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**Walk-behind powered rotary tillers —
Definitions, safety requirements and test
procedures**

*Motoculteurs à conducteur à pied — Définitions, exigences de sécurité
et méthodes d'essai*



Reference number
ISO 11449:1994(E)

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 11449 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 13, *Powered lawn and garden equipment*.

Annex A forms an integral part of this International Standard.

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Walk-behind powered rotary tillers — Definitions, safety requirements and test procedures

1 Scope

This International Standard specifies mechanical safety requirements and tests applicable to pedestrian-controlled (walk-behind) powered rotary tillers of a rated engine motor capacity less than or equal to 7,5 kW, designed primarily for garden and horticulture use.

It does not apply to

- rotary tillers having a rated engine/motor capacity greater than 7,5 kW used in commercial agricultural or forestry operations;
- PTO-driven machines;
- electric powered handheld front-mounted tillers;
- the electric aspects of electrically powered rotary tillers having a voltage exceeding 42 V d.c. or which are mains-connected.

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

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

ISO 3767-2:1991, *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 3789-2:1982, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Location and method of operation of operator controls — Part 2: Controls for agricultural tractors and machinery.*

ISO 5395:1990, *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.*

ISO 11684:—¹⁾, *Tractors and machinery for agriculture and forestry, powered lawn and garden equipment — General principles for safety signs and hazard pictorials.*

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

3 Definitions

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

3.1 pedestrian-controlled (walk-behind) powered rotary tiller: Tilling machine with a powered rotary member, with or without traction drive that is intended to break up soil and is normally controlled by the operator walking behind or alongside it.

3.1.1 front tine rotary tiller: Pedestrian-controlled (walk-behind) powered rotary tiller whose ground traction is provided by its rotating tines or whose rotating member is substantially forward of the drive wheels. [See figure 1 a).]

3.1.2 rear tine rotary tiller: Pedestrian-controlled (walk-behind) powered rotary tiller whose ground traction is provided by the drive wheels and whose rotating member is substantially behind the drive wheels. [See figure 1 b).]

3.1.3 handheld rotary tiller: Pedestrian-controlled (walk-behind) rotary tiller whose ground traction is provided by its rotating tines with or without support wheels in such a way that its rotating elements act as hoeing blades and ensure forward propulsion. [See figure 1 c).]

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

3.3 clutch: Device used for engaging or disengaging the load from the power source.

3.4 starting device: Handle, lever, switch or similar control required to actuate starting mechanism.

3.5 handlebars: Device equipped with grips enabling the machine to be controlled manually.

3.6 tines [tools]: Those portions of the rotating member that are in contact with and penetrate the soil.

3.7 tine barrier: Structural members, such as transport wheels, portions of the tiller frame, ground stake, or any combination of these members, that restrict entry of the operator into the rotating tines.

3.8 guard; shield: Part of the rotary tiller or component incorporated to provide protection for the operator.

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

3.10 engine [motor] start: Change of engine state from not producing power to producing power.

3.11 manual start: Use of operator force on a device to rotate the engine for starting purposes.

3.12 operator hand-control position: Area or space within which all hand-controls to be operated from the operator position are located.

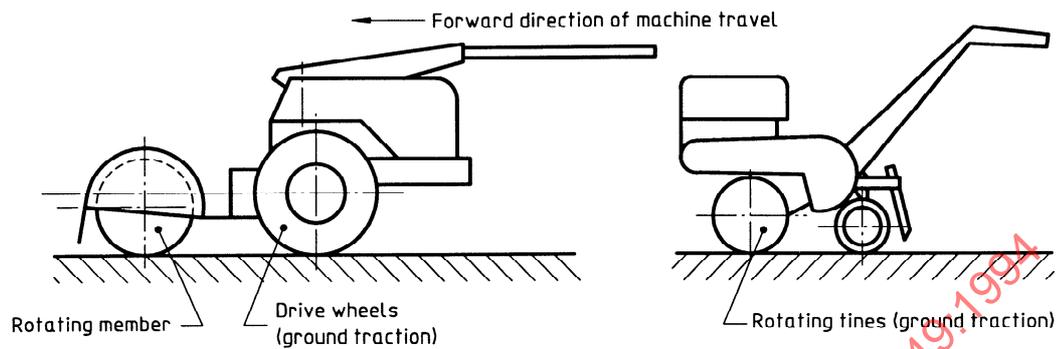
3.13 operator position: Area occupied by the operator during normal operation of the machine.

3.14 operator zone: Area into which the extremities of a 95th percentile male can reach from the normal operator position. (See figure 5.)

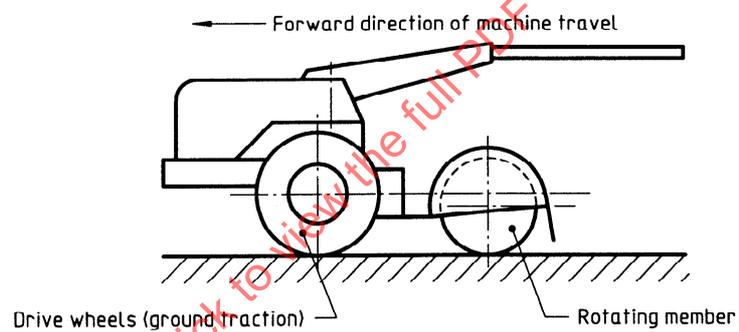
3.15 normal operation: Any use of the machine which is reasonably foreseeable, as perceived by the ordinary user, and which is consistent with such activities as tilling, starting, stopping, fuelling and transporting.

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

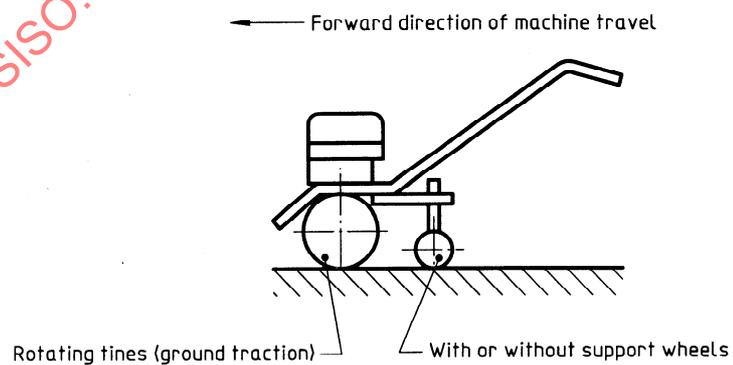
1) To be published.



a) Front tine tiller



b) Rear tine tiller



c) Handheld tiller

Figure 1 — Types of rotary tillers

4 General construction

4.1 Powered driven components (other than tilling)

4.1.1 Powered driven gears, chains, sprockets, belts, friction drives, pulleys, fans, fan-wheel shafting and other moving parts whenever they create a pinch point or are capable of causing injury shall be so positioned or guarded by shields or similar attachments to prevent accidental contact with these components by the operator during normal starting and operation of the machine. Drive-shafts shall be fully guarded.

The principles set out in ISO 5395:1990, annex A, shall be followed when developing a guarding system.

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

4.2 Heat protection

4.2.1 Temperature limits of exposed parts

A guard or shield shall be provided to prevent accidental contact with engine exhaust components greater than 10 cm² of surface and with a hot surface greater than 80 °C at (20 ± 3) °C ambient temperature during normal operation of the machine.

4.2.1.1 Test method

Conduct the test in the shade. Operate the engine at its maximum no-load speed until the surface temperature stabilizes.

Temperatures shall 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 over 100 mm, cone A in figure 2 shall be used. For a distance less than 100 mm between the identified hot area and the nearest control, cone B in figure 2 shall be used.

Move cone A, with the axis of the cone anywhere between 0° and 180° to the horizontal with the nose or point of the cone downward (in relation to the 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. Cone B may be moved in any direction for exhaust surfaces.

4.2.1.2 Test acceptance

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

4.3 Protection from exhaust fumes

Engine exhausts shall be directed away from the operator in all operating positions.

5 Guarding of tilling means

5.1 Rear tiller

The rear tines shall be guarded as shown in figure 3.

A protective guard shall be provided at the rear of the tiller that, when the tines are placed on a level supporting surface, will extend to a maximum of 25 mm above the level supporting surface and shall have a width of at least the composite width of the tines. Any movable shield, when released, shall automatically return. The protective guard shall have side coverings.

5.2 Front and handheld tillers

The rotating member of the front tine and handheld tillers shall be protected by a solidly fixed guard, covering the rotating elements rearward to an angle of at least 60° to the vertical [see figure 4 a)].

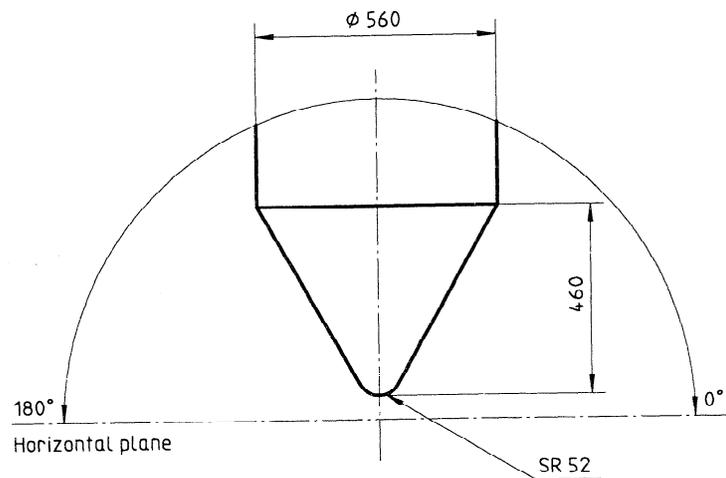
The minimum length of the guard shall be as specified in table 1.

Table 1

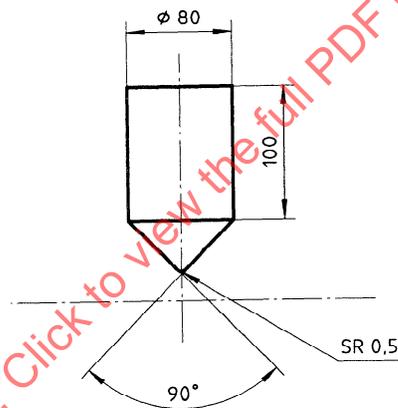
Dimensions in millimetres

Working width	Length of guard min.
< 600	working width
≥ 600	600

Dimensions in millimetres



Cone A



Cone B

Figure 2 — Test cones

Dimensions in millimetres

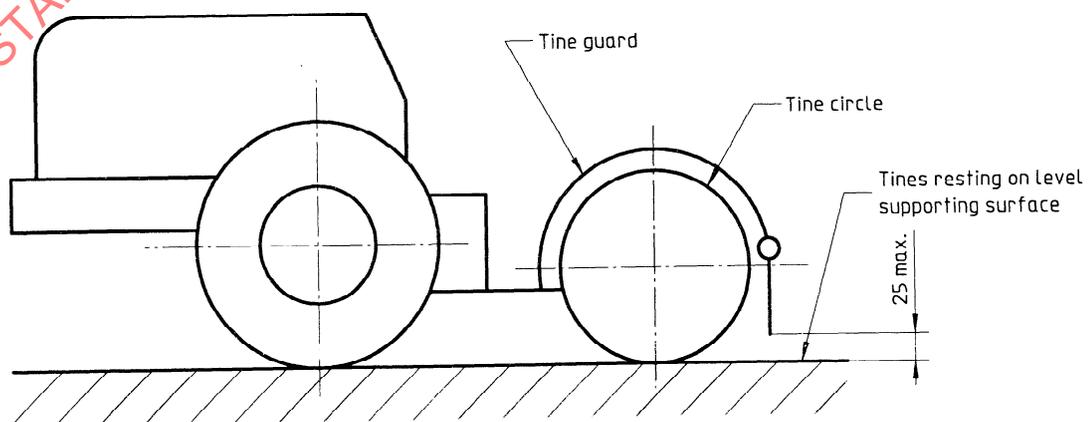
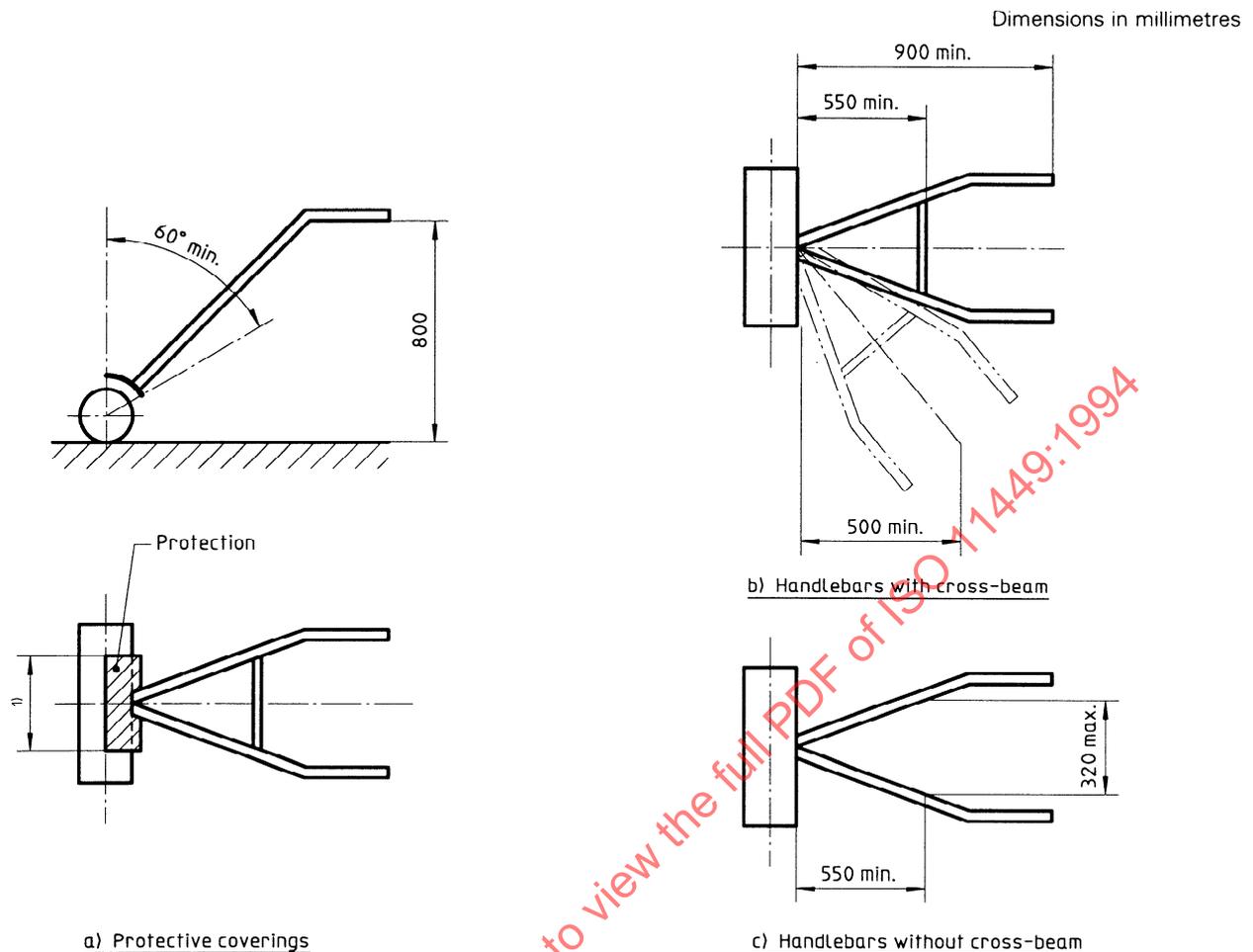


Figure 3 — Guarding of tilling means — Rear tillers



1) See table 1.

Figure 4 — Guarding of tilling means — Front and handheld tillers

The distance between the projection on the horizontal plane of the midpoint of the straight line which joins the ends of the handlebars and the projection on this plane of the outer periphery of the rotating parts of the tool shall be at least 900 mm and at least 500 mm in the case of horizontal handlebars which are not parallel to the direction of machine movement [see figure 4 b)].

A cross-beam shall be placed between the handlebars, located at more than 550 mm from the tool periphery to prevent the operator approaching [see figure 4 b)]. This crossbeam is not necessary if, at 550 mm from the tool, the distance between the handlebars is less than 320 mm [see figure 4 c)].

The tiller handlebar shall be fastened to the tiller to prevent loss of control by unintentional uncoupling while in operation. The barrier between the handlebars and the body of the machine shall be de-

signed so that it does not yield under normal working conditions.

6 Controls

6.1 General

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

The following are not considered operator controls:

- depth control;
- engine starting;
- tiller attachment discharge arrangements;
- tiller cover adjustment arrangements.

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 5. The operating range of less frequently used controls may be extended by considering that the operator's trunk, when standing with both feet on the ground, articulates within the confines of the operator zone, for example leans forward until contacting the handle in any of the operating positions.

Engine starting controls may be outside this range if starting can only be accomplished with tine drive disengaged.

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 tillers, it shall be possible to engage or disengage the traction drive when the tilling means is operating.

The machine shall be fitted with a device on the control handle which will automatically stop tine 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 tine clutch/brake mechanism.

6.2 Starting device

Machines shall be equipped with a device which prevents all means of starting the engine where this starting could induce rotation of the wheels and/or working tools. The type of device which could be considered as fulfilling this requirement is one which, for example, only allows the engine to start when the gear-lever is in neutral and the tool is disengaged (declutched).

Such a device is not necessary if the start-up system is located in such a way, when disengaged, that the operator cannot place himself in the danger zone in order to actuate it. The danger zone (see figure 6) is the longitudinal band defined by the working width of the tool or equipment limited towards the rear at a distance of 550 mm from the exterior envelope of the tool or equipment.

In the case of rearward motion, the danger zone includes the whole longitudinal zone to the rear, only limited by the working width of the tools.

Should the operator have to lean on the machine to start the engine, the appropriate place shall be indicated or a support provided with corresponding symbol.

The engine shall not be equipped with a starter operated by means of a loose rope or belt.

6.3 Engine speed control

An engine speed control lever, if in the operator hand-control position, shall move away from the operator (generally forward and/or upward) to increase engine speed and move towards the operator (generally rearward and/or downward) to decrease engine speed.

An engine speed push/pull control, if in the operator hand-control position, shall be pulled to increase speed and pushed to decrease speed.

6.4 Tine/traction control

6.4.1 General

Operation of the tiller in the reverse direction of travel shall require an operator-presence control(s) for traction and tine engagement located in the operator hand-control position (see figure 5).

A means shall be provided to disengage the tines from the power supply. It shall require intentional activation in order to start operation.

In all machines with reverse gear, a neutral position shall be provided. In the case of rear tines and front tine machines with drive wheels, the working tools shall not be driven when the reverse gear is engaged. The following are allowed for:

- the engaging of the reverse gear simultaneously disengages the working tool, or
- the engaging of the drive to the working tool prevents engaging of the reverse gear.

6.4.2 Power supply disengagement tests

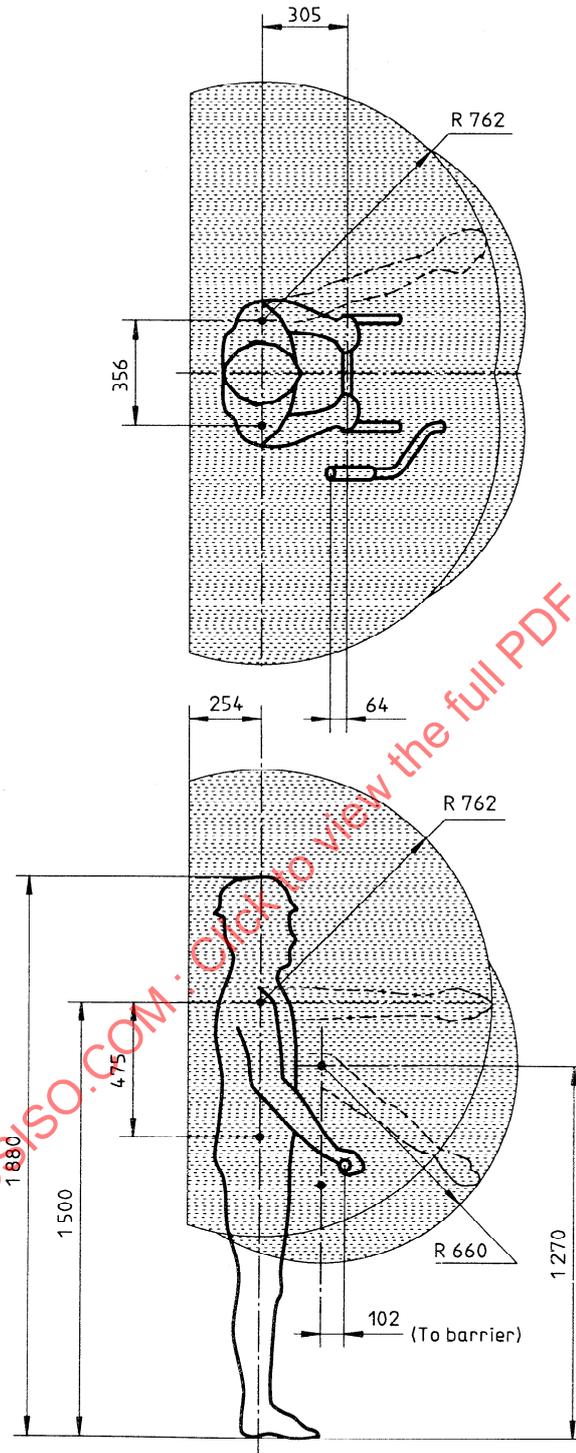
6.4.2.1 Tine drive

Except for powered rotary tillers with centrifugal clutches and electrically driven tillers, the powered rotary tillers shall be tested twice: first with the engine running at the idle speed recommended by the tiller manufacturer and then with the engine running at the maximum governed speed recommended by the tiller manufacturer.

Engage the tines while raised off the ground.

The tines shall cease to rotate when disengaged and lowered to a hard, flat, level surface.

Dimensions in millimetres



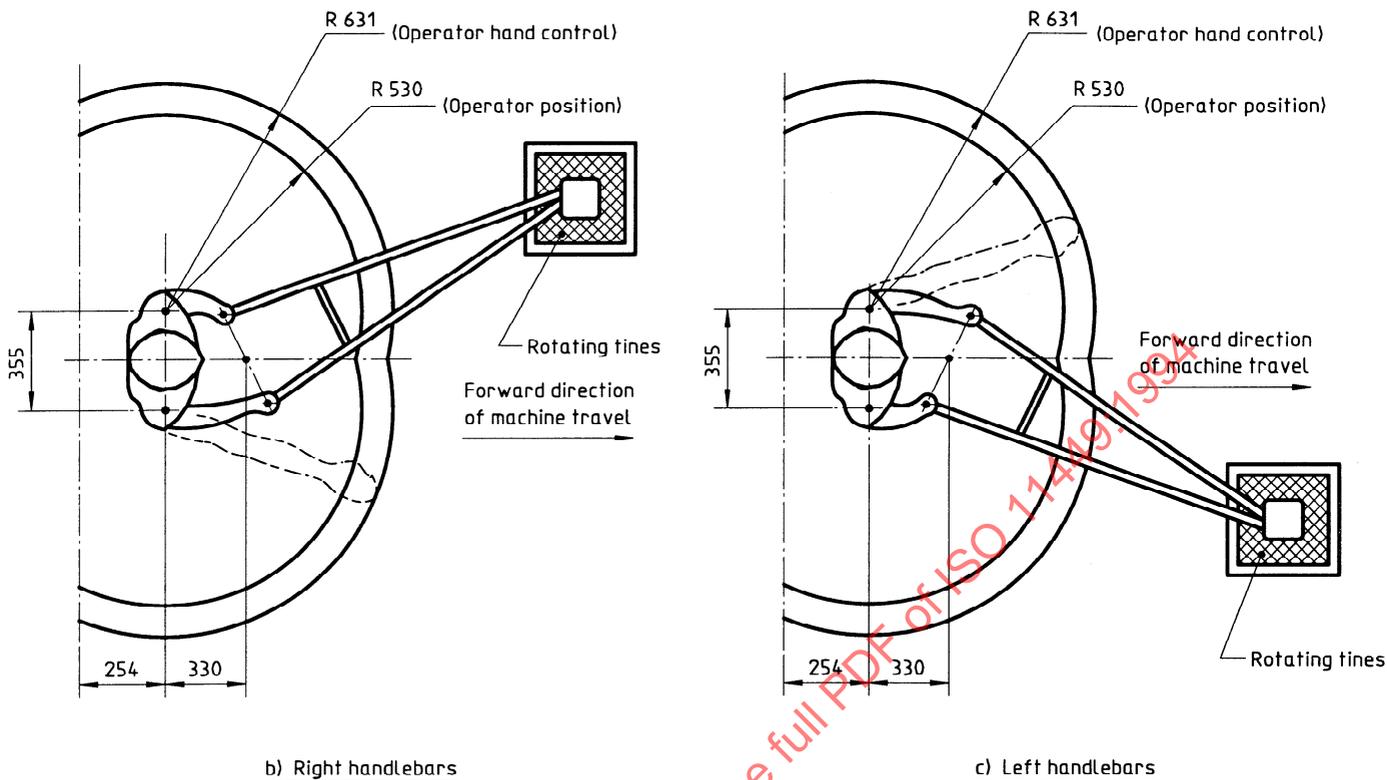
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See notes on following page.

a) Operator zone

Figure 5

Dimensions in millimetres



NOTES

- 1 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.
- 2 All barriers within the operator zone will reduce the zone by the space occupied and protected by the barrier.
- 3 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 5 — Operator zone — Walk-behind pedestrian-controlled machine

Dimensions in millimetres

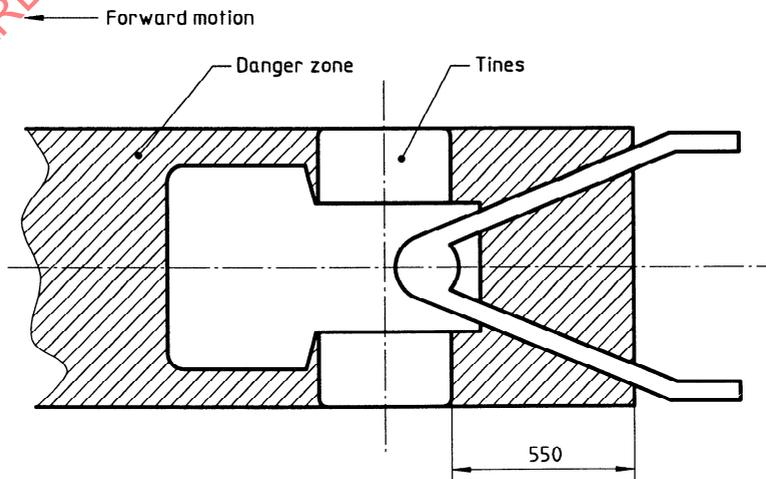


Figure 6 — Limits of danger zone when operating starting device for machines with no reverse gear

For powered rotary tillers with centrifugal clutches, if the means to disengage the tines from the power supply, as required in 6.4.1, is a combination throttle/disengagement control, raise the tines from the ground and actuate the control to engage the tines.

Upon release of the control, the tines shall cease to rotate when lowered to a hard, flat, level surface.

Electrically driven tillers shall be tested only once, with the motor running at the idle speed recommended by the tiller manufacturer.

Engage the tines while raised off the ground.

The tines shall cease to rotate when disengaged and lowered to hard, flat level surface.

6.4.2.2 Traction drive

With the tines and wheels disengaged, place all wheels of the tillers before a 25,4 mm vertical step. Attempt to mount the step, first with the engine running at the idle speed recommended by the tiller manufacturer and then with the engine running at the maximum governed speed recommended by the tiller manufacturer. However, electrically driven tillers shall only be tested with the motor running at the idle speed recommended by the tiller manufacturer.

The tillers shall not traverse the vertical step and the wheels shall not rotate when disengaged.

6.5 Engine shutoff

A shutoff control device shall be provided to stop operation of the engine (motor). This device shall require manual and intentional activation in order to start the engine (motor). A key switch, or similar device, shall be provided to prevent unauthorized starting of the engine (motor), unless manual start is the only means of starting the engine.

6.6 Identification of controls

6.6.1 Controls 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.

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

6.6.3 A tiller with a recoil starter shall have a labelled designated area to indicate where the operator's foot or free hand shall be placed when manually starting the engine.

7 Electrical requirements

The following electrical requirements apply only to battery circuits of less than 42 V and excludes magneto grounding circuits. For the electrical requirements for mains-connected electrically driven machines, reference should be made to IEC 335-1.

7.1 Battery installation

The compartment for a vented storage battery shall have openings to provide ventilation and drainage. Drainage of acid from the battery in its operating position shall not come in contact with parts that will be critically affected such as to create a hazard.

7.2 Overload protection

All circuits, except starting motor and ignition circuits, shall have overload protective devices on the battery feed side of switches, except that for two-wire, non-grounded systems the overload protection may be located in either line.

7.3 Terminals and uninsulated electrical parts

Terminals and uninsulated electrical parts shall be protected against short-circuiting by a fuel can or tools during normal servicing, refuelling and lubrication.

8 Marking

8.1 General

8.1.1 Every machine shall be marked to identify the manufacturer, model number and/or serial number together with appropriate warnings (e.g. fuel type and mixture, recommendation to wear ear protection, distance warning for bystanders, advice to read the owner's manual and other useful information).

8.1.2 Every machine shall be prominently marked with the warning "Wear eye protection" or with the appropriate ISO hazard pictorial (see ISO 11684).

8.1.3 Labels giving cautionary information shall be located close to the relevant hazard. Such labels shall be in the official language(s) of the country in which the machine is sold, and easily visible.