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Power lawn-mowers — Definitions, safety requirements and test procedures

[Revision of first edition (ISO 5395:1990) and its Amendment 1:1992]

Tondeuses à gazon à moteur — Définitions, exigences de sécurité et modes opératoires d'essai

ICS 65.060.70

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

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*, SC 13, *Powered lawn and garden equipment.*

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This second edition cancels and replaces the first edition, ISO 5395:1990, and Amendment 1:1992-08-01. It has been restructured to a great extent to improve the grouping of requirements by lawnmower type. Some sections, such as clause 5, *Controls*, have retained the grouping by subject matter to facilitate expected further revisions.

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A rationale has been added as Annex A (informative) to indicate some of the background for selected clauses.

A list of hazards and the clauses associated with them has been added as Annex B (informative).

Powered lawn-mowers - Definitions, safety requirements and test procedures

1. Scope

This International Standard defines terms and specifies safety requirements and test procedures applicable to powered rotary and cylinder lawnmowers.
This International Standard does not apply to grass trimmers, lawn trimmers, edgers, flail mowers, sickle-bar mowers, agricultural mowers, motor mowers, automatic (robot) mowers, ride-on lawn mowers with a standing operator and the electrical aspects of electrically driven lawnmowers.
This International Standard does not apply to rotary lawnmowers which use only cutting means consisting of either one or more non-metallic filaments, or one or more non-metallic cutting elements pivotally mounted on a generally circular central drive unit, which rely on centrifugal force to achieve cutting, and have a kinetic energy for each single cutting element of less than 10 J.

2. Normative References

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The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred applies.
Members of IEC and ISO maintain registers of currently valid International Standards.
ISO 500:1991, *Agricultural tractors - Power take-off and drawbar - Specification.*
ISO 3416:1986, *Textile floor coverings - Determination of thickness loss after prolonged, heavy static loading.*
ISO 3600:1996, *Tractors and machinery for agriculture and forestry - Operator manuals and technical publications - Presentation.*
ISO 3767-1:1998, *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 3767-3:1995, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment - Symbols for operator controls and other displays - Part 3: Symbols for powered lawn and garden equipment.*
ISO 4253-1993, *Agricultural tractors -- Operator's seating accommodation - Dimensions*
ISO 5353:1995, *Earth-moving machinery, and tractors and machinery for agriculture and forestry - Seat index point*
ISO 6682:1995*, Earth-moving machinery - Zones of comfort and reach for controls.*
ISO 9190: 1990, *Lawn and garden ride-on (riding) tractors – Drawbar*
ISO 9191: 1991- *Lawn and garden ride-on (riding) tractors -- Three-point hitch*
ISO 9192: 1991, *Lawn and garden ride-on (riding) tractors -- One-point tubular sleeve hitch*
ISO 9193:1990, *Lawn and garden ride-on (riding) tractors - Power take-off*

ISO 11684: 1995, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment -- Safety signs and hazard pictorials - General principles*
ISO 12003-2: 2001, *Agricultural and forestry tractors. Narrow track wheeled tractors. Part 2- Rear-mounted roll-over protection structures*
ISO 13852: 1996, *Safety of machinery -- Safety distances to prevent danger zones being reached by the upper limbs*
IEC 60335-1:1994, *Safety of household and similar electrical appliances - Part 1: General requirements*.
IEC 60335-2-77:1996, *Safety of household and similar electrical appliances - Part 2: Particular requirements for pedestrian controlled mains-operated lawnmowers.*

3. Definitions

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

3.1.
agricultural mower
power-driven machine, whose cutting tools are either mounted or an integral part of the machine and which is used for cutting grass, similar plants, scrub or woody vegetation, and not for groomed lawns

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3.2.
blade: (See cutting means)

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3.3.
blade tip circle
path described by the outer-most point of the cutting means cutting edge as it rotates about its shaft axis

3.4.
braking distance
distance travelled between the point of the first application of the brake control and the point at which the lawnmower comes to rest

3.5.
braking system
combination of one or more brakes and related means of operation and control

3.6.
control
means or device which will control the operation of the lawnmower or any specific operating function thereof

3.7.
cutting means
blade mechanism used to provide the cutting action

3.8.
cutting means enclosure
part or assembly which provides the protective means around the cutting means

3.9.
cutting height
any height setting of the cutting means designated by the manufacturer for cutting grass

3.10.
cutting width
the total width of cut measured across the cutting means at right-angles to the direction of travel

3.11.
cylinder [reel] lawnmower
powered lawnmower with one or more cutting means rotating about a horizontal axis to provide a shearing action with a fixed cutter bar or knife

3.12.
discharge chute
extension of the cutting means enclosure from the discharge opening, generally used to control the discharge of material from the cutting means

3.13.
discharge opening
gap or opening in the cutting means enclosure through which grass can be discharged

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3.14.
edger
powered machine suitable for cutting lawn and soil, usually in a vertical plane

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3.15.
exhaust system
means of conveying exhaust gases from the engine exhaust port to the atmosphere

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

3.17.
grass catcher
part or combination of parts which provides a means for collecting grass clippings or debris

3.18.
grass trimmer
combustion engine powered machine fitted with either one or more non-metallic filaments, or one or more non-metallic pivotally mounted cutting elements which rely on centrifugal force to achieve cutting of weed, grass, or similar soft vegetation

3.19.
guard
part of the lawnmower or a component incorporated to provide protection for the operator and/or bystander

3.20.
jackknifing
movement of an articulated unit which results in any of the following:

- prevention of further operation in the reverse direction, or
- entrapment of the operator, or
- displacement of the operator sufficient to cause loss of control
-

3.21.
lawnmowing attachment
cutting means designed to be easily detached from the machine, generally to allow the machine to be used for other purposes

3.22.
lawn trimmer
electrically powered grass trimming machine in which the cutting means operates in a plane approximately parallel to the ground.

3.23.
maximum operating engine [motor] speed
highest engine/motor speed obtainable when adjusted in accordance with lawnmower manufacturer's specifications and/or instructions with the cutting means engaged

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3.24.
mulching lawnmower
powered rotary lawnmower without discharge openings in the cutting means enclosure

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3.25.
normal operation
any use of the machine by the ordinary user which is predictable, such as cutting grass, starting, stopping, emptying grass catcher, fueling, or connecting to (or disconnecting from) a power source, or the mounting of, and dismounting from, ride-on lawnmowers

3.26.
normal use
normal operation, plus routine maintenance, servicing, cleaning, transporting, storage, attaching or removing accessories, and making ordinary adjustments as determined by the manufacturer's instructions

3.27.
open discharge chute
discharge chute without a self-closing guard, or with a self-closing guard which does not completely close the chute

3.28.
operator presence control
control designed so that it will automatically interrupt power to a drive when the operator's actuating force is removed

3.29.
parking brake
means of preventing a stationary machine from moving that can remain applied without the

operator being present

3.30.
pedestrian-controlled lawnmower
walk-behind lawnmower: Grass-cutting machine, either pushed or self-propelled, normally controlled by the operator walking behind the unit

3.31.
powered lawnmower
grass-cutting machine where the cutting means operates in a plane approximately parallel to the ground and which uses the ground to determine the cutting height by means of wheels, air cushion or skids, etc., and which utilizes an engine or an electric motor as a power source

3.32.
power source
engine or motor which provides mechanical energy for linear or rotational movement.

3.33.
ride-on [riding] lawnmower
self-propelled lawnmower on which an operator rides and designed primarily for cutting grass and auxiliary garden work
Note: The cutting means may be an integral part of the machine or suspended from or attached to the machine.

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3.34.
rotary lawnmower
powered lawnmower in which one or more elements, cutting by impact, rotate about an axis normal to the cutting plane\

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3.35.
seat index point
point on the central vertical plane of the seat as defined in ISO5353:1995

3.36.
service brake system
designated primary means for decelerating and stopping a machine from its ground travel speed

3.37.
sickle bar mower
lawnmower 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

3.38.
side discharge lawnmower
rotary lawnmower which discharges grass clippings generally perpendicular to direction of travel, and from in front of the rear wheels

3.39.
standard operator
operator weighting 75 kg ± 5 kg, and 1,75 m ± 0,05 m tall, or a mass of 75 kg ± 5 kg having a centre of gravity at the seat index point

3.40.
sulky: (see trailing seat/platform.)

3.41.
throw line (of cylinder lawnmowers)
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 lawnmower See figure 14.

3.42.
towed unit
implement pulled from the drawbar of a propelling machine and usually equipped with wheels for transport

3.43.
traction drive
means or system used to transmit power from the power source to the ground drive means

3.44.
trailing seat/platform
sulky
removable, trailing device designed to carry a seated or standing operator to ride behind while controlling a self-propelled, pedestrian-controlled lawnmower

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3.45.
trailing seat unit
sulky unit
pedestrian controlled powered lawnmower with an optional trailer seat (sulky) attached

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3.46.
transport position
designated condition of the cutting means of a powered lawnmower for propelled transport.

4. General requirements

4.1. Guarding

4.1.1.Power-driven components except cutting means and power driven wheels

4.1.1.1.All power driven components except rotating covers or discs with a continuous unbroken or smooth surface shall be guarded to prevent contact with these parts during normal operation.
Unless otherwise stated in this standard, the principles set out in ISO 13852:1996 shall be followed when developing a guarding system. Compliance to be checked by inspection.
4.1.1.2.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 marking warning of the hazard shall be located on the guard or adjacent to the hazard.
Compliance to be checked by inspection.
4.1.1.3.All guards shall be permanently attached to the lawnmower. Detaching or opening of guards shall require the use of a tool except:

- interlocked guards which disable the protected moving parts independent of the operator presence control
- hinged, automatically closing guards for grass discharge chutes
- engine compartment access where the operator presence control stops the engine.

Compliance to be checked by inspection.
4.1.1.4.Fans to assist grass collection which do not comply with the same stopping time as the cutting means when tested according to 9.2 shall either:

- have the collection device interlocked to prevent access to the fan while it is running, or
- have a reach distance from the opening to the fan which complies with ISO 13852:1996.

Note: the fan stopping time test may be conducted at the same time as the blade stopping test.

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4.1.2.Guards and grass catchers

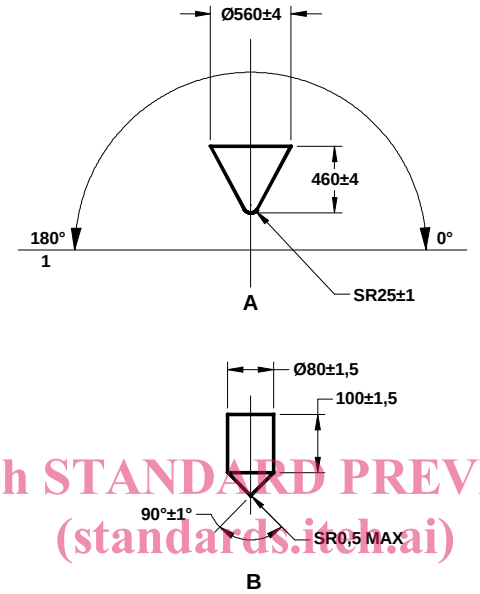
Swinging guards or guards which have to be opened in order to fit the grass catcher shall automatically return to the closed position when the grass catcher is removed. These guards shall be considered as forming part of the blade enclosure for the purposes of 9.1.

4.1.3.Hot surfaces

4.1.3.1.Requirements:

Exposed engine exhaust components having a surface temperature greater than 80°C at an ambient temperature of 20°C ± 3°C shall be considered hot and shall be guarded so that they are not accessible to unintentional contact during normal use . These parts are considered accessible if the hot area contactable by the point of the cone or conical surface of the appropriate test cone (see 4.1.3.3) is larger than 10 cm^2. The cylindrical surface of cone B and the flat surfaces of both cones shall not be considered.
4.1.3.2.Test equipment:
The temperature measuring equipment for hot surfaces shall have a maximum error of ± 4°C.
4.1.3.3.Test Method
4.1.3.3.1.The test shall be conducted in the shade. The power source shall be operated at maximum no-load speed until the surface temperatures stabilise.
4.1.3.3.2.Identify the hot surface area(s). Temperatures shall be determined by correcting the observed temperature by the difference between 20°C and ambient temperature at the time of the test (i.e. Temperature(°C) = observed temp. - ambient temp. + 20°C)

4.1.3.3.3.When the distance between the nearest contactable part of the identified hot area and the nearest control is > l00 mm, cone A in Figure 1 shall be used. If this distance is ≤ l00 mm cone B in Figure 1 shall be used.
4.1.3.3.4.Cone A shall be used with the axis of the cone anywhere between 0° and 180° to the horizontal (see figure 1) and with the point of the cone in a downward to horizontal direction, move the cone towards the hot surface. Cone A shall not be moved in an upward direction and shall not be used with the cone pointing in an upward direction. Table 1 summarizes the use of cones.



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Key:
1 Horizontal plane
Note 1 Dimensions in millimeters

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Figure 1 - Test cones for determination of hot parts accessibility

4.1.3.3.5.Cone B (see figure 1) shall be used with the axis of the cone in any direction and moved in any direction.

NOTE : It is not necessary to test the accessibility of hot parts while they are hot. Allow the lawnmower to cool before using the cone(s).

NOTE: The requirements and test for this clause are currently under study.

Table 1 - Method of use of test cones

Distance from nearest control (mm)	>100	≤100
Type of cone to be used	A	B
Orientation of cone	Point down or horizontal only	Any direction
Direction of movement of cone	Downwards or horizontal only	Any direction

4.1.4.Exhaust fumes

4.1.4.1.Engine exhaust shall not be directed towards the operator. Compliance to be checked by inspection.

4.1.4.2.On lawnmowers equipped with an enclosure for the operator, the engine exhaust shall not be directed towards the enclosure or the air inlet to the enclosure. Compliance to be checked by inspection.

4.1.5.Pressurized components

Pressurized hoses, lines, and components shall be located or guarded so that in the event of failure the fluid can not be discharged directly on to the operator when in the operator position. Compliance to be checked by inspection.

4.1.6.Liquid Containers

When filled to the maximum according to manufacturer's instructions, liquid containers, batteries, fuel systems, oil reservoirs, and coolant systems shall be constructed to prevent spillage while the lawnmower is tilted for 1 min as specified in the stability test according to 7.3.2. Weeping at vent systems is not considered spillage. Compliance to be checked by inspection.

4.1.7.Noise and vibration

Lawnmowers should be designed to minimise noise and vibration. Further information is contained in Annex C (informative)

4.2. Minimum marking

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4.2.1.A warning shall be located in a position easily visible to the operator, indicating, (in words or the pictograms in Annex D) "Warning: Keep bystanders away. Read instruction book before operating." Compliance to be checked by inspection.

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4.2.2.Every lawnmower and lawnmowing attachment shall be marked indicating the manufacturer or supplier, model number and/or serial number. Compliance to be checked by inspection.

4.3. Labels and markings

4.3.1.Markings giving cautionary information shall be located close to the relevant hazard. Compliance to be checked by inspection.
4.3.2.Markings giving cautionary information shall be either in the official language(s) of the country in which the lawnmower is sold, or use pictograms in accordance with established ISO standards such as ISO 11684:1995. Compliance to be checked by inspection.
4.3.3.Markings giving cautionary information shall be shall be in contrasting colours, except if embossed, moulded, cast or stamped. Compliance to be checked by inspection.
4.3.4.Labels and markings provided for identification, directional or cautionary information shall satisfy the following requirements:

- Labels shall have a durable bond with the base material surface;
  Note: Metal plates fastened with rivets or equivalent fastening means, are also considered sufficient.
- Labels shall be water resistant and be designed to be permanently legible. Labels shall not curl at the edges and legibility shall not be impaired by fuel or lubricant.
  Note: Embossed, moulded, etched or stamped markings are considered to have a reasonable life without tests.

4.3.5.All required markings shall be rubbed by hand for 15 s with a piece of cloth soaked in water and again for 15 s with a piece of cloth soaked in petrol. The marking shall remain easily legible. It shall not be easily possible to remove any label nor shall any label show any signs of curling.

4.4. Instruction manual

Each lawnmower shall be provided with pertinent operating, servicing, and maintenance instructions, such as those presented in Annex E and conforming to ISO 3600: 1996. For mains-connected electrically driven lawnmowers these shall be revised as necessary to conform with the relevant requirements of IEC 60335-1: 1994.

4.5. Electrical requirements

4.5.1.Application

These electrical requirements apply only to battery circuits of less than 42 V and to high tension ignition circuits. Magneto grounding circuits are not included. For the electrical requirements for mains-connected electrically driven lawnmowers, reference shall be made to IEC 60335-2-77:1996.

4.5.2.Electrical cables

Electrical cables shall be protected if located in potentially abrasive contact with metal surfaces and shall be resistant to, or protected from, contact with lubricant and fuel.
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. Compliance to be checked by inspection.

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4.5.3.Battery installation

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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 to the extent that a hazard would be created. Compliance to be checked by inspection.

4.5.4.Overload protection

All circuits, except starter motor and high-tension ignition circuits, shall be provided with an overload protection device in the ungrounded line of a single wire system, or in either wire of a two-wire system.
This requirement shall not, however, apply to battery-powered lawnmowers 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 lawnmower 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 lawnmower.

NOTE: The above requirement for battery operated lawnmowers shall not apply if a battery lawnmower standard is developed.

4.5.5.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 refueling and lubrication servicing. Compliance to be checked by inspection.

4.5.6.Ignition circuits

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

4.5.6.2.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. Compliance to be checked by inspection.

4.6. Engine stopping and starting

4.6.1.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 the operating position.
4.6.2.A switch operated by a removable key, or a similar device shall be provided to prevent unauthorised starting of the engine unless a manual starter is the only means of engine starting.
4.6.3.Lawnmowers shall not be equipped to be started by means of a loose rope.

4.7. Transport

4.7.1.When there is a designated transport position where the height of no part of the cutting means nor the cutting means enclosure from the ground exceeds 400 mm, there shall be a means to disengage the cutting means drive while the traction drive is engaged.
4.7.2.If movement of the cutting means towards the transport position raises any part of the cutting means or the cutting means enclosure 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.
4.7.3.When moving the cutting means from the transport position to the working position it shall not be possible to engage the drive to the cutting means shall not be engaged unless:

- the operator is at the operator's position; and
- all parts of the cutting means and the cutting means enclosure are within 400 mm of the ground; and
- there is a deliberate activation of the drive to the cutting means by the operator.

4.7.4.If any part of the cutting means or the cutting means enclosure be raised higher than 400 mm for transport or maintenance, it shall be capable of being secured in the position by positive means such as latches. Compliance to be checked by inspection.
4.7.5.If the cutter units have to be brought to the transport position by hand, they shall be provided with appropriate handles. The maximum force required for operation shall be 350 N.

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5. Controls

5.1. All lawnmowers

Controls other than those for:

- height of cut setting,
- fixed blade (on-cut) setting or adjustment on cylinder lawnmowers,
- engine starting,
- grass catcher discharge arrangements,

shall meet the applicable requirements of 5.2 and 5.3.
Detailed instructions on the operation of all controls shall be provided in an instruction handbook.

5.2. All self-propelled lawnmowers

5.2.1.The controls to operate the cutting means shall be independent of the controls to engage and disengage the traction drive.