowers and turf care equipment: additional requirements

3.7.1 For those pedestrian-controlled and ride-on machines which are operated for long periods of time, e.g. professional mowers, consideration should be given to anthropometric body dimensions when designing the locations of controls, seating accommodation and reducing the vertical whole-body vibrations transmitted to the operator.

3.7.2 National regulations may present specific requirements for machines of this type.

Section 4: Requirements for cylinder mowers

4.1 Applications

Section 4 specifies the safety requirements and test procedures applicable to powered cylinder mowers, including pedestrian-controlled and ride-on (riding) types, ride-on (riding) lawn tractors, lawn and garden tractors, professional mowers, and lawn and garden tractors with mowing attachments.

4.2 General construction: guarding and shielding

4.2.1 Cutting cylinders shall be guarded on both sides and from front and rear, so that it is not possible for a vertical 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 blades within 10 mm when any grass catcher has been removed. See figure 14.

4.2.2 Cutting cylinders shall be covered at the sides with shields extending at least as shown in figure 15.

4.2.3 Cutting cylinders of free discharge and of rear mowers shall be covered from above with a shield that extends so that its projection on the horizontal plane covers at least the projection of the cylinder on the same horizontal plane, when any grass catcher has been removed. See figure 16.

NOTES

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

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

4.2.4 Cutting cylinders of front discharge mowers shall be covered from the rear with a shield that extends so that its projection on the vertical plane covers at least the projection of the cylinder on the same vertical plane, less up to 25 mm. See figure 17.

NOTE 12 Front discharge denotes throwing out grass clippings so that they will be collected in a grass catcher which is located in front of the cylinder.

4.3 Thrown grass, thrown objects, operator safety

4.3.1 Walk-behind mowers

Front discharge machines are not required to be tested.

Rear discharge and free discharge machines shall be fitted with a non-detachable guard which limits the vertical throw line, as defined in 1.3.46, to a maximum height of 1 m in the vertical plane of the handle grips (see figure 18). Measurements shall be taken at the most unfavourable height of cut setting.

4.3.2 Ride-on mowers

On free and rear discharge type machines, the throw line shall not intersect the vertical plane at the front edge of the driver's seat at a point higher than the seat upper surface. The seat shall be in its most unfavourable adjustment position and loaded with 75 kg. It shall be ensured that this is satisfied for a width of 400 mm on both sides of the seat centreline.

4.4 Pedestrian-controlled machines: requirements

4.4.1 Handle structure

4.4.1.1 The end of the handle adjacent to the operator shall be at least 450 mm horizontally behind the rear vertical tangent of the cylinder, or the requirement in 4.4.1.2 applies.

4.4.1.2 If the end of the handle adjacent to the operator is less than 450 mm horizontally behind the rear vertical tangent of the cylinder, the requirements of a foot probe test shall be fulfilled in that the foot probe shall not contact the cutting cylinder.

The foot probe in figure 11 shall be applied from the operator position side only, with the sole of the probe held horizontally at any height and then tilted forward or backward up to 15° from the horizontal.

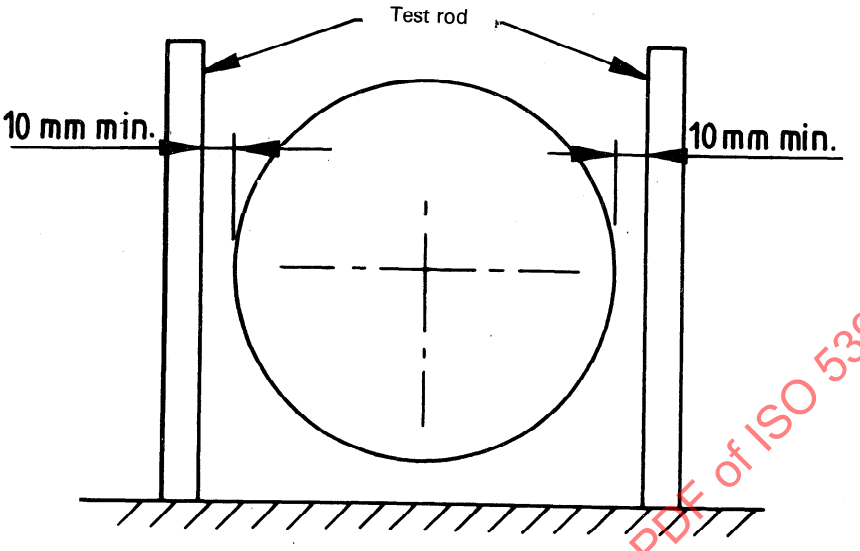


Figure 14 — Guarding cylinders

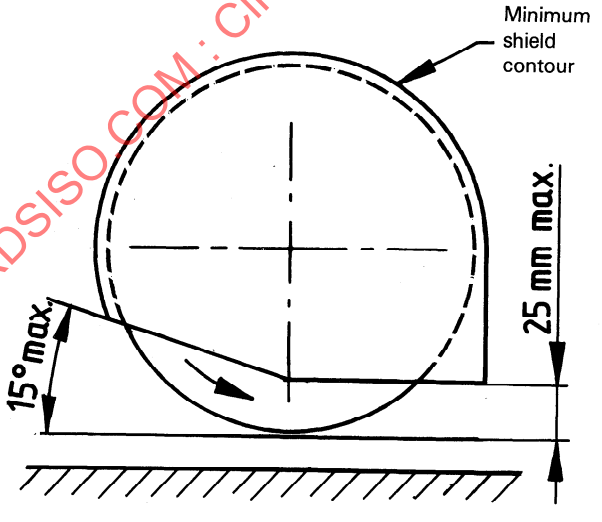


Figure 15 — Side coverage of cylinder

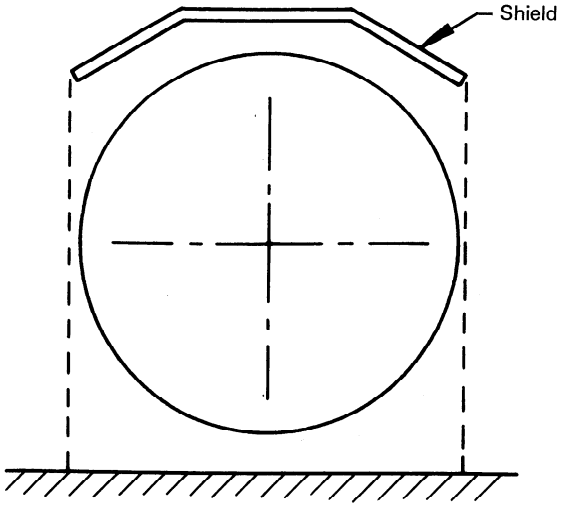


Figure 16 — Guarding cylinders of free and rear discharge mowers

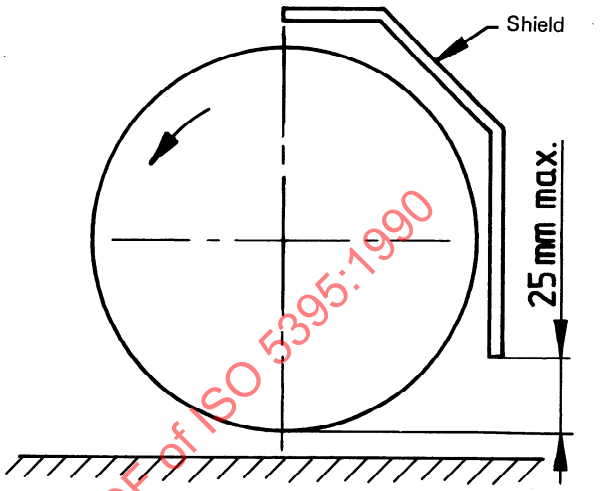


Figure 17 — Guarding cylinders of front discharge mowers

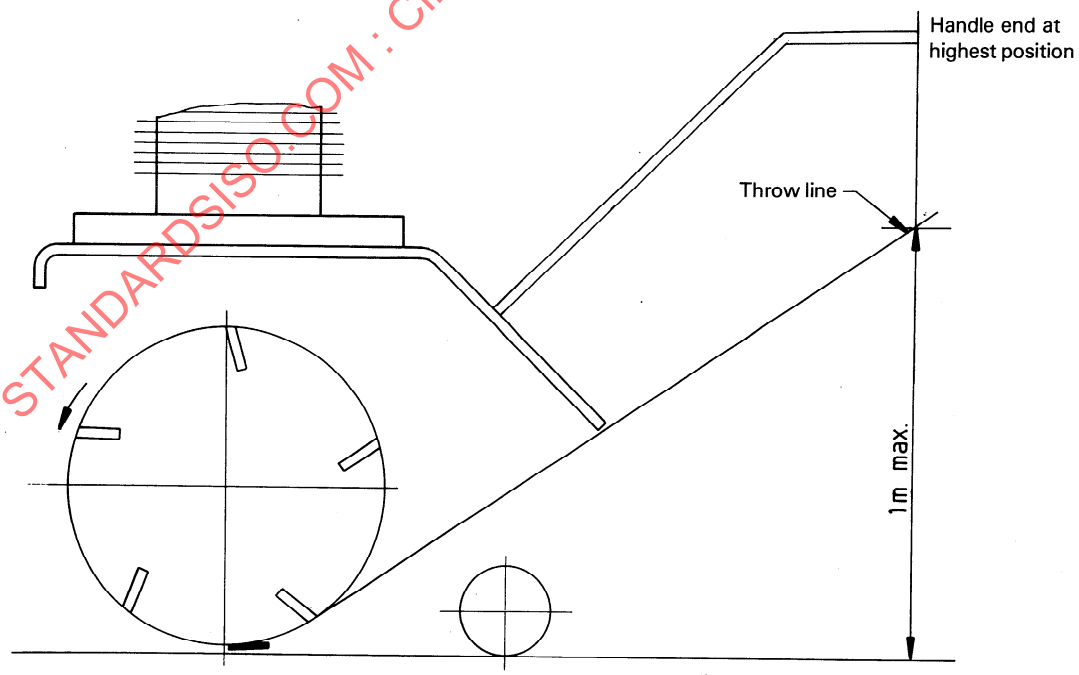


Figure 18 — Throw line

4.4.2 Operator presence control

Pedestrian-controlled machines shall be fitted with a device on the control handle which will automatically stop cutting cylinder rotation when the operator's hands are removed from the handle. This may be accomplished either by stopping the drive motor or by an intermediate cutting cylinder clutch/brake mechanism. For restarting cutting cylinder 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, thereby preventing accidentally switching on.

4.4.3 Brake requirements and test method

The brake requirements of 3.4.3 apply to pedestrian-controlled cylinder mowers.

4.4.4 Safety instructions

A manufacturer shall supply pertinent instructions with the equipment as follows:

a) for petrol-engined machines: instructions such as those given in annex E;

b) for mains-connected electrically driven machines: instructions such as those given in annex E, revised as necessary to conform with IEC 335-1;

c) for battery-powered machines (less than 42 V): instructions such as those given in annex E.

4.4.5 Trailing seat units

The requirements of 3.4.4 apply.

4.5 Ride-on (riding) machines: requirements

4.5.1 Operator presence control

Ride-on machines shall be fitted with a device which will automatically stop the cutting cylinder rotation when the operator leaves the normal operating position. If the operator returns to the operator's position before the cylinder has stopped, the cutting cylinders may automatically resume operation. Cylinder starting shall require intentional reactivation by a means other than the operator presence control after stopping.

4.5.2 Brake requirements

The brake requirements of 3.5.2 apply to ride-on cylinder mowers.

4.5.3 Stability requirements and test method

The requirements of 3.5.3 apply.

4.5.4 Safety instructions

The manufacturer shall supply with the equipment pertinent instructions such as given in annex E. Electrical aspects of safety are covered in IEC documents.

4.6 Towed units: requirements

4.6.1 Hitches

Suitable hitch devices with secure couplings shall be provided.

For towed units with an upward force at the hitch point, a warning label shall be placed adjacent to the hitch equipment.

4.6.2 PTO drive-shafts to power source

PTO drive-shafts for universal application shall meet the requirements of ISO 500 or ISO 9193, as applicable.

NOTE 13 A manufacturer may supply a non-standard PTO for driving an exclusive attachment providing the safety requirements of ISO 500 or ISO 9193 are met.

4.6.3 Controls

The controls shall meet the requirements specified in ISO 3789-1 and ISO 3789-3.

Controls shall be so positioned on the towed implement that when the propelling machine is turned or otherwise operated through its maximum operable limitations, the controls do not physically impinge on the operator zone in a hazardous manner.

4.7 Professional (commercial) mowers and turf care equipment: additional requirements

4.7.1 For those pedestrian-controlled and ride-on machines which are operated for long periods of time, e.g. professional mowers, consideration should be given to anthropometric body dimensions when designing the locations of controls, seating accommodation and reducing the vertical whole-body vibrations transmitted to the operator.

4.7.2 National regulations may present specific requirements for machines of this type.

Annex A
(normative)

Guarding principles

NOTE 14 See 2.2.1.1.

A.1 Safety distance from dangerous parts

The safety distance is based on measurements from the location which a person can occupy to use equipment, i.e. to start, mount or operate it.

In those instances where other guarding requirements do not apply and where safety distances are used to provide personal protection, the requirements of this annex shall be followed.

A.2 Round reach

When reaching edges in any position, the safety distance of freely articulating body parts is given in table A.1.

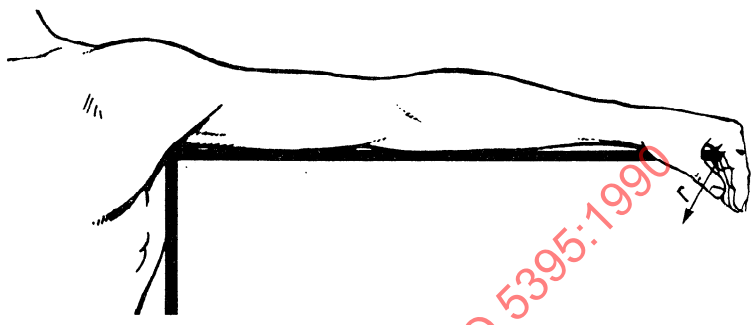
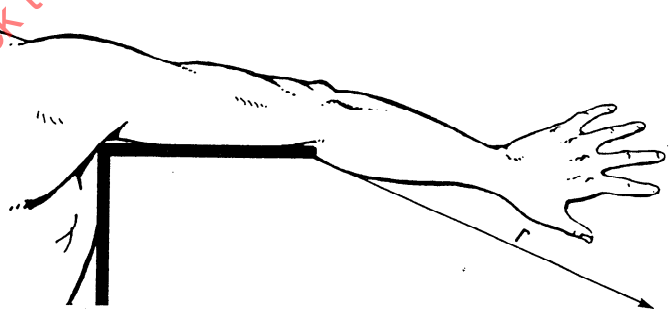
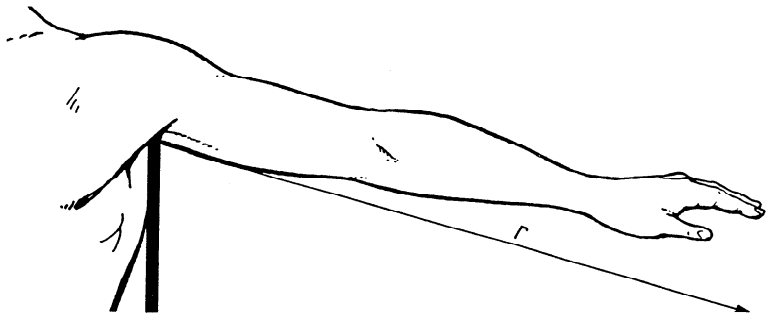
The radius of the movement, r, about a fixed edge is determined by the reach of given body parts. The safety distances assigned should be respected as a minimum if the body part concerned is not to be allowed to reach a danger point.

Of special importance is the danger area which can be reached when these body parts are introduced through slots.

When applying safety distances, it is to be assumed that the basic joint component of the relevant body part is in fixed contact with the edge. The safety distances apply only if it is ensured that further advance or penetration of the body part towards the danger point is excluded.

Table A.1 — Extent of reach

Dimensions in millimetres

Body part	Safety distance, r mm	Illustration
Hand (from root of finger to fingertip)	⩾ 120	
Hand from wrist to fingertip	⩾ 230	
Arm from elbow to fingertip	⩾ 550	
Arm from arm-pit to fingertip	⩾ 850	

A.3 Reaching in and through elongated openings with parallel sides

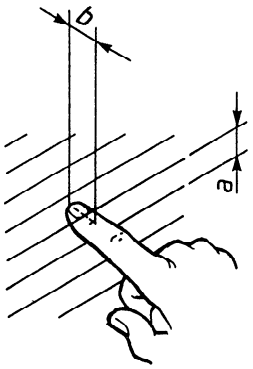
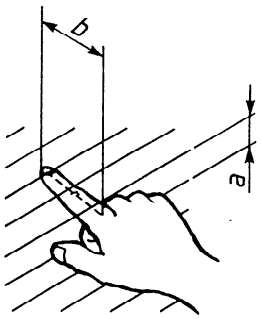
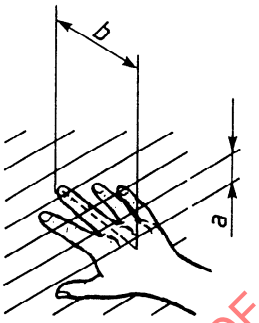
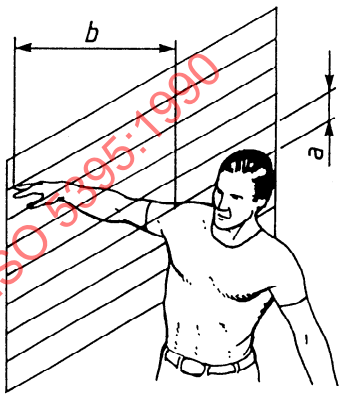
Safety distances are given in table A.2 where

a is the smaller dimension of the aperture;

b is the safety distance from the danger point.

Table A.2 — Values of a and b

Dimensions in millimetres

Fingertip	Finger		Hand to ball of thumb	Arm to arm-pit
				
$4 < a \leqslant 8$	$8 < a \leqslant 12$	$12 < a \leqslant 20$	$20 < a \leqslant 30$	$30 < a < 150$ max.
$b \geqslant 15$	$b \geqslant 80$	$b \geqslant 120$	$b \geqslant 200$	$b \geqslant 850$

A.4 Reaching in and through square or circular apertures

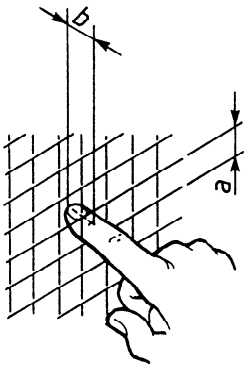
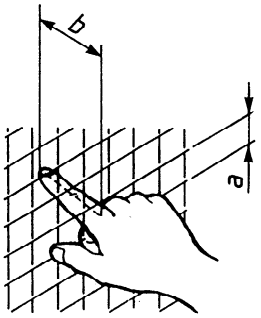
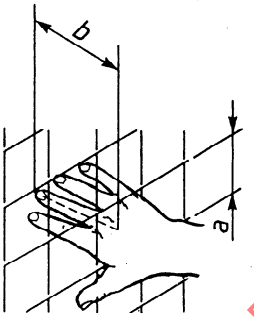
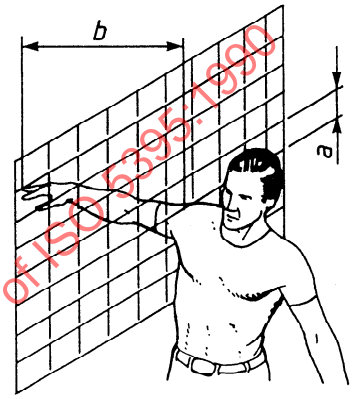
Safety distances are given in table A.3 where

a is the aperture diameter or length of side;

b is the safety distance from the danger point.

Table A.3 — Values of a and b

Dimensions in millimetres

Fingertip	Finger		Hand to thumb root	Arm to arm-pit
				
$4 < a \leqslant 8$	$8 < a \leqslant 12$	$12 < a \leqslant 25$	$25 < a \leqslant 40$	$40 < a < 150$ max.
$b \geqslant 15$	$b \geqslant 80$	$b \geqslant 120$	$b \geqslant 200$	$b \geqslant 850$

A.5 Openings of irregular shape

To choose a safety distance for an opening of irregular shape, refer to table A.2 and table A.3 using either the smallest circular aperture, d, that describes the opening, or the narrowest slot with parallel sides, e, that will contain the opening (see figure A.1). The greatest safety distance arrived at using this method should be employed.

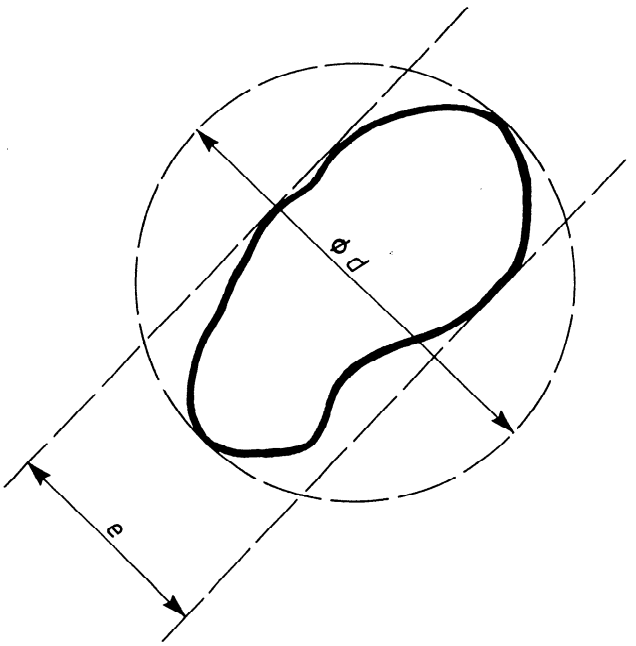


Figure A.1 — Openings of irregular shape

Annex B
(normative)

Test enclosure

B.1 Base

The test enclosure specified in 3.3.2.1.1 shall consist of a test fixture base of 19 mm plywood covered with 500 mm squares of coconut matting nailed to the plywood with nails spaced as shown in figure B.1 and figure B.2.

NOTE 15 Squares are used so that, should wear develop, the worn area can be replaced without replacing the entire test surface.

The minimum base size shall be 1,55 m larger than the cutting width and 1,5 m larger than the distance between the forward edge of the leading blade tip circle and the rear edge of the trailing blade circle shown in figure 8 and figure 9.

The coconut matting shall have approximately 20 mm high fibres embedded in a PVC base weighing approximately 7000 g/m^2. See ISO 3416 for determining compressibility of the matting.

B.2 Target composition

A single target panel may be of any of the following (see figure B.3), that meet the penetration tests specified in annex C:

a) a single sheet of corrugated fibreboard;

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

c) two sheets of corrugated fibreboard stacked together.

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

The kraft paper shall be of nominal 225 g/m^2[3] construction which satisfies the conditions of ISO 2758.

NOTE 16 The 900 mm to 2000 mm high in the top operator target area for pedestrian-controlled machines comprises only a single thickness of kraft paper.

3) 225 g/m^2 = 50 lb/1000 ft^2.

Dimensions in millimetres

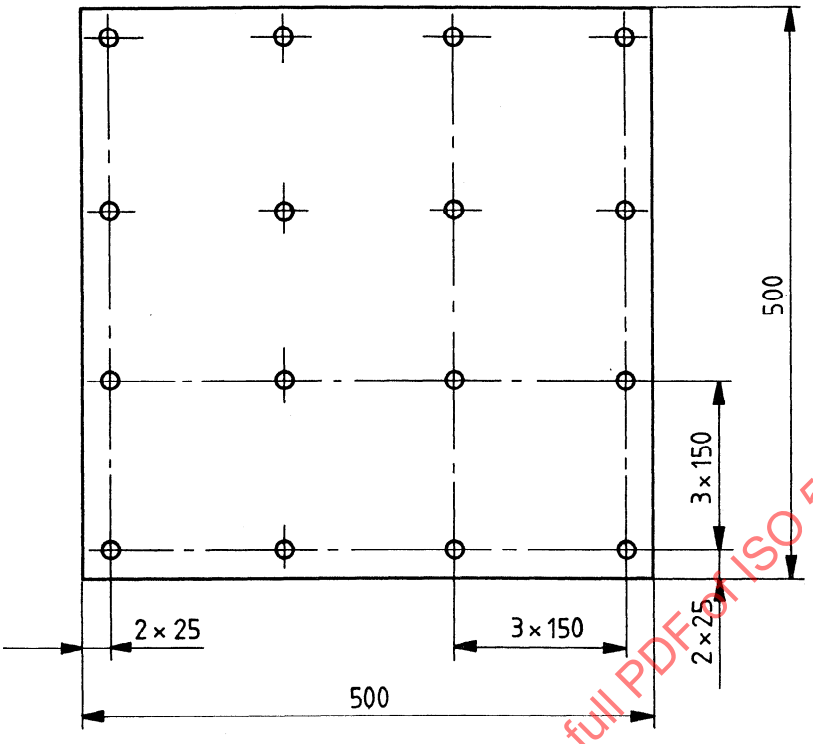


Figure B.1 — Nail plan of test fixture base

Dimensions in millimetres

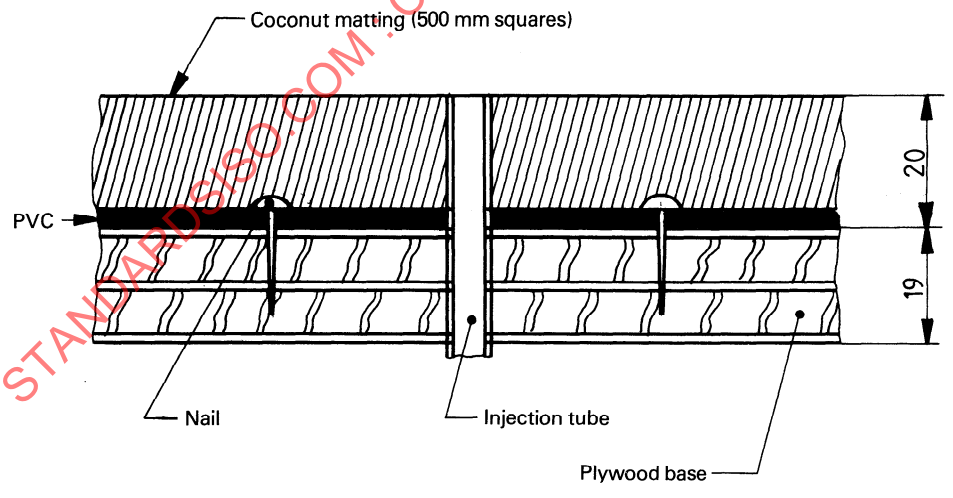


Figure B.2 — Thrown object test fixture: base detail

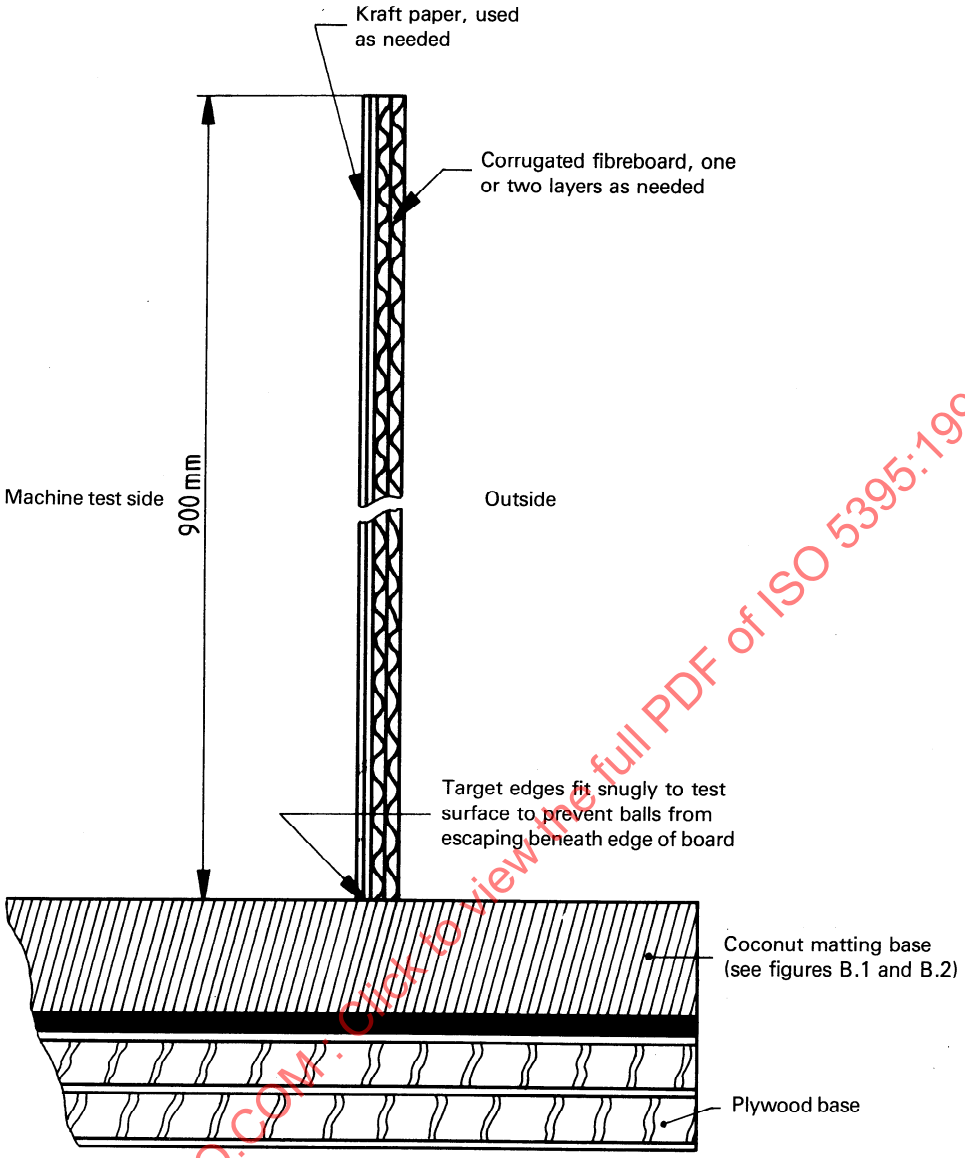


Figure B.3 — Test enclosures walls and base