UL 62841-4-7

STANDARD FOR SAFETY

Electric Motor-Operated Hand-Held Tools, Transportable Tools and Lawn and Garden Machinery – Safety – Part 4-7: Particular Requirements for Pedestrian Controlled Walk-Behind Lawn Scarifiers and Aerators

UL Standard for Safety for Electric Motor-Operated Hand-Held Tools, Transportable Tools and Lawn and Garden Machinery – Safety – Part 4-7: Particular Requirements for Pedestrian Controlled Walk-Behind Lawn Scarifiers and Aerators, UL 62841-4-7

First Edition, Dated December 21, 2023

SUMMARY OF TOPICS

Adoption of the First Edition of IEC 62841-4-7, Standard for Electric Motor-Operated Hand-Held Tools, Transportable Tools and Lawn and Garden Machinery – Safety – Part 4-7: Particular Requirements for Pedestrian Controlled Walk-Behind Lawn Scarifiers and Aerators, as the First Edition of UL 62841-4-7 dated December 21, 2023.

UL 62841-4-7 is an adoption of IEC 62841-4-7, First Edition, issued by the IEC July 2022, including Corrigendum 1, issued 2023. Please note that the National Difference document incorporates all of the U.S. national differences for UL 62841-4-7.

The new requirements are substantially in accordance with Proposal(s) on this subject dated October 22, 2021.

No Text on This Page

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First Edition
(IEC 62841-4-7:2022, MOD)

ULSE Inc.
UL 62841-4-7
First Edition

Electric Motor-Operated Hand-Held Tools, Transportable Tools and Lawn and Garden Machinery – Safety – Part 4-7: Particular Requirements for Pedestrian Controlled Walk-Behind Lawn Scarifiers and Aerators

December 21, 2023

This national standard is based on publication IEC 62841-4-7 First Edition (2022), including Corrigendum 1 (2023).

Approved American National Standard

ANSI/UL 62841-4-7-2023

Commitment for Amendments

This standard is issued jointly by Canadian Standards Association (operating as “CSA Group”) and ULSE Inc. (ULSE). Comments or proposals for revisions on any part of the standard may be submitted to CSA Group or ULSE at anytime. Revisions to this standard will be made only after processing according to the standards development procedures of CSA Group and ULSE. CSA Group and ULSE will issue revisions to this standard by means of a new edition or revised or additional pages bearing their date of issue.

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This Standard is subject to review within five years from the date of publication, and suggestions for its improvement will be referred to the appropriate committee. The technical content of IEC and ISO publications is kept under constant review by IEC and ISO. To submit a proposal for change, please send the following information to inquiries@csagroup.org and include "Proposal for change" in the subject line: Standard designation (number); relevant clause, table, and/or figure number; wording of the proposed change; and rationale for the change.

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This ANSI/UL Standard for Safety consists of the First Edition.

The most recent designation of ANSI/UL 62841-4-7 as an American National Standard (ANSI) occurred on December 21, 2023. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page (front and back), or the Preface. The National Difference Page and IEC Foreword are also excluded from the ANSI approval of IEC-based standards.

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Preface

This is the harmonized CSA Group and ULSE Standard for Electric Motor-Operated Hand-Held Tools, Transportable Tools and Lawn and Garden Machinery – Safety – Part 4-7: Particular Requirements for Pedestrian Controlled Walk-Behind Lawn Scarifiers and Aerators. It is the First edition of CSA C22.2 No. 62841-4-7 and the First edition of UL 62841-4-7.

This harmonized standard is based on IEC Publication 62841-4-7: First edition, Electric Motor-Operated Hand-Held Tools, Transportable Tools and Lawn and Garden Machinery – Safety – Part 4-7: Particular Requirements for Pedestrian Controlled Walk-Behind Lawn Scarifiers and Aerators, issued July 2022, and IEC Corrigendum 1, issued May 2023. IEC 62841-4-7 is copyrighted by the IEC.

This harmonized standard was prepared by CSA Group and ULSE. The efforts and support of the International Harmonization Committee (IHC) for the adoption of the IEC series of standards for Hand-Held, Motor-Operated, and Transportable Tools and Lawn and Garden Machinery, are gratefully acknowledged.

This standard is considered suitable for use for conformity assessment within the stated scope of the standard.

This standard was reviewed by the CSA Subcommittee on Safety of Hand-Held Motor-Operated Electric Tools, under the jurisdiction of the CSA Technical Committee on Consumer and Commercial Products and the CSA Strategic Steering Committee on requirements for Electrical Safety, and has been formally approved by the CSA Technical Committee. This standard has been developed in compliance with Standards Council of Canada requirements for National Standards of Canada. It has been published as a National Standard of Canada by CSA Group.

Application of Standard

Where reference is made to a specific number of samples to be tested, the specified number is to be considered a minimum quantity.

Note: Although the intended primary application of this standard is stated in its scope, it is important to note that it remains the responsibility of the users of the standard to judge its suitability for their particular purpose.

CSA C22.2 No. 62841-4-7 is to be used in conjunction with the First edition of CAN/CSA-C22.2 No. 62841-1. The requirements for pedestrian controlled walk-behind lawn scarifiers and aerators are contained in this Part 4 Standard and CAN/CSA-C22.2 No. 62841-1. Requirements of this Part 4 Standard, where stated, amend the requirements of CAN/CSA-C22.2 No. 62841-1. Where a particular subclause of CAN/CSA-C22.2 No. 62841-1 is not mentioned in CSA C22.2 No. 62841-4-7, the CAN/CSA-C22.2 No. 62841-1 subclause applies.

UL 62841-4-7 is to be used in conjunction with the First edition of UL 62841-1. The requirements for pedestrian controlled walk-behind lawn scarifiers and aerators are contained in this Part 4 Standard and UL 62841-1. Requirements of this Part 4 Standard, where stated, amend the requirements of UL 62841-1. Where a particular subclause of UL 62841-1 is not mentioned in 62841-4-7, the UL 62841-1 subclause applies.

Level of harmonization

This standard adopts the IEC text with national differences.

This standard is published as an equivalent standard for CSA Group and ULSE.

An equivalent standard is a standard that is substantially the same in technical content, except as follows: Technical national differences are allowed for codes and governmental regulations as well as those recognized as being in accordance with NAFTA Article 905, for example, because of fundamental climatic, geographical, technological, or infrastructural factors, scientific justification, or the level of protection that the country considers appropriate. Presentation is word for word except for editorial changes.

All national differences from the IEC text are included in the CSA Group and ULSE versions of the standard. While the technical content is the same in each organization's version, the format and presentation may differ.

Reasons for Differences From IEC

National differences from the IEC are being added in order to address safety and regulatory situations present in the US and Canada.

Interpretations

The interpretation by the standards development organization of an identical or equivalent standard is based on the literal text to determine compliance with the standard in accordance with the procedural rules of the standards development organization. If more than one interpretation of the literal text has been identified, a revision is to be proposed as soon as possible to each of the standards development organizations to more accurately reflect the intent.

IEC Copyright

For CSA Group, the text, figures, and tables of International Electrotechnical Commission Publication 62841-4-7, Electric motor-operated hand-held tools, transportable tools and lawn and garden machinery – Safety – Part 4-7: Particular requirements for pedestrian controlled walk-behind lawn scarifiers and aerators, copyright 2022, are used in this standard with the consent of the International Electrotechnical Commission. The IEC Foreword and Introduction are not a part of the requirements of this standard but are included for information purposes only.

These materials are subject to copyright claims of IEC and ULSE. No part of this publication may be reproduced in any form, including an electronic retrieval system, without the prior written permission of ULSE. All requests pertaining to the Electric motor-operated hand-held tools, transportable tools and lawn and garden machinery – Safety – Part 4-7: Particular requirements for pedestrian controlled walk-behind lawn scarifiers and aerators, UL 62841-4-7 Standard should be submitted to ULSE.

NATIONAL DIFFERENCES

National Differences from the text of International Electrotechnical Commission (IEC) Publication 62841-4-7, Electric motor-operated hand-held tools, transportable tools and lawn and garden machinery – Safety – Part 4-7: Particular requirements for pedestrian controlled walk-behind lawn scarifiers and aerators, copyright 2022, are indicated by notations (differences) and are presented in bold text. The national difference type is included in the body.

There are five types of National Differences as noted below. The difference type is noted on the first line of the National Difference in the standard. The standard may not include all types of these National Differences.

DR – These are National Differences based on the **national regulatory requirements**.

D1 – These are National Differences which are based on **basic safety principles and requirements**, elimination of which would compromise safety for consumers and users of products.

D2 – These are National Differences from IEC requirements based on existing **safety practices**. These requirements reflect national safety practices, where empirical substantiation (for the IEC or national requirement) is not available or the text has not been included in the IEC standard.

DC – These are National Differences based on the **component standards** and will not be deleted until a particular component standard is harmonized with the IEC component standard.

DE – These are National Differences based on **editorial comments or corrections**.

Each national difference contains a description of what the national difference entails. Typically one of the following words is used to explain how the text of the national difference is to be applied to the base IEC text:

Addition / Add - An addition entails adding a complete new numbered clause, subclause, table, figure, or annex. Addition is not meant to include adding select words to the base IEC text.

Modification / Modify - A modification is an altering of the existing base IEC text such as the addition, replacement or deletion of certain words or the replacement of an entire clause, subclause, table, figure, or annex of the base IEC text.

Deletion / Delete - A deletion entails complete deletion of an entire numbered clause, subclause, table, figure, or annex without any replacement text.

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FOREWORD

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRIC MOTOR-OPERATED HAND-HELD TOOLS, TRANSPORTABLE TOOLS AND LAWN AND GARDEN MACHINERY – SAFETY – Part 4-7: Particular requirements for pedestrian controlled walk-behind lawn scarifiers and aerators

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.

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8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.

9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 62841-4-7 has been prepared by IEC technical committee 116: Safety of motor-operated electric tools. It is an International Standard.

The text of this International Standard is based on the following documents:

Draft	Report on voting
116/589/FDIS	116/621/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document is to be used in conjunction with the first edition of IEC 62841-1 (2014).

This document supplements or modifies the corresponding clauses in IEC 62841-1, so as to convert it into the IEC Standard: Particular requirements for pedestrian controlled walk-behind lawn scarifiers and aerators.

Where a particular subclause of IEC 62841-1 is not mentioned in this document, that subclause applies as far as reasonable. Where this document states "addition", "modification" or "replacement", the relevant text in IEC 62841-1 is to be adapted accordingly.

The following print types are used:

– requirements: in roman type;

– *test specifications: in italic type;*

– notes: in small roman type.

The terms defined in Clause 3 are printed in **bold typeface**.

Subclauses, notes, tables and figures which are additional to those in IEC 62841-1 are numbered starting from 101.

Subclauses, notes, tables and figures in Annex K and Annex L which are additional to those in the main body of this document are numbered starting from 301.

A list of all parts in the IEC 62841 series, published under the general title *Electric motor-operated hand-held tools, transportable tools and lawn and garden machinery – Safety*, can be found on the IEC website.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

• reconfirmed,

• withdrawn,

• replaced by a revised edition, or

• amended.

NOTE The attention of National Committees is drawn to the fact that equipment manufacturers and testing organizations may need a transitional period following publication of a new, amended or revised IEC publication in which to make products in accordance with the new requirements and to equip themselves for conducting new or revised tests.

It is the recommendation of the committee that the content of this publication be adopted for implementation nationally not earlier than 36 months from the date of publication.

The contents of the corrigendum 1 (2023-05) have been included in this copy.

101DV DE *Modification: Add the following to the IEC Foreword:*

The numbering system in the standard uses a space instead of a comma to indicate thousands and uses a comma instead of a period to indicate a decimal point. For example, 1 000 means 1,000 and 1,01 means 1.01.

102DV DE *Modification: Add the following to the IEC Foreword:*

For this Standard, all references to "Part 1" refer to CAN/CSA-C22.2 No. 62841-1 and UL 62841-1.

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INTRODUCTION

The International Electrotechnical Commission (IEC) draws attention to the fact that it is claimed that compliance with this document may involve the use of a patent. IEC takes no position concerning the evidence, validity, and scope of this patent right.

The holder of this patent right has assured IEC that s/he is willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statement of the holder of this patent right is registered with IEC. Information may be obtained from the patent database available at http://patents.iec.ch.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights other than those in the patent database. IEC shall not be held responsible for identifying any or all such patent rights.

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ELECTRIC MOTOR-OPERATED HAND-HELD TOOLS, TRANSPORTABLE TOOLS AND LAWN AND GARDEN MACHINERY – SAFETY – Part 4-7: Particular requirements for pedestrian controlled walk-behind lawn scarifiers and aerators

1 Scope

IEC 62841-1:2014, Clause 1 is applicable, except as follows:

Addition:

This document applies to pedestrian controlled walk-behind **lawn scarifiers** and **lawn aerators** which are designed for regenerating lawns by combing out materials such as grass, thatch and moss or cutting vertically into the lawn face using

– metallic **tines**; and/or

– rigid non-metallic **tines**

which rotate about a horizontal axis.

This document does not apply to

– pedestrian controlled walk-behind lawnmowers;

– towed/semi-mounted **lawn scarifiers** and **lawn aerators**;

– ride-on machines;

– non-powered **lawn scarifiers** and **lawn aerators**;

– combustion engine powered **lawn scarifiers** and **lawn aerators**;

– plug aerators (corers);

– hybrid and fuel cell powered machines and associated charging systems; and

– garden tractors or their attachments.

NOTE 101 Pedestrian controlled walk-behind lawnmowers are covered by IEC 62841-4-3.

2 Normative references

IEC 62841-1:2014, Clause 2 is applicable, except as follows:

Addition:

IEC 60664-3:2016, *Insulation coordination for equipment within low-voltage systems – Part 3: Use of coating, potting or moulding for protection against pollution*

IEC 60664-4:2005, *Insulation coordination for equipment within low-voltage systems – Part 4: Consideration of high-frequency voltage stress*

IEC 61058-2-6:2018, *Switches for appliances – Part 2-6: Particular requirements for switches used in electric motor-operated hand-held tools, transportable tools and lawn and garden machinery*

IEC 61672-1:2013, *Electroacoustics – Sound level meters – Part 1: Specifications*

IEC 62841-1:2014, *Electric motor-operated hand-held tools, transportable tools and lawn and garden machinery – Safety – Part 1: General requirements*

ISO 354:2003, *Acoustics – Measurement of sound absorption in a reverberation room*

ISO 2758:2014, *Paper – Determination of bursting strength*

ISO 13857:2019, *Safety of machinery – Safety distances to prevent hazard zones being reached by upper and lower limbs*

Replacement:

IEC 61058-1:2016, *Switches for appliances – Part 1: General requirements*

ISO 3744:2010, *Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Engineering methods for an essentially free field over a reflecting plane*

ISO 11201:2010, *Acoustics – Noise emitted by machinery and equipment – Determination of emission sound pressure levels at a work station and at other specified positions in an essentially free field over a reflecting plane with negligible environmental corrections*

3 Terms and definitions

IEC 62841-1:2014, Clause 3 is applicable, except as follows:

Addition:

3.101
catcher
part or combination of parts, intended to be used with the **lawn scarifier** or **lawn aerator**, which provides a means for collecting material such as grass, thatch, moss or other debris

3.102
cutting width
total width of scarification/aeration measured across the **tines** at 90° to the direction of travel

3.103
discharge chute
extension of the **tines enclosure** from the **discharge opening**, generally used to control the discharge of material from the **tines**

3.104
discharge opening
gap or opening in the **tines enclosure** through which grass, thatch, moss and other debris may be discharged

3.104.1
front discharge
discharge opening for throwing out grass, thatch and moss so that they will be collected in a **catcher** which is located in front of the **tines**

3.104.2
rear discharge
discharge opening for throwing out grass, thatch and moss so that they will be collected in a **catcher** which is located behind the **tines**

3.105
lawn aerator
machine equipped with a **tines assembly** which uses the ground to determine the depth of cut, designed for penetrating the lawn surface

Note 101 to entry: See Figure 101.

Note 102 to entry: **Lawn aerators** that are designed to only make shallow cuts or slices in the soil are also known as verticutters.

3.106
lawn scarifier
machine equipped with a **tines assembly** designed to scratch the surface or earth face

Note 101 to entry: See Figure 101.

Note 102 to entry: **Lawn scarifiers** are also known as lawn rakes and dethatchers.

3.107
maximum speed
highest steady-state **tines** speed attainable under all conditions of **normal use**, including no-load, when adjusted in accordance with the manufacturer's specifications and/or instructions

Note 101 to entry: The steady-state **tines** speed excludes transients such as overshoot that may occur before attaining a steady-state condition.

3.108
operator control
device requiring operator actuation to perform specific functions during **normal operation**

3.109
operator presence control
device that deactivates rotation of the **tines** when the operator's hand(s) is removed from the control

Note 101 to entry: The device typically consists of a combination of a mechanical actuator and other mechanical and electrical components (e.g. tactile switch, relays, load switches or **electronic components**).

3.110
parking brake
device to prevent a stationary machine from moving

3.111
service brake
device for decelerating and stopping a machine from its ground travel speed

3.112
tines
mechanism used to provide the penetrating action or scratching action of the machine

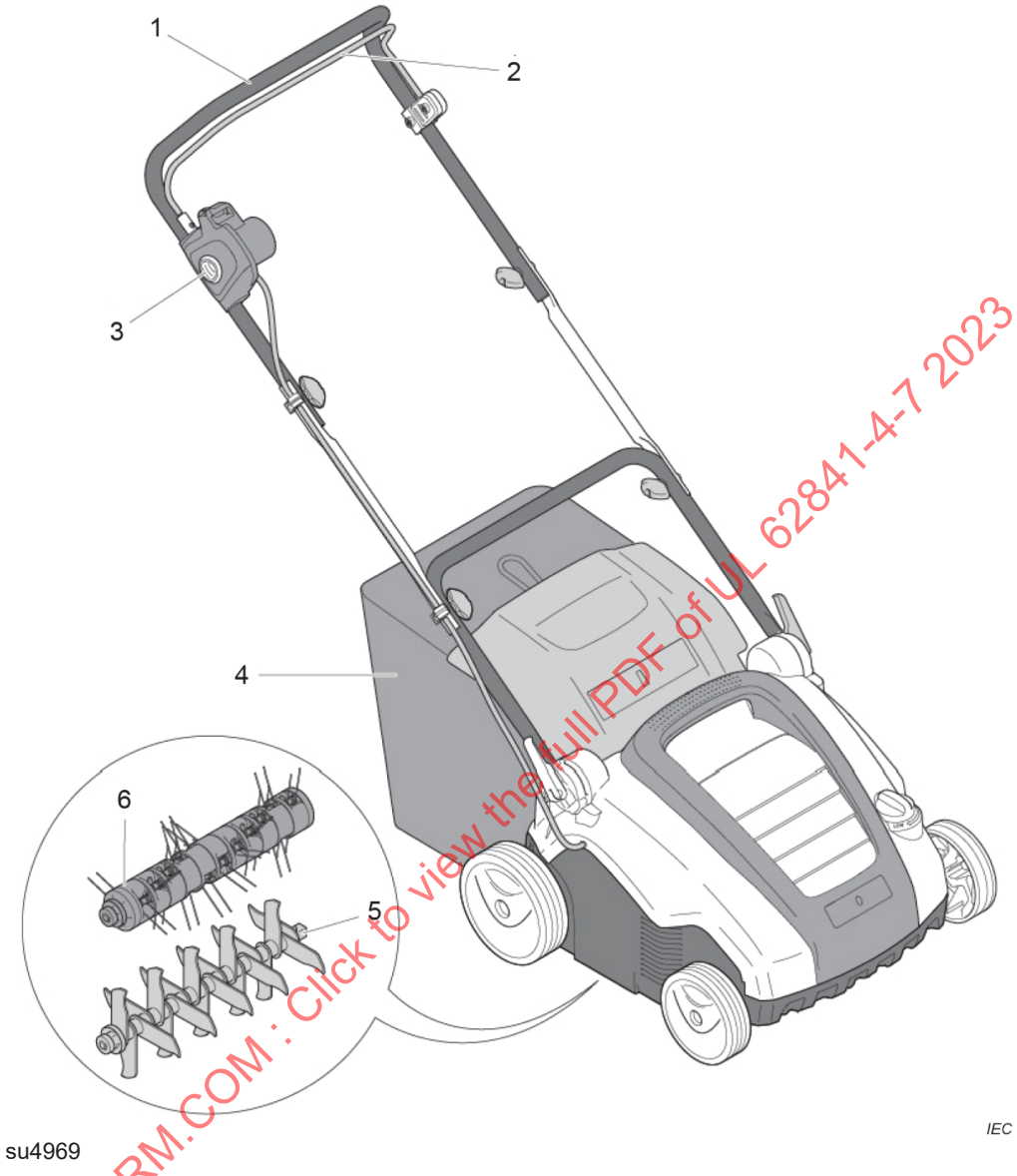
3.113
tines assembly
tines together with any supporting part(s), which together perform the aerating or scarifying action

3.114
tines enclosure
part or assembly which provides the protective means around the **tines**

3.115
tines tip circle
path described by the outermost point of the **tines** as they rotate about their shaft axis

3.116
traction drive
means (system) used to transmit power from the motor to the ground drive means

3.117
working position
any depth setting of the **tines** designated by the manufacturer



Key

1 handle

2 **operator presence control**

3 lock-off device

4 **catcher**

5 **tines assembly** for a **lawn aerator**

6 **tines assembly** for a **lawn scarifier**

Figure 101

Example of a lawn scarifier or a lawn aerator

4 General requirements

IEC 62841-1:2014, Clause 4 is applicable.

5 General conditions for the tests

IEC 62841-1:2014, Clause 5 is applicable, except as follows:

5.4 *Addition:*

Handle positions that are used for storage purposes are not included in this requirement.

5.7.2 *Replacement:*

*Machines are tested at **rated voltage**. Machines having more than one **rated voltage** or having a **rated voltage range** are tested at the highest voltage.*

5.17 *Addition:*

*The mass of the machine includes the **tines assembly**, **catcher** (empty) (if any), **catcher** adapter (if any), **tines enclosure** cover (if any) in the heaviest configuration in accordance with 8.14.2.*

5.101 *During the tests, the **tines** may be adjusted and lubricated as needed to permit operation for extended periods.*

5.102 *For tests that are performed at **maximum speed** and no-load, the manufacturer may need to provide special hardware and/or software in order to achieve **maximum speed** at no-load.*

5.103 *The tests are performed using all **tines** in accordance with 8.14.2 a) 103).*

6 Radiation, toxicity and similar hazards

IEC 62841-1:2014, Clause 6 is applicable.

7 Classification

IEC 62841-1:2014, Clause 7 is applicable, except as follows:

7.1 *Replacement:*

Machines shall be of one of the following classes with respect to protection against electric shock:

class II tool (machine) or **class III tool** (machine).

Compliance is checked by inspection and by the relevant tests.

7.2 *Addition:*

Class II tools (machines) shall be at least IPX4. **Class III tools** (machines) shall be at least IPX1.

8 Marking and instructions

IEC 62841-1:2014, Clause 8 is applicable, except as follows:

8.1.101 Machines with more than one motor (i.e. separate motors for the **tines** and **traction drive**) shall be marked with the **rated input** or **rated current** for each motor. These markings may be located on each motor.

Compliance is checked by inspection.

8.2 *Addition:*

Lawn scarifiers and **lawn aerators** shall be marked with the following safety warnings:

– "⚠ WARNING – Beware of thrown objects – keep bystanders away" or one of the product safety labels specified in Figure AA.1;

– "⚠ WARNING – Keep hands and feet away from the tines" or the product safety label specified in Figure AA.2.

For mains supplied machines:

– "⚠ WARNING – Remove plug from mains before maintenance or if cord is damaged" or one of the product safety labels specified in Figure AA.3;

– "⚠ WARNING – Keep the supply cord away from the tines" or the product safety label specified in Figure AA.4.

8.3 *Replacement of the sixth dashed list item:*

– "> 25 kg" if the mass of the machine is over 25 kg. For this requirement, the mass of the machine includes the mass of a **supply cord** with a length not less than 10 m, if any, in addition to the items specified in 5.17.

NOTE 101 In Europe (EN IEC 62841-4-7), the following requirement applies:

Replacement of the sixth dashed list item:

– the mass of the machine in kg. For this requirement, the mass of the machine includes the mass of a **supply cord** with a length not less than 10 m, if any, in addition to the items specified in 5.17.

8.9 *Replacement:*

Unless it is obviously unnecessary, switches and controls (e.g. a **tines** brake/clutch) which may give rise to a hazard when operated shall be marked or so placed as to indicate clearly which part of the machine they control.

Compliance is checked by inspection.

8.11 This subclause of IEC 62841-1:2014 is not applicable for traction drive speed controls.

8.14.1 *Addition:*

The additional safety instructions as specified in 8.14.1.101 shall be given. These additional safety instructions may be printed separately from the "General Machine Safety Warnings".

NOTE 101 "General Machine Safety Warnings" are referred to as "General Power Tool Safety Warnings" in IEC 62841-1:2014.

8.14.1.1 *Replacement for item 2) c) of IEC 62841-1:2014, 8.14.1.1:*

c) **Do not expose the machine to rain or wet conditions.** *Water entering the machine will increase the risk of electric shock.*

For machines classified at least IPX4, the warning in item c) above may be replaced as specified below.

c) **Do not operate the machine in rain or wet conditions.** *This may increase the risk of electric shock.*

8.14.1.101 Lawn scarifier and lawn aerator safety warnings

For the warnings below, the term "machine" may be replaced by alternate wording (e.g. "scarifier", "lawn rake", "aerator", "verticutter" or "lawn scarifier or aerator").

a) **Do not use the machine in bad weather conditions, especially when there is a risk of lightning**. *This decreases the risk of being struck by lightning.*

b) **Thoroughly inspect the area for wildlife where the machine is to be used.** *Wildlife may be injured by the machine during operation.*

c) **Thoroughly inspect the area where the machine is to be used and remove all stones, sticks, wires, bones, and other foreign objects.** *Thrown objects can cause personal injury.*

d) **Before using the machine, always visually inspect to see that the tines and the tines assembly are not worn or damaged.** *Worn or damaged parts increase the risk of injury.*

e) **Before use, check the supply cord and any extension cord for signs of damage or aging. Do not use the machine if the cord is damaged or worn. If the cord is damaged or worn during use, switch off the machine and do not touch the cord before disconnecting it from the supply.** *A damaged supply cord or extension cord may result in electric shock, fire and/or serious injury.*

f) **Check the catcher frequently for wear or deterioration.** *A worn or damaged catcher may increase the risk of personal injury.*

NOTE 101 It is possible to replace the term "catcher" by an alternative term such as "collector" or "bag".

NOTE 102 The warning in item f) above is omitted for machines that are not designed to be used with a **catcher**.

g) **Keep guards in place. Guards must be in working order and be properly mounted.** *A guard that is loose, damaged, or is not functioning correctly may result in personal injury.*

h) **Keep all cooling air inlets clear of debris.** *Blocked air inlets and debris may result in overheating or risk of fire.*

i) **While operating the machine, always wear non-slip and protective footwear. Do not operate the machine when barefoot or wearing open sandals.** *This reduces the chance of injury to the feet from contact with the moving tines.*

j) **While operating the machine, always wear long trousers.** *Exposed skin increases the likelihood of injury from thrown objects.*

k) **Do not operate the machine in wet grass. Walk, never run.** *This reduces the risk of slipping and falling which may result in personal injury.*

l) **Do not operate the machine on excessively steep slopes.** *This reduces the risk of loss of control, slipping and falling which may result in personal injury.*

m) **When working on slopes, always be sure of your footing, always work across the face of slopes, never up or down and exercise extreme caution when changing direction.** *This reduces the risk of loss of control, slipping and falling which may result in personal injury.*

n) **Use extreme caution when reversing or pulling the machine towards you. Always be aware of your surroundings**. *This reduces the risk of tripping during operation.*

o) **Keep the supply cord away from the tines.** *A damaged supply cord may result in electric shock, fire and/or serious injury.*

p) **Switch off and remove plug from mains if the cord is entangled or damaged.** *Entangled or damaged cords can increase the risk of electric shock.*

q) **Hold the machine by insulated gripping surfaces only, because the tines may contact hidden wiring or its own cord**. *Tines contacting a "live" wire may make exposed metal parts of the machine "live" and could give the operator an electric shock.*

r) **Do not touch tines and other hazardous moving parts while they are still in motion.** *This reduces the risk of injury from moving parts.*

s) **When clearing jammed material or cleaning the machine, make sure all power switches are off and the power cord is disconnected.** *Unexpected operation of the machine may result in serious personal injury.*

8.14.2 a) *Addition:*

101) Explanation of the safety devices that the **lawn scarifier** or **lawn aerator** incorporates as part of the original equipment;

102) Information regarding pre-operating procedures;

103) Information regarding the **tines** to be used on the **lawn scarifier** or **lawn aerator**;

104) Instructions on the permitted operating positions for handles.

8.14.2 b) *Addition:*

101) Hazards which may be encountered while using the **lawn scarifier** or **lawn aerator**, such as blockage of the **tines**, and how to avoid them while performing typical tasks;

102) Instructions to stop the **tines** if the machine has to be tilted for transportation when crossing surfaces other than grass and when transporting the machine to and from the area in which it is to be used;

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

104) For single-axle machines, instructions to maintain operating position and stability by properly grasping and supporting the handle;

105) Instructions to stop the machine, and remove plug from the socket, and to make sure that all moving parts have come to a complete stop

– after striking a foreign object, and to inspect the machine for damage and make repairs before restarting and operating the machine;

– if the machine starts to vibrate abnormally, and then to immediately inspect for damage, replace or repair any damaged parts and to check for and tighten any loose parts;

106) Recommendation for the use of a **residual current device** with a tripping current of 30 mA or less;

107) Instructions to empty the **catcher** before storage, if applicable.

8.14.2 c) *Addition:*

101) Information regarding regular maintenance routines;

102) Recommendations for cleaning and maintenance before storage;

103) Information explaining the consequences of improper maintenance, the use of non-conforming replacement components, or the removal or modification of safety components;

104) Instruction to replace worn or damaged components in sets to preserve balance, as applicable;

105) Instructions to be careful during adjustment of the machine to prevent entrapment of the fingers between moving **tines** and fixed parts of the machine;

106) Instructions to always allow the machine to cool down before storing;

107) Instructions regarding replacing or servicing **tines**;

108) For machines where the **tines** may be serviced by **user maintenance**, advice that when servicing the **tines** to be aware that, even though the power source is switched off, the **tines** can still be moved.

Replacement of NOTE:

NOTE In Europe (EN IEC 62841-4-7), the following additional requirements apply:

Emissions

1) The noise emission, measured in accordance with Clause I.2, as follows:

• A-weighted emission sound pressure level L_{pA} and its uncertainty K_{pA}, where L_{pA} exceeds 70 dB(A). Where L_{pA} does not exceed 70 dB(A), this fact shall be indicated;

• the A-weighted guaranteed sound power level L_{WA}.

2) Recommendation for the operator to wear hearing protection.

3) The vibration total value and its uncertainty measured in accordance with Clause I.3.

When the vibration total value does not exceed 2,5 m/s^2, this shall be stated.

When the vibration total value exceeds 2,5 m/s^2 , its value shall be given in the instructions.

4) The following information:

- that the declared vibration total value(s) and the declared noise emission value(s) have been measured in accordance with a standard test method and may be used for comparing one machine with another;

- that the declared vibration total value(s) and the declared noise emission value(s) may also be used in a preliminary assessment of exposure.

5) A warning:

- that the vibration and noise emissions during actual use of the machine can differ from the declared total value depending on the ways in which the machine is used; and

- of the need to identify safety measures to protect the operator that are based on an estimation of exposure in the actual conditions of use (taking account of all parts of the operating cycle such as the times when the machine is switched off and when it is running).

8.14.3 *Replacement:*

If information about the mass or weight of the machine is provided, it shall be the mass specified in 5.17 together with the mass of a **supply cord** with a length not less than 10 m, if any.

Compliance is checked by inspection.

9 Protection against access to live parts

IEC 62841-1:2014, Clause 9 is applicable.

10 Starting

IEC 62841-1:2014, Clause 10 is applicable, except as follows:

10.1 *Addition:*

*For the test, the **tines** are raised so that they are not in contact with any surface.*

10.2 *Addition:*

*For the test, the **tines** are raised so that they are not in contact with any surface.*

11 Input and current

IEC 62841-1:2014, Clause 11 is applicable.

12 Heating

IEC 62841-1:2014, Clause 12 is applicable, except as follows:

12.2.1 *Replacement:*

The load conditions for the heating test of 12.2 are as follows.

*The test is conducted with the machine mounted on an unperforated flat horizontal surface with the **tines** attached, and with the minimum size of openings for connection to the torque load. The **traction drive** wheels, if any, are lifted the minimum amount required to avoid contact with the unperforated flat horizontal surface. The **working position** is adjusted to the minimum position required to avoid contact with the unperforated flat horizontal surface. The **lawn scarifier** or **lawn aerator** is operated with a torque load applied such that **rated input** or **rated current** is drawn until thermal equilibrium is reached under the most unfavourable conditions. For machines with more than one motor (i.e. separate motors for the **tines** and **traction drive**), the **lawn scarifier** or **lawn aerator** is operated with torque loads such that **rated input** or **rated current** of each motor in accordance with 8.1.101 is drawn until thermal equilibrium is reached under the most unfavourable conditions.*

*The most unfavourable conditions are determined using the configuration of **attachments** and **tines** in accordance with 8.14.2, which yields the highest temperature at a reference location. This determination may be made at one of the required voltages of 12.2 using thermocouples.*

The reference location is chosen on the motor assembly at a location that minimises the cooling effect of air flow.

NOTE A measurement of the rotating speed of the **tines** during the heating test is needed in some cases for the test of 17.2.

13 Resistance to heat and fire

IEC 62841-1:2014, Clause 13 is applicable.

14 Moisture resistance

IEC 62841-1:2014, Clause 14 is applicable, except as follows:

14.2 *Replacement:*

The enclosure of the machine shall provide the degree of protection against moisture in accordance with the marking of the machine.

Compliance is checked by the appropriate treatment specified in 14.2.2, with the machine conditions as in 14.2.1.

14.2.1 *Replacement:*

The machine is not connected to the supply.

***Detachable parts** which can be removed without the aid of a tool are removed and subjected, if necessary, to the relevant treatment with the main part. Machines fitted with an appliance inlet, plug or other connector are tested without the mating connector in place. Air filters are not removed.*

14.2.2 *Replacement:*

Machines other than IPX0 are subjected to tests of IEC 60529, as follows:

– IPX1 machines are subjected to the test described in IEC 60529:1989, 14.2.1;

– IPX2 machines are subjected to the test described in IEC 60529:1989, 14.2.2;

– IPX3 machines are subjected to the test described in IEC 60529:1989, 14.2.3 a);

– IPX5 machines are subjected to the test described in IEC 60529:1989, 14.2.5. For this test, the water stream is applied from all practicable directions, including the underside of the machine;

– IPX6 machines are subjected to the test described in IEC 60529:1989, 14.2.6. For this test, the water stream is applied from all practicable directions, including the underside of the machine;

– IPX7 machines are subjected to the test described in IEC 60529:1989, 14.2.7. For this last test, the machine is immersed in water containing approximately 1,0 % NaCl.

Machines classified as IPX4 are subjected to the test described in 14.2.4 a) of IEC 60529:1989, except as follows:

– the test is conducted with a circular horizontal unperforated support having a diameter of twice the oscillating tube radius minus 15 cm. The support is placed at the level of the pivot axis of the oscillating tube. During the test, the support is rotated about its vertical axis at a rate of (1 ± 0,1) r/min; and

– the machine is placed on the unperforated support; and

*– the **working position** of the **lawn scarifier** or **lawn aerator** is set to the highest position at which the **tines** would still drive when the **operator presence control** is engaged. If this setting still allows the **tines** to make contact with the ground surface, the ground support system of the machine (e.g. wheels) are raised on support blocks to ensure ground clearance. The blocks are to be as small as is practicable; and*

– the horizontal centreline of the machine is aligned with the pivot axis of the oscillating tube at the start of test. The movement of the oscillating tube is limited to 90° either side from the vertical, the time for one complete oscillation (2 × 90°) being (6 ± 1) s; and

– the duration of the test is 10 min.

*Immediately after the appropriate treatment, the machine shall withstand the electric strength test of IEC 62841-1:2014, Annex D between **live parts** and **accessible parts**, the test voltage being 2 500 V. Afterwards, having carefully wiped the external enclosure to remove any surplus water, inspection shall show that there is no trace of water on insulation which could result in a reduction of **creepage distances** and **clearances** below the values specified in 28.1. Water drops on an appliance inlet, plug or other connector are not considered.*

The machine is then evaluated for

– the risk of fire in accordance with item a) of 18.6.1; and

*– the loss of any **SCF**, unless the machine is rendered into a safe state.*

14.3 to 14.5 These subclauses of IEC 62841-1:2014 are not applicable.

15 Resistance to rusting

IEC 62841-1:2014, Clause 15 is applicable.

16 Overload protection of transformers and associated circuits

IEC 62841-1:2014, Clause 16 is applicable.

17 Endurance

IEC 62841-1:2014, Clause 17 is applicable, except as follows:

17.2 *Replacement:*

The machine is operated at no-load. The machine is fitted with the most unfavourable ***tines*** *in accordance with 8.14.2 a) 103).*

Series motors are supplied at a voltage such that the rotating speed of the ***tines*** *is the same as that obtained in 12.2.1 at* ***rated voltage*** *or the lower limit of the* ***rated voltage range****. Other motor types are operated at* ***rated voltage*** *or the lower limit of the* ***rated voltage range****.*

The machine is operated for 48 h. If the test is conducted on the same sample used for the tests of Clause 12, the 48 h is reduced by the running time necessary for the tests of Clause 12. During the test, the machine is placed in its normal operating position according to 8.14.2.

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

The machine may be switched on and off by means of a switch other than that incorporated in the machine unless this disables a functionality of the machine switch.

During this test, replacement of the carbon brushes is allowed, and the machine is oiled and greased as in ***normal use****. If mechanical failure occurs and does not impair compliance with this document, the part that failed may be replaced.*

If the temperature rise of any part of the machine exceeds the temperature rise determined during the test of 12.1, forced cooling may be applied. If forced cooling is applied, it shall not alter the air flow of the machine or redistribute carbon deposits.

During these tests, overload protection devices incorporated in the machine shall not activate.

18 Abnormal operation

IEC 62841-1:2014, Clause 18 is applicable, except as follows:

18.5 *Replacement:*

Protection against electric shock shall not be impaired when a **class II tool** (machine) is subjected to overload conditions according to the type of motor.

For machines with

– motors having electronically commutated stator windings, compliance is checked by the test of 18.5.4;

– series motors, compliance is checked by the test of 18.5.1;

– other motors, compliance is checked by the test of 18.5.3.

18.5.2 This subclause of IEC 62841-1:2014 is not applicable.

18.8 *Replacement of Table 4:*

Table 4
Required performance levels

Type and purpose of SCF	Minimum Performance Level (PL)
Power switch (operator presence control) – prevent unwanted switch-on	b
Power switch (operator presence control) – provide desired switch-off	b
Provide desired direction of rotation of the **tines**	Not an **SCF**
Provide desired direction of rotation of the **traction drive**	a
Any electronic control to pass the test of 18.3	a
Service brake as in 19.101.2	b
Parking brake as in 19.101.3	b
Prevent exceeding 150 % of the **tines** stopping time as required in 19.104 b), if applicable,which is only applicable under any single fault condition (i.e. an abnormal condition) [a]	a
Limit the **tines** stopping time that does not exceed 150 % of that required in 19.104 b), if applicable, under any single fault condition (i.e. an abnormal condition) [a]	Not an **SCF**
Prevent increase of rotational speed of **tines** that would cause non-compliance with 19.105	a
Prevent increase of rotational speed of **tines** that would cause non-compliance with 20.101	a
Any other speed limiting device	Not an **SCF**
Lock-off function as required by 21.104.2	b
Visual or audible indicator as referenced in 21.104.2	Not an **SCF**
Traction drive control system as in 21.104.3.1	b
Prevent self-resetting as required in 23.3	a
[a] The **tines** stopping time shall still meet the requirements of 19.104 b), if applicable, under **normal operation**.	

19 Mechanical hazards

IEC 62841-1:2014, Clause 19 is applicable, except as follows:

19.1 *Replacement:*

All power-driven hazardous parts (e.g. drive belts), other than the **tines**, shall be so positioned or enclosed to provide adequate protection. The guarding of the **tines** is covered in 19.103. Ground contacting parts (e.g. wheels) are considered not to be hazardous and are not required to be guarded.

All openings and safety distances shall conform to 4.2.4.1 and 4.2.4.3 of ISO 13857:2019 unless otherwise specified in this document.

Protective enclosures, covers, **guards** and the like shall have adequate mechanical strength for their intended purpose.

Opening automatically closing **guards** for **discharge chutes** does not require the use of a tool.

The use of a **guard** shall not create other dangers, for example by reducing or obstructing the operator's view or by transferring heat.

Compliance is checked by inspection, by measurement, by functional test, by the tests of Clause 20 and by means of the test probe B of IEC 61032:1997 with a force not exceeding 5 N. Prior to the application of the test probe any soft materials (elastomers), such as soft grip coverings, shall be removed. It shall not be possible to touch power-driven hazardous parts with this test probe.

19.3 This subclause of IEC 62841-1:2014 is not applicable.

19.4 This subclause of IEC 62841-1:2014 is not applicable.

NOTE 101 Requirements for handles are given in 19.102.

19.5 This subclause of IEC 62841-1:2014 is not applicable.

19.6 This subclause of IEC 62841-1:2014 is not applicable.

19.7 *Replacement:*

Lawn scarifiers and **lawn aerators** shall have adequate stability.

This requirement is not applicable for single-axle machines.

Compliance is checked by the following test.

*For **lawn scarifiers** or **lawn aerators** provided with an appliance inlet or a **supply cord** with a length between 0,2 m and 0,5 m, a mass of (500 ± 20) g is suspended from either*

– the appliance inlet; or

*– the **supply cord** plug; or*

*– any **supply cord** retaining device in accordance with 8.14.2*

whichever is the most unfavourable.

*For **lawn scarifiers** or **lawn aerators** provided with a **supply cord** with a length not less than 10 m, the **supply cord** is placed resting on the inclined plane used for this test in the most unfavourable position.*

The machine is placed with the motor switched off in any normal position of use on a plane inclined at an angle of 10° to the horizontal. If, however, the machine is such that, were it to be tilted through an angle of 10° when standing on a horizontal plane, a part of it not normally in contact with the supporting surface would touch the horizontal plane, the machine is placed on a horizontal support and tilted in the most unfavourable direction through an angle of 10°. For the test, the machine is prevented from sliding.

The machine shall not tip over or, if the machine tips over, the requirements for single-axle machines shall be fulfilled.

19.8 This subclause of IEC 62841-1:2014 is not applicable.

19.101 Brake requirements and test method

19.101.1 General

A **lawn scarifier** or **lawn aerator** exceeding a mass of 78 kg shall be equipped with a **service brake** and a **parking brake**.

Machines requiring a **service brake** and a **parking brake** shall fulfil the requirements of 19.101.2 and 19.101.3.

If steering-assist brakes are also used for the **service brake**, it shall be possible to connect them in a way that they apply both brakes with equal force.

Compliance is checked by inspection and by the requirements of 19.101.2 and 19.101.3.

19.101.2 Service brake

The **service brake** shall meet all of the following requirements:

– the **service brake** performance shall only rely on the effectiveness of the braking system;

– the **service brake** control shall be hand-operated;

– the **service brake control device** shall be located within the **operator control** zone (see Figure 102) and its position shall not interfere with the position of other controls; and

– if the **lawn scarifier** or **lawn aerator** is equipped with combined traction clutch and brake controls, the **service brake** engagement shall simultaneously disengage the traction clutch.

NOTE 101 Examples of **service brakes** include mechanical, electric and hydrostatic means.

Compliance is checked by inspection and by manual test.

The **service brake** shall be capable of stopping the motion of the **lawn scarifier** or **lawn aerator** so that the average measured stopping distance does not exceed 0,19 m for each 1 km/h of the maximum forward speed and maximum reverse speed, if a reverse **traction drive** is provided.

Compliance is checked by the following test.

*The tests are conducted on a **lawn scarifier** or **lawn aerator** in its heaviest configuration in accordance with 8.14.2 and with*

*– pneumatic tyres, if any, inflated to the maximum recommended pressures for the **lawn scarifier** or **lawn aerator** in accordance with 8.14.2; and*

– brakes adjusted in accordance with 8.14.2; and

*– any **catcher** filled to its maximum volumetric capacity with material of density (150 ± 10) kg/m^3. As an alternative to filling the **catcher** to its maximum volumetric capacity with a material of (150 ± 10) kg/m^3 density, an equivalent mass may be positioned and secured inside the **catcher** at its volumetric centre of gravity.*

The tests shall be conducted on a dry, smooth, hard concrete (or equivalent) surface with a maximum slope of 1 %.

*The **service brake** is first conditioned by running the **lawn scarifier** or **lawn aerator** for 10 min during which 10 stops shall be performed from the maximum forward speed.*

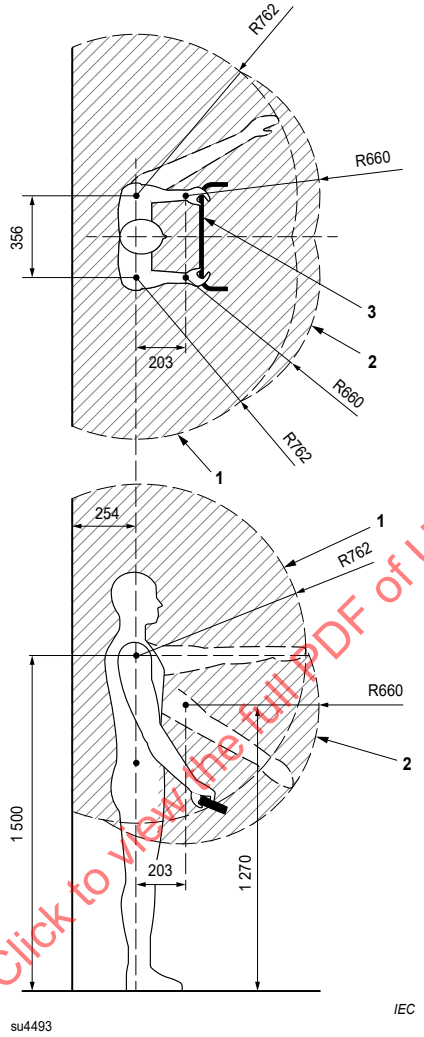
*If a reverse **traction drive** is provided, this break-in period shall be extended to 20 min during which the **service brake** shall be applied to stop the machine 10 times from maximum forward speed, and 10 times from maximum reverse speed.*

*If the **lawn scarifier** or **lawn aerator** is equipped with separate **traction drive** and **service brake** controls, the **traction drive** is simultaneously disengaged with the **service brake** engagement.*

*After the conditioning procedure has been completed, the **service brake** test is conducted three times in the forward direction of travel and, for a **lawn scarifier** or **lawn aerator** with a reverse **traction drive**, repeated three times in the reverse direction of travel.*

*With the **lawn scarifier** or **lawn aerator** operating at its maximum ground speed, the **traction drive** control is released and a maximum force of 220 N is applied to the centre of the grip area of the hand control for the **service brake**. The stopping distance is measured for each test and the average value is calculated for each direction tested.*

Dimensions in millimetres



Key

1 zone 1 – **operator control** zone

2 zone 2 – **operator control** zone when leaning against handle

3 handle

NOTE 101 Zone 1 is the area into which the extremities of a 95th percentile male can reach from the normal operator position.

NOTE 102 Zone 2 is the area into which a 5th percentile male or a 50th percentile female can reach when leaning against the handle. This zone can also be reached by a 95th percentile female leaning forward against the handle.

NOTE 103 All handles within zone 1 will reduce the zone by the space occupied and protected by the handle.

NOTE 104 Zone 1 includes the maximum range of movement of all frequently used **operator controls** but is not intended to represent preferred **operator control** positions.

Figure 102

Operator control zones

19.101.3 Parking brake

A **lawn scarifier** or **lawn aerator** required to be equipped with a **service brake** shall also be equipped with a **parking brake**. The **parking brake** shall be capable of holding the **lawn scarifier** or **lawn aerator** facing both uphill and downhill on a slope up to and including 16,7° (30 %).

To allow the removal of initial slack in the system, a distance of 50 mm movement is allowed during the first 30 s after the **parking brake** has been applied. There shall be no further movement after the 30 s.

The **parking brake** may be combined with the **service brake**.

The engagement of the **parking brake** shall not rely on the machine being connected to the supply.

The maximum force to actuate the **parking brake** shall not exceed

– 220 N for a hand-grip **parking brake**, actuated by hand gripping motion only; or

– 330 N for a hand-lever **parking brake**, actuated by arm motion with a hand on a lever; or

– 450 N for a foot-operated **parking brake**.

The unlocking force shall not exceed the maximum specified actuating force.

NOTE The forces 220 N, 330 N and 450 N are considered as maximum forces that can be applied to meet the test requirements of this subclause. The operating forces during **normal use** would in general be less.

If the **lawn scarifier** or **lawn aerator** is equipped with an automatic **parking brake**, it shall be activated when the **operator presence control** is released.

Compliance is checked by inspection, by measurement and by the following test.

The tests are conducted

– on the same sample and under the same conditions as in 19.101.2, if applicable;

– with the transmission in neutral and the motor stopped;

– if so equipped, with the hydrostatic bypass valve in the normal position for scarifying or aerating;

*– on a smooth flat surface with 16,7° (30 %) slope, and a coefficient of friction such that the **lawn scarifier** or **lawn aerator** does not slide down the slope;*

*– with the **parking brake** applied; and*

*– for a period of 5 min, or if the **parking brake** is hydrostatic, for a period of 60 min.*

19.102 Handles

19.102.1 Handle construction

The handle(s) of **lawn scarifiers** and **lawn aerators** shall be fastened to the machine so as to prevent loss of control by unintentional uncoupling from the machine while in operation.

Compliance is checked by inspection.

19.102.2 Handle latches and handle length

19.102.2.1 The handle shall either

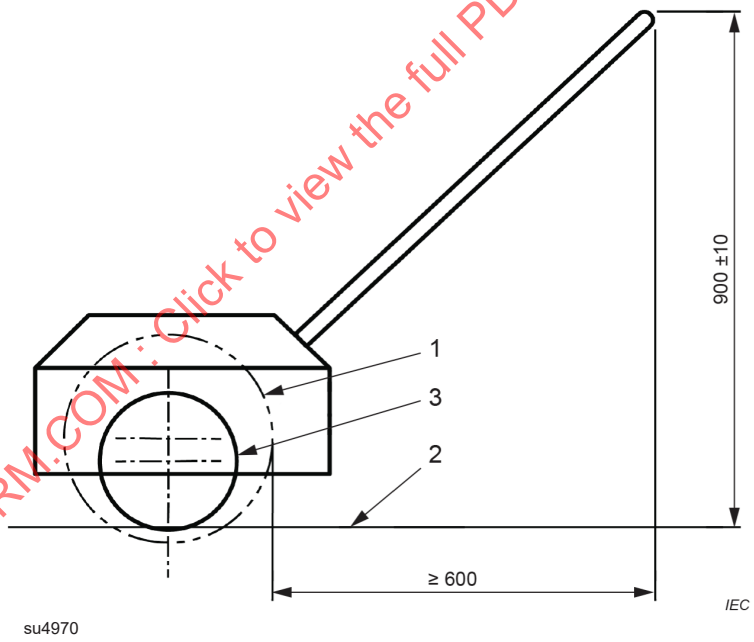
– have, for a single-axle machine a horizontal distance of at least 600 mm from the rear part of the handle to the vertical tangent of the **tines tip circle,** when the top of the grasping area of the handle is at a height of (900 ± 10) mm above the ground (see Figure 103), or the requirements of the foot protection test of Annex CC shall be fulfilled; or

– have, for machines other than single-axle machines, a horizontal distance of at least 450 mm from the rear part of the handle to the vertical tangent of the **tines tip circle**, which serves as a barrier between the operator and the **tines** (see Figure 104) or the requirements of the foot protection test of Annex CC shall be fulfilled.

Compliance is checked by measurement and, if applicable, by the foot protection test of Annex CC.

*The foot probe shall not contact the **tines**.*

Dimensions in millimetres



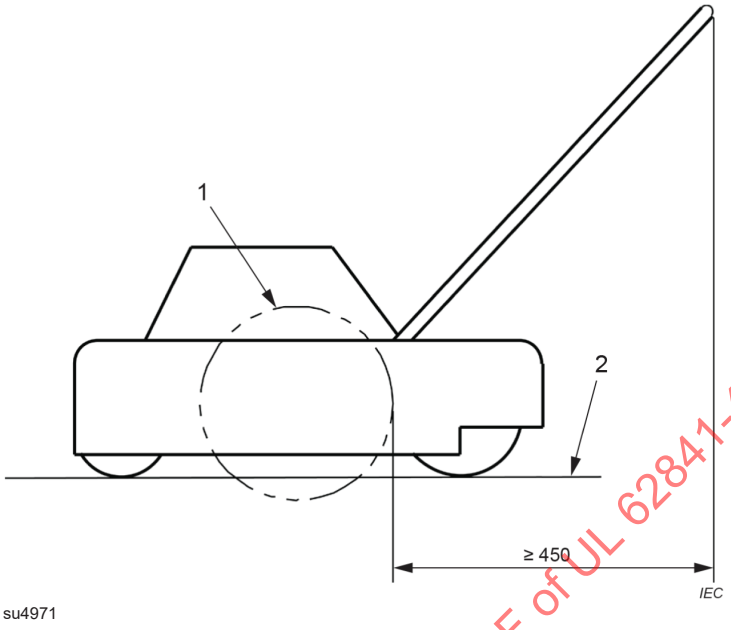
Key

1 **tines tip circle**
2 ground level
3 wheel

Figure 103

Safety distances – single-axle machines

Dimensions in millimetres



Key

1 **tines tip circle**

2 ground level

Figure 104

Handle distance – machines with more than one axle

19.102.2.2 For single-axle machines, there shall be positive means (e.g. latch or upper stop) which cannot be unintentionally disengaged during **normal operation** of the **lawn scarifier** or **lawn aerator**, to prevent the dimension in Figure 103 from becoming less than 600 mm.

Compliance is checked by inspection and by measurement.

19.102.2.3 For machines with more than one axle, there shall be positive means (e.g. latch or upper stop) which cannot be unintentionally disengaged during **normal operation** of the **lawn scarifier** or **lawn aerator**, to prevent the dimension in Figure 104 from becoming less than 450 mm.

Compliance is checked by inspection and by measurement.

19.102.3 Pivoting

A pivoting handle, if any, which has a temporary storage position (park position), usually just forward of the vertical, shall be equipped with a means to either manually or automatically lock the handle back into an operating position.

Compliance is checked by inspection.

19.103 Tines enclosure

19.103.1 **Tines** shall be guarded.

The **tines enclosure** shall have adequate mechanical strength for its intended purpose. It shall not be removable without the use of tools and withstand a force of 75 N in any direction.

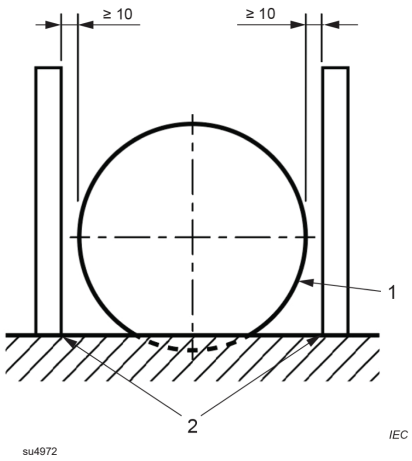
Compliance is checked by inspection and by manual test.

19.103.2 It shall not be possible for any part of the rod specified below to approach closer than 10 mm to any point on the **tines**, with or without the **catcher** attached (see Figure 105).

Compliance is checked by measurement and by the following test.

*A rod, (50 ± 1) mm diameter and 500 mm long minimum, is placed on the supporting surface with its axis vertical and is moved towards the **tines** until stopped by a part of the **lawn scarifier** or **lawn aerator**.*

Dimensions in millimetres



Key

1 **tines**

2 test rod

Figure 105

Guarding of lawn scarifier and lawn aerator tines, general

19.103.3 **Tines** shall be covered at the sides with **guards** which extend as specified in a) through c) below.

a) From the middle of the **tines** to the rear of the machine, parallel to the ground, the maximum distance from the lower **guard** edge to the ground shall be the maximum penetration depth (*a*) plus 25 mm.

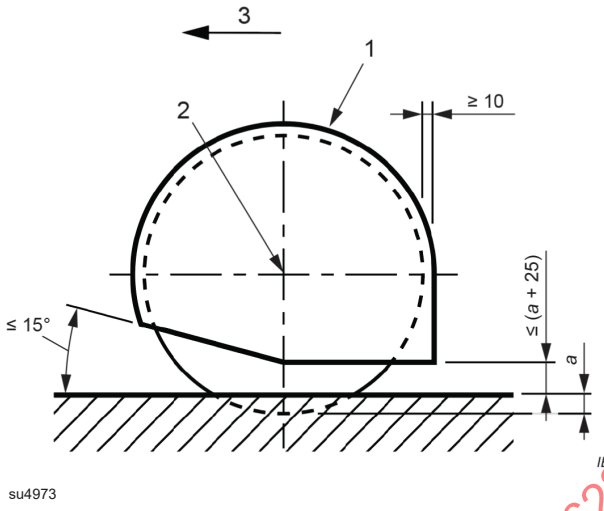
b) There shall be a radial clearance of at least 10 mm between the inner surface of the **guard** and the **tines tip circle**.

c) From the middle of the **tines** to the front of the machine, the coverage of the **guard** may be reduced by a maximum of 15°.

See Figure 106.

Compliance is checked by inspection and by measurement.

Dimensions in millimetres



Key

1 minimum **guard** contour

2 centre of rotation of the **tines**

3 direction of travel

a maximum penetration depth of the **tines**

Figure 106

Guarding of lawn scarifier and lawn aerator tines, side coverage

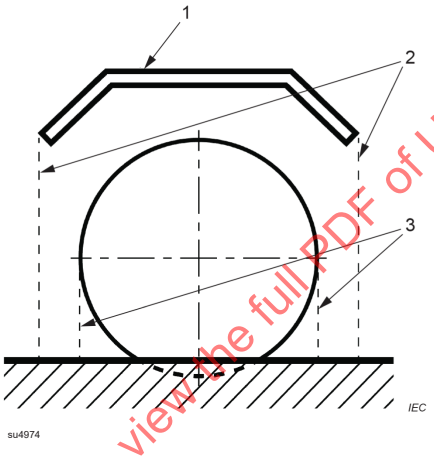
19.103.4 For machines with a **rear discharge opening**, the **tines assembly** shall be covered from above by a **guard**. The vertical projection of the **guard** onto the supporting surface shall be at least as large, in all directions, as the vertical projection of the **tines**, when any **catcher** has been removed (see Figure 107).

When the **catcher** is not fitted to the machine, the **tines assembly** shall either

– be covered from the rear with a self-closing **guard** that extends so that its projection on the vertical plane covers from the top of the **tines** to not more than 25 mm from the supporting surface (see Figure 108); or

– comply with the foot protection test of Annex CC.

Compliance is checked by inspection, by measurement and if applicable, by the foot protection test of Annex CC.



Key

1 **guard**

2 vertical projection of **guard**

3 vertical projection of **tines**

NOTE 101 The distance between 2 and 3 is considered to be greater than 0.

Figure 107

Guarding of lawn scarifier and lawn aerator tines, rear discharge

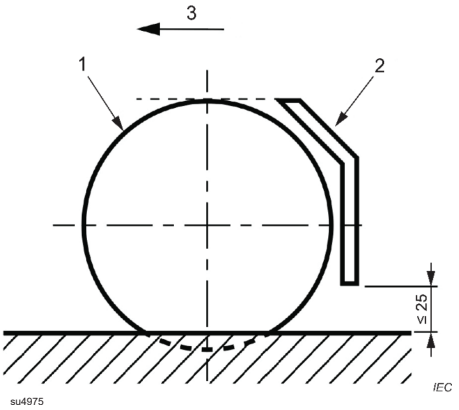
19.103.5 For machines with a **front discharge opening**, the **tines assembly** shall either

– be covered from the rear with a **guard** that extends so that its projection on the vertical plane covers from the top of the **tines** to not more than 25 mm from the supporting surface (see Figure 108); or

– comply with the foot protection test of Annex CC.

Compliance is checked by inspection, by measurement and if applicable, by the foot protection test of Annex CC.

Dimensions in millimetres



Key

1 **tines**

2 **guard**

3 direction of travel

Figure 108

Guarding of lawn scarifier and lawn aerator tines, front discharge

19.104 Foot protection for tines in a transport position

Lawn scarifiers and **lawn aerators** that have a designated position that raises the **tines** such that they are not in contact with the ground, in accordance with 8.14.2 b) (i.e. a transport position), shall be provided with a means to prevent unintentional contact with the rotating **tines**. This shall be achieved by one of the following options a) through c):

a) it shall not be possible to raise the **tines** into a transport position unless the **tines** are stopped and it shall not be possible to engage the drive to the **tines** when the machine is in the transport position (i.e. the **tines** are not in contact with the ground); or

b) the **tines** shall stop within 3 s of the **operator presence control** being released whilst the machine is in the transport position; or

c) the machine shall comply with the foot protection test of Annex CC whilst the machine is in the transport position.

Compliance is checked for a) by inspection and by manual test, for b) by measurement in accordance with Annex DD and for c) by the foot protection test of Annex CC.

19.105 Thrown objects

19.105.1 The **tines enclosure**, **guards**, trailing shields (if any) and **catchers** (if any) shall be designed and constructed in such a way as to minimize the risk of injury from thrown objects in **normal use**.

There shall not be more than five hits in the target panel between the lower edge of the target panel and the 450 mm line (lower zone). There shall be no hits above the 450 mm line (higher zone).

Compliance is checked by the tests of 19.105.2 to 19.105.6.

19.105.2 General test requirements

The tests are performed at an ambient temperature of (25 ± 10) °C.

*The **lawn scarifier** or **lawn aerator** is tested at **maximum speed** in all operational configurations in accordance with 8.14.2, e.g. with and without **attachments** such as **catchers**.*

*Each test is carried out on a **lawn scarifier** or **lawn aerator** equipped with a new **tines assembly**.*

NOTE 101 It is possible that the tests of 19.105.4 and 19.105.6, if applicable, could subject the operator or bystanders to impacts by thrown objects.

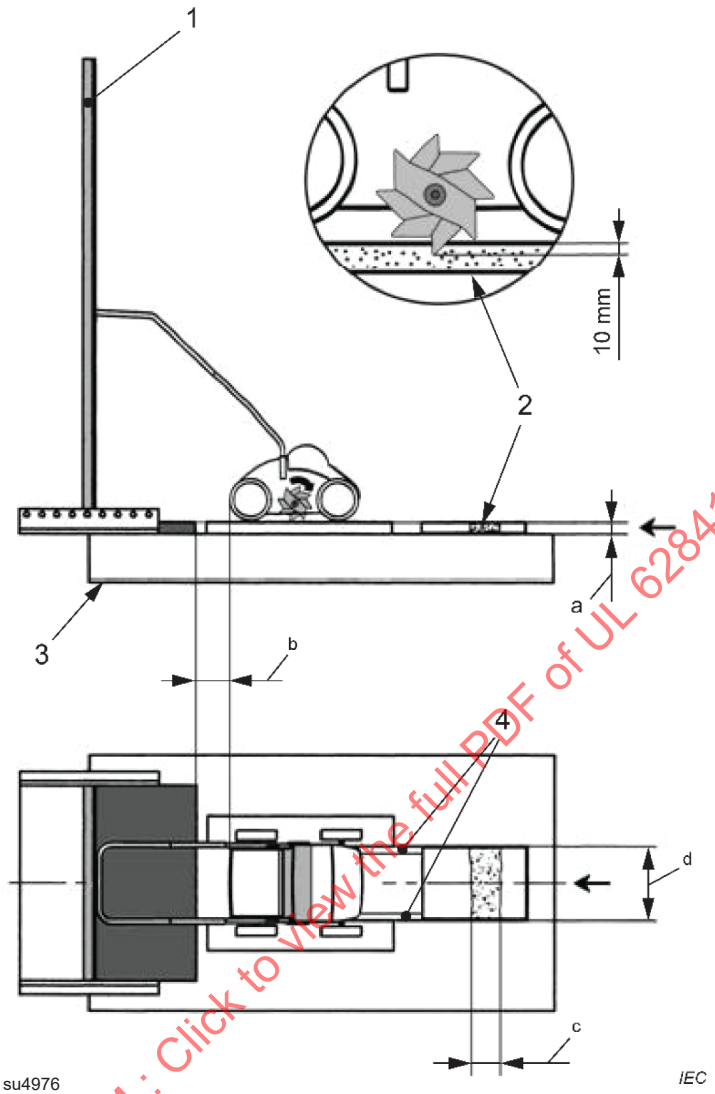
19.105.3 Test equipment

*The **lawn scarifier** or **lawn aerator** is tested on a test installation as shown in Figure 109.*

*The tray consists of a rigid waterproof material (e.g. plastics) and the bottom of the inside of the tray has a coarse surface to avoid movement of the sand-gravel mixture when the tray moves towards the machine. The width of the tray is at least equal to the **cutting width**.*

A uniform sand-gravel mixture is made up by volume of 1/2 building sand and 1/2 smooth gravel (pebbles) of grain size (12 ± 4) mm. The mixture is dampened just sufficiently to ensure that the mixture does not separate during the test. It is kept damp during the test(s).

A single thickness of kraft paper 1 000 mm wide × 2 000 mm high with a nominal 225 g/m^2 construction, according to ISO 2758:2014, is affixed to a frame and used as a target panel for the operator area. The panel is placed behind and in contact with the end of the handle and perpendicular to the base. The lower edge of the target panel is at the height of the wheel's supporting surface. The target panel is divided by a horizontal line into a lower zone which reaches up to 450 mm from the lower edge and a higher zone which is above 450 mm.



Key

1 target panel for the operator area 1 000 mm wide × 2 000 mm high. Material: Kraft paper 225 g/m^2

2 tray with a mixture of sand and gravel (50:50)

3 base (supporting frame)

4 frame (loose)

a (18 ± 1) mm

b minimal distance

c diameter of the **tines tip circle** + 10 mm

d at least equal to the **cutting width**

Figure 109

Thrown object test rig for rear discharge lawn scarifiers and lawn aerators

19.105.4 Test method

*The handle(s) of the **lawn scarifier** or **lawn aerator** is set such that the horizontal distance from the rear of the handle(s) to the **tines assembly** is a minimum. For a single-axle **lawn scarifier** or **lawn aerator** the height of the handle grasping surface(s) is fixed at (900 ± 10) mm above the wheel supporting surface.*

The sand-gravel mixture is placed in the drawer and is lightly compressed and flattened to a height of (18 ± 1) mm.

*The wheels of the **lawn scarifier** or **lawn aerator** are restrained on supporting cover plates. In this position the **tines** are set to penetrate the surface of the sand-gravel mixture to a depth of 10 mm or at the next deepest setting. For a single-axle **lawn scarifier** or **lawn aerator** the machine ground supports may be lowered to achieve (10 ± 1) mm penetration.*

*The sand-gravel mixture in the drawer is moved once from the front towards the rear of the **lawn scarifier** or **lawn aerator** into the rotating **tines** for a distance equal to the diameter of the **tines tip circle**. The speed of movement of the drawer is (1 ± 0,5) m/s.*

The distance "b" in Figure 109 between the base of the target panel and the rear of the machine is necessary to allow the tray to fully move underneath the length of the machine deck. The settings of the machine shall allow this distance to be minimal.

19.105.5 Test results

All holes in the target panel are evaluated in order to determine if they are regarded as a hit. A nominal 10 mm diameter steel ball (as used for ball bearings) is applied with a force of (3 ± 0,3) N perpendicular to the target panel material. If the steel ball passes through the target panel, it is recorded as a hit.

19.105.6 Additional testing

*In the event of a failure, two additional tests are conducted. These additional tests are either carried out on the existing **lawn scarifier** or **lawn aerator** or on new identical machines. New sand-gravel mixture is used for each test.*

If either of the additional tests is failed, the machine has failed the test.

20 Mechanical strength

IEC 62841-1:2014, Clause 20 is applicable, except as follows:

20.3 *Replacement:*

*For **lawn scarifier** and **lawn aerators**, the test of 20.3.2 applies.*

20.3.2 *Addition:*

The test is carried out with the machine resting on a smooth horizontal concrete surface. During the test, the machine is not restrained or placed against any other supporting structure.

20.5 This subclause of IEC 62841-1:2014 is not applicable.

20.101 **Tines** and their mountings shall have adequate strength to withstand impact with solid objects.

Compliance is checked by the following test.

NOTE 101 It is possible that the following test could subject the operator or bystanders to impacts by thrown objects.

*The test is carried out at **maximum speed** at no load. The test is carried out on all **tines assemblies** as identified in 8.14.2.*

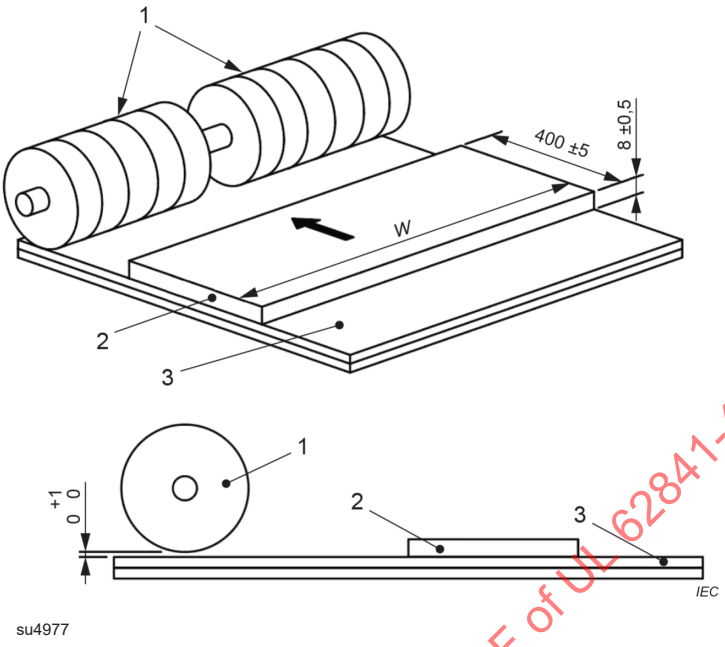
*The **lawn scarifier** or **lawn aerator** is placed on the flat, horizontal surface of a carriage, see Figure 110. The handle(s) of the machine is restrained elastically. Single-axle machines are positioned so that the height of the handle grasping surface(s) is fixed at (900 ± 10) mm above the wheel supporting surface.*

*The **working position** is adjusted such that there is a clearance of $0{,}0^{+1}_{-0}$ mm between the **tines tip circle** and the flat, horizontal surface of the carriage, see Figure 110. The mounting of the machine shall allow for an upward movement of the machine.*

*A steel plate, (8,0 ± 0,5) mm thick, (400 ± 5) mm long and wide enough to contact all of the **tines** of the **tines assemblies** at one pass, is mounted on the upper surface of the carriage so that it is located at the **tines tip circle**, see Figure 110. The carriage is pulled centrally under the **tines assembly** from the front of the machine toward the rear. The speed of the pull is 0,75 m/s to 1 m/s. The test is then repeated with the carriage pulled under the **tines assembly** from the rear of the machine towards the front.*

*During the test, no complete **tines** or parts thereof shall break off and there shall be no visible cracks. Chipping of **tines** or breakage of parts intended to break such as shearing pins shall not be considered a failure. The **tines** need not be suitable for further use after the test. Ejection of small chips of machine parts not exceeding 2 g are ignored.*

Dimensions in millimetres



Key

1 **tines assembly**

2 steel plate

3 upper surface of the carriage

W dimension of steel plate sufficient to make contact with the tines over the full width of the tines assembly

Figure 110

Strength of tines assembly

21 Construction

IEC 62841-1:2014, Clause 21 is applicable, except as follows:

21.17 *Replacement:*

Lawn scarifiers and **lawn aerators** shall be fitted with a **power switch** to control the motor. The actuating member of this switch shall be easily visible and accessible. This requirement may be fulfilled by an **operator presence control** as specified in 21.104.2.

Compliance is checked by inspection.

21.18 *Replacement:*

Additional requirements for **power switches** are given in 21.104.2.

21.30 *Replacement:*

Handle shafts shall be

– of insulating material; or

– if not of insulating material,

- covered with insulating material having a thickness of at least 1 mm which extends for a distance of 150 mm from handles and handle mounted **operator controls**; and

- electrically isolated by material equivalent to **supplementary insulation** from other conductive **accessible parts** which are within 75 mm of the ground measured as a clearance or from conductive **accessible parts** connected to such parts.

Handles and **operator controls** which are held when operating the machine shall be insulated from the **tines assembly** and other parts that may become live in the event of contact with live wires.

Compliance is checked by inspection, by measurement and by the following test.

An electric strength test according to Clause D.2 using 1 250 V a.c. is made between

*– conductive parts of the **tines assembly** and all other conductive parts of the **lawn scarifier** or **lawn aerator**, except for handle shafts and their fixings, within 200 mm from the supporting surface when the **lawn scarifier** or **lawn aerator** is positioned for **normal use** and set for the lowest level of **working position**, and*

*– metal foil wrapped around the handle, **operator controls** and other controls located in the **operator control** zone defined in Figure 102.*

*If passing this test relies upon an insulating covering on metal parts of handles or **operator controls**, these parts are conditioned as follows prior to the test:*

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

Inspection shall show that

– the covering has not shrunk to cause non-compliance with the insulation dimensional requirements; or

– the required insulation is no longer given; or

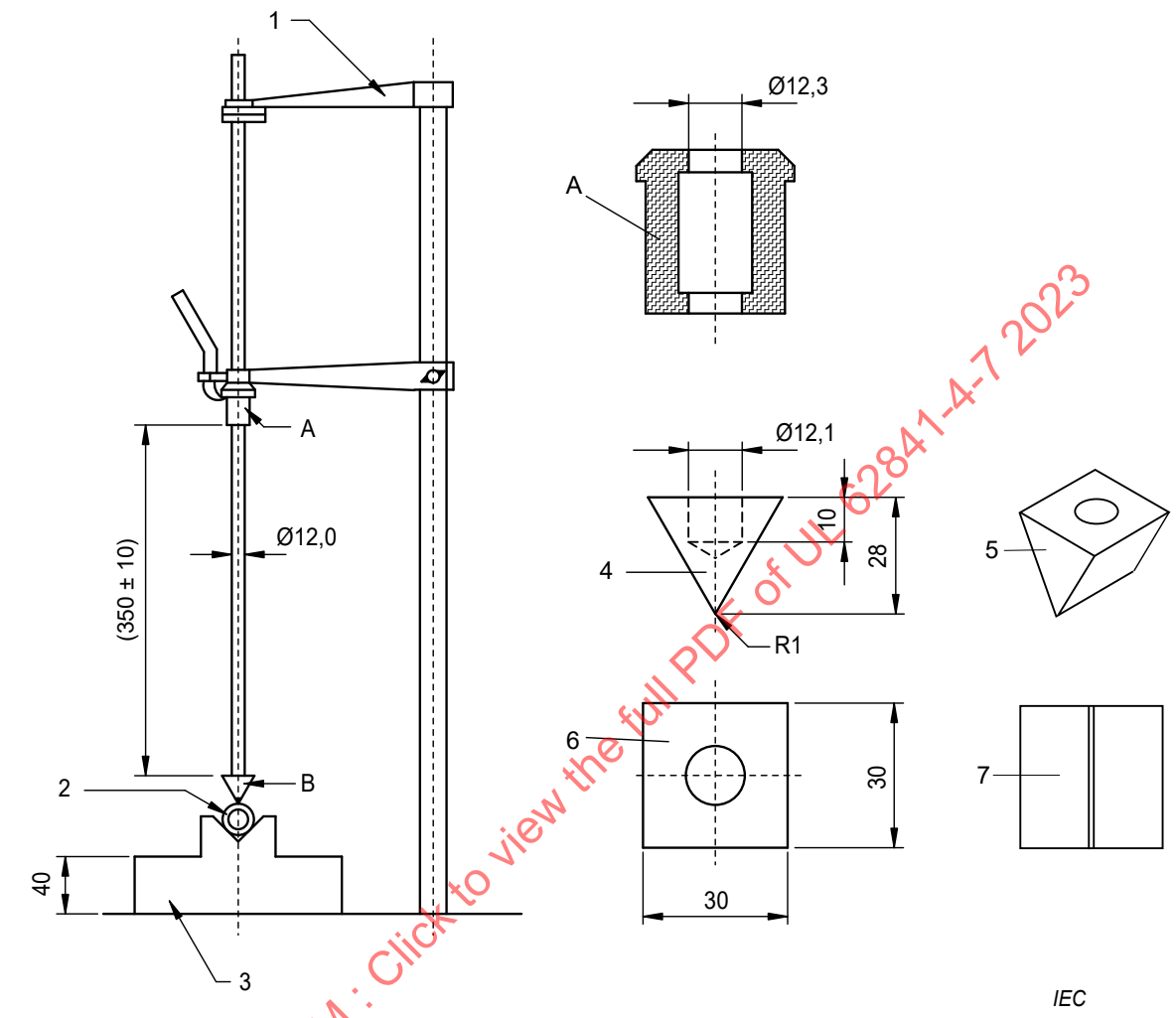
– the covering has not peeled off and that it may move longitudinally.

After this, the sample is conditioned by maintaining it for at least 4 h at a temperature of (−10 ± 2) °C.

Immediately following the conditioning at (−10 ± 2) °C, the sample is then subjected to impact by means of the apparatus shown in Figure 111. The weight A having a mass of (300 ± 5) g falls from a height of (350 ± 10) mm onto the chisel B of hardened steel, the edge of which is placed on the sample.

*One impact is applied to each place where the covering is likely to be weak or damaged in **normal use**, the distance between the points of impact being at least 10 mm. After this test, inspection shall show that the covering has not peeled off.*

Dimensions in millimetres



Key

A weight with mass of (300 ± 5) g
B chisel made of hardened steel
1 fixing arm
2 sample
3 base having a mass of at least 10 kg
4 chisel detail
5 chisel isometric view
6 chisel plan view
7 chisel bottom view

Figure 111

Impact test fixture for handle insulation

21.35 Dust collection

This subclause of IEC 62841-1:2014 is not applicable.

21.101 Any drain holes provided to prevent accumulation of water in an enclosure shall be at least 5 mm in diameter or 20 mm^2 in area with a width of at least 3 mm.

Compliance is checked by inspection and by measurement.

21.102 Machines shall be provided with a means such that damage to the **supply cord** due to movement of the machine is prevented as far as possible. The means provided shall be re-usable.

This requirement may be fulfilled by

– a **supply cord** retaining device to keep the **supply cord** out of the vicinity of the **tines**, to which the cable may be adequately fastened; or

– the **supply cord** entry or attachment being at least 0,6 m from the nearest point of the **tines**.

Compliance is checked by inspection and by measurement.

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

This requirement may be fulfilled if the air filter

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

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

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

Compliance is checked by inspection.

21.104 Controls

21.104.1 Location

The location of **operator controls** which require sustained activation shall be within the gripping area of the handle(s).

The lock-off device specified in 21.104.2 shall be located

– in zone 1 as shown in Figure 102; and

– within 600 mm from the top of the **lawn scarifier** or **lawn aerator** handle(s).

The location of **operator controls** that do not require sustained activation but that might be operated during lawn scarifying or aerating shall be within zone 1 or zone 2 as shown in Figure 102.

A manually operated **parking brake**, if any, shall be operable within zone 1 or zone 2.

NOTE 101 The **operator control** zones defined in Figure 102 include the maximum movement range of the controls but are not intended to represent preferred **operator control** positions.

For the purpose of 21.104.1, the following shall not be considered as controls that are operated during lawn scarifying or aerating:

– **working position**;

– **discharge opening** to the **catcher**; or

– control for a transport position in accordance with 19.104.

Compliance is checked by inspection and by measurement.

21.104.2 Operator presence control

Machines shall be fitted with an **operator presence control** on the handle, which automatically stops **tines** rotation when the operator's hand(s) is removed from the **operator presence control**. This may be accomplished, for example, by stopping the drive motor or by an intermediate **tines** brake/clutch mechanism. If the **operator presence control** operates by electrical means, the **operator presence control** is considered to be a **power switch**.

For restarting **tines** rotation, the control shall require a lock-off device such that two separate and dissimilar actions are necessary before drive to the **tines** is restarted (e.g. an actuator which has to be pushed in before it can be moved laterally to close the contacts to start the motor). It shall not be possible to achieve these two actions with a single grasping motion or a straight line motion. The lock-off device shall fulfil the requirements of 21.17.1.

The two separate and dissimilar actions before drive to the **tines** is restarted may be omitted for up to 10 s if

– the **operator presence control** is reactivated within 10 s after being released; and

– there is a visual or audible indication as soon as the **operator presence control** is released and continues at least until the **operator presence control** is reactivated or until the machine returns to its original locked state (i.e. at least two separate and dissimilar actions are required before drive to the **tines** is possible).

If the **operator presence control** is not reactivated within 10 s after being released, the machine shall return to its original locked state.

It shall not be necessary to sustain the actuation of the lock-off device until the **power switch** is activated, provided

– the **operator presence control** is activated within 5 s of the release of the lock-off device; and

– there is a visual or audible indication as soon as the lock-off actuator is released and continues at least until the **operator presence control** is activated or until the machine returns to its original locked state.

NOTE 101 The visual or audible indication is intended to only indicate the state of the machine.

Compliance is checked by inspection.

21.104.3 Traction drive control

21.104.3.1 Machines shall be fitted with a device on the handle which will automatically stop the **traction drive**, if any, when the operator's hand(s) is removed from the handle. This may be fulfilled in combination with the **operator presence control** specified in 21.104.2.

The **traction drive** may be started by a single action.

Compliance is checked by inspection and by measurement.

21.104.3.2 The **traction drive** control system shall be sufficiently durable.

*Compliance is checked by cycling the **traction drive** control system "on" and "off" for 10 000 operations. After the test, the **traction drive** control system shall comply with 21.104.3.1.*

22 Internal wiring

IEC 62841-1:2014, Clause 22 is applicable.

23 Components

IEC 62841-1:2014, Clause 23 is applicable, except as follows:

23.1.10 *Replacement:*

Switches shall be so constructed that there will be no failure that might impair compliance with this document.

Compliance is checked by the following.

Switches, if separately tested and found to comply with IEC 61058-1:2016 or IEC 61058-2-6:2018, shall meet the requirements specified in 23.1.10.1.

Switches which have not been separately tested and found to comply with IEC 61058-1:2016 or IEC 61058-2-6:2018 or do not meet the requirements of 23.1.10.1, are tested in accordance with 23.1.10.2 to 23.1.10.3.

23.1.10.1 *Replacement:*

Switches shall be rated and classified as follows.

Power switches shall be rated as follows:

– for a voltage not less than the **rated voltage** of the machine;

– for a current not less than the **rated current** of the machine;

– for a.c., if the machine is rated for a.c.;

– for d.c., if the machine is rated for d.c.

Electronic **power switches** shall, as a minimum, be classified for Continuous Duty in accordance with IEC 61058-1:2016 or IEC 61058-2-6:2018.

Power switches shall further be classified with respect to load:

– switches for motor-operated **lawn and garden machinery**: for resistive and motor load in accordance with IEC 61058-1:2016, 7.2.2 or with IEC 61058-2-6:2018, 7.2.2, if the switch would encounter this load in **normal use**;

– switches for magnetically driven **lawn and garden machinery**: for inductive load in accordance with IEC 61058-1:2016, 7.2.8 or with IEC 61058-2-6:2018, 7.2.8, if the switch would encounter this load in **normal use**;

– alternatively, switches may be regarded as switches for a declared specific load in accordance with IEC 61058-1:2016, 7.2.5 or with IEC 61058-2-6:2018, 7.2.5 and may be classified based upon the load conditions encountered in the machine in **normal use**.

Ratings and load classifications for switches other than **power switches** shall be based on the conditions encountered in the machine.

Switches shall further be classified as follows with respect to endurance:

– **power switches** (**operator presence control**) for **lawn scarifiers** and **lawn aerators**: 5 000 operating cycles, applied at the **power switch** (**operator presence control**) actuator;

– electromechanical switches employed within the circuit of the **power switch** (**operator presence control**) that switch motor load: 10 000 operating cycles as specified in IEC 61058-1:2016 or IEC 61058-2-6:2018;

– **power switches** which possess series electronics: 1 000 operating cycles with the electronics bypassed;

NOTE 1 By default, switches without any declared endurance with the electronics bypassed have been tested to 1 000 operating cycles in accordance with IEC 61058-1:2016 or IEC 61058-2-6:2018.

– switches other than **power switches**, such as speed selector switches, which are likely to be switched under electrical load: 1 000 operating cycles. However, this test is not required if the requirements of this document are met with the switch short-circuited;

– switches other than **power switches** that either

- are intended for operation without electrical load, and which can be operated only with the aid of a tool or are interlocked so that they cannot be operated under electrical load; or
- provide a motor direction reversing function; or
- are switches for 20 mA load as classified in IEC 61058-1:2016, 7.2.6 or IEC 61058-2-6:2018, 7.2.6,

are not required to possess any particular endurance characteristic.

NOTE 2 Motor reversing endurance is tested in 18.7.

Compliance is checked by inspection of the markings on the switch and by the documentation and certificate provided with the switch.

NOTE 3 **Power switches** for **lawn scarifiers** and **lawn aerators** are covered by the **operator presence control** specified in 21.104.2.

23.3 *Replacement:*

Protective devices (e.g. overload or over-temperature devices) or circuits that switch off the **tines** and/or the **traction drive** (if any) shall be of the non-self-resetting type.

Electronic speed and load regulators that do not switch off the machine but that reduce the speed of the **tines** and/or the **traction drive** (if any), including down to zero, as a load is applied and increase the speed of the machine when the load is removed are not covered by this Subclause 23.3. An **RCD** is considered not to be a **protective device**.

Resetting a **protective device** by switching the machine off and on with the **power switch** is considered to be a non-self-resetting action.

Compliance is checked by inspection and by manual test.

24 Supply connection and external flexible cords

IEC 62841-1:2014, Clause 24 is applicable, except as follows:

24.1 *Replacement:*

Machines shall be provided with one of the following means of connection to the supply:

– an appliance inlet; or

– a **supply cord** with a length between 0,2 m and 0,5 m and fitted with a plug or other connector having at least the same degree of protection against moisture as marked in accordance with 8.1 for the machine when it is connected to a mating connector in accordance with 8.14.2 a) 3); or

– a **supply cord** with a length not less than 10 m and fitted with a plug.

Plugs, connectors and appliance inlets shall be suitable for the **rated voltage**, **rated current** or **rated input** of the machine, as applicable.

Compliance is checked by inspection and by measurement.

The cord is measured from where it exits the machine to where it enters the plug or connector. The length of a cord guard projecting from the body of the machine or from the body of the plug is included in the measurement when determining the length of the cord.

NOTE 1 In Canada and the United States of America, the following conditions apply:

Machines shall be provided with one of the following means of connection to the supply:

– an appliance inlet; or

– a **supply cord** with a length between 0,2 m and 0,5 m and fitted with a plug or other connector.

Plugs, connectors and appliance inlets shall be suitable for the **rated voltage**, **rated current** or **rated input** of the machine, as applicable.

Compliance is checked by inspection and by measurement.

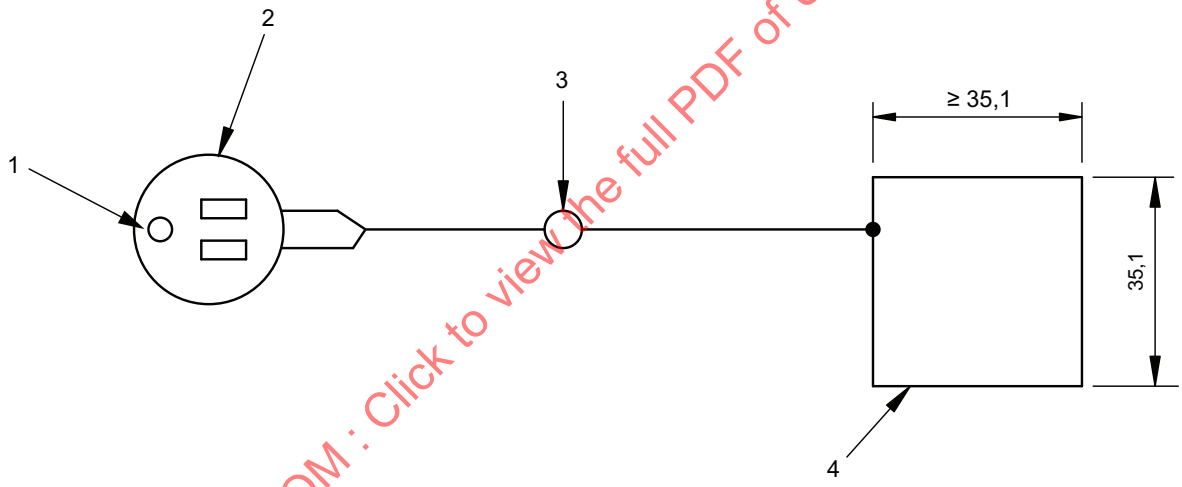
The cord is measured from where it exits the machine to where it enters the plug or connector. The length of a cord guard projecting from the body of the machine or from the body of the plug is included in the measurement when determining the length of the cord.

The appliance inlet or the attachment plug on the **supply cord** shall be constructed so that, when inserted in the connector of an extension cord, the blades will not be energized until they are inaccessible to contact.

Compliance is checked by the following test.

The receptacle shall be connected to the extension cord of the test assembly illustrated in Figure 112 with the plug inserted in the receptacle as far as possible. The plug shall be withdrawn not more than the distance necessary to permit the test probe to be inserted between the plug body and the extension cord receptacle. The test probe shall be inserted with a force of 18 N (4,1 lb) or less, until the probe contacts one blade of the plug. While the probe is in contact with the blade, the electrical continuity shall be determined by an ohmmeter or similar instrument between the contacts of the extension cord receptacle and the test probe. The test probe shall not contact any current-carrying blade of the attachment plug while the plug is conductively connected to the connector of the extension cord. The test shall be repeated for the other blade of the attachment plug.

Dimensions in millimetres



Key

1 GH (grounding open)

2 extension cord receptacle (three wire grounded)

3 continuity tester

4 test probe made of 1,5 mm thick metal

NOTE 2 This figure refers to additional conditions applicable in Canada and the United States of America.

Figure 112

Test assembly for accessibility of attachment plug blades

24.2 *Addition:*

A **type Z attachment** is not allowed.

24.4 *Replacement of Note 1 and Note 2:*

NOTE 1 In the United States of America, the following conditions apply:

Supply cords and **interconnection cords** shall be not lighter than type SJOW, SJTW, or the equivalent that is oil and weather resistant in accordance with the National Electrical Code, ANSI/NFPA 70.

Attachment plugs and cords shall be equal to or greater than the rating of the machine.

NOTE 2 In Canada, the following conditions apply:

Supply cords and **interconnection cords** shall be not lighter than type SJOW, SJTW, or the equivalent that is oil and weather resistant in accordance with CSA C22.1-18.

Attachment plugs and cords shall be equal to or greater than the rating of the machine.

24.6 This subclause of IEC 62841-1:2014 is not applicable.

24.13 *Replacement of the first paragraph:*

Machines provided with a **supply cord** or an **interconnection cord** shall have a cord anchorage. The cord anchorage shall relieve conductors from strain, including twisting, at the terminals and protect the insulation of the conductors from abrasion.

Replacement of Table 9:

Table 9
Pull and torque value

Mass of machine as specified in 5.17 kg	Pull N	Torque Nm
All machines	150	0,35

25 Terminals for external conductors

IEC 62841-1:2014, Clause 25 is applicable.

26 Provision for earthing

IEC 62841-1:2014, Clause 26 is applicable.

27 Screws and connections

IEC 62841-1:2014, Clause 27 is applicable.

28 Creepage distances, clearances and distances through insulation

IEC 62841-1:2014, Clause 28 is replaced as follows:

28.1 **Creepage distances** and **clearances** shall not be less than the values in millimetres shown in Table 12. The values specified in Table 12 do not apply to cross-over points of motor windings.

The values in Table 12 are equal to or larger than the values required by IEC 60664-1, when

– an overvoltage category II;

– a material group III;

– a pollution degree 1 for parts protected against deposition of dirt and for lacquered or enamelled windings;

– a pollution degree 3 for other parts;

– inhomogeneous electric field; and

– transient overvoltages originating in the equipment not exceeding 4 000 V

are applied.

Protection against deposition of dirt may be achieved through the use of

– encapsulation with a minimum thickness of 0,5 mm; or

– protective coatings that prevent the combined deposition of fine particles and moisture on surfaces between conductors. Requirements for these types of protective coatings are described in IEC 60664-3:2016; or

- enclosures that prevent the ingress of dust by means of filters or seals, provided that no dust is generated within the enclosure itself.

NOTE 1 An example of encapsulation is potting.

If a resonance voltage occurs between the point where a winding and a capacitor are connected together, and metal parts which are separated from **live parts** by **basic insulation** only, the **creepage distance** and **clearance** shall not be less than the values specified for the value of the voltage imposed by the resonance, these values being increased by 4 mm in the case of **reinforced insulation**.

Compliance is checked by measurement.

For machines provided with an appliance inlet, the measurements are made with an appropriate connector inserted. For other machines, they are made on the machine as delivered.

For machines provided with belts, the measurements are made with the belts in place, and the devices intended for varying the belt tension adjusted to the most unfavourable position within their range of adjustment, and also with the belts removed.

Movable parts are placed in the most unfavourable position; nuts and screws with non-circular heads are assumed to be tightened in the most unfavourable position.

*The **clearances** between terminals and accessible metal parts are also measured with the screws or nuts unscrewed as far as possible, but the **clearances** shall then be not less than 50 % of the value shown in Table 12.*

Table 12
Minimum creepage distances and clearances

Dimensions in millimetres

Distances	Class III machines		Other machines					
			Working voltage ≤ 130 V		Working voltage > 130 V and ≤ 280 V		Working voltage > 280 V and ≤ 480 V	
	Creepage distance	Clearance	Creepage distance	Clearance	Creepage distance	Clearance	Creepage distance	Clearance
Between parts of different potential [a]:								
– if lacquered or enamelled windings or if protected against deposition of dirt	1,0	1,0	1,0	1,0	2,0	2,0	2,0	2,0
– if not protected against deposition of dirt	2,0 [c]	1,5	2,0 [b]	1,5	3,0 [b]	2,5	8,0 [e]	3,0
Between **live parts** and other metal parts over **basic insulation**:								
– if the **live parts** are lacquered or enamelled windings [d] or if protected against deposition of dirt	–	–	1,0	1,0	2,0	2,0	2,0	2,0
– if not protected against deposition of dirt	–	–	2,4 [c]	1,5	4,0 [c]	3,0	8,0 [e]	3,0
Between **live parts** and other metal parts over **reinforced insulation**:								
– if the **live parts** are lacquered or enamelled windings or protected against deposition of dirt	–	–	5,0	5,0	6,0	6,0	10,0 [e]	6,0
– for other **live parts** not protected against deposition of dirt	–	–	5,0	5,0	8,0	8,0	16,0 [e]	8,0
Between metal parts separated by **supplementary insulation**	–	–	2,5	2,5	4,0	4,0	8,0 [e]	4,0

[a] The **clearances** specified do not apply to the air gap between the contacts of thermal controls, **protective devices**, switches of micro-gap construction, and the like, or to the air gap between the current-carrying members of such devices where the **clearance** varies with the movement of the contacts.

[b] These **creepage distances** are slightly lower than suggested by IEC 60664-1. **Creepage distances** between parts of different potential (functional insulation) are only associated to fire hazard, not to electric shock hazard. As products in the scope of IEC 62841 are products supervised during **normal use**, lower distances are justified.

Table 12 Continued on Next Page

Table 12 Continued

Dimensions in millimetres

Distances	Class III machines		Other machines					
			Working voltage ≤ 130 V		Working voltage > 130 V and ≤ 280 V		Working voltage > 280 V and ≤ 480 V	
	Creepage distance	Clearance	Creepage distance	Clearance	Creepage distance	Clearance	Creepage distance	Clearance

[c] These **creepage distances** may be reduced to values in accordance with IEC 60664-1, if the insulation parts are of material group II or lower.

[d] Windings are considered to have **basic insulation** if they are wrapped with tape and then impregnated, or if they are covered with a layer of self-hardening resin, and if, after the test of 14.1, an electric strength test as specified in Clause D.2 is withstood, the test voltage being applied between the conductors of the winding and metal foil in contact with the surface of the insulation.

It is sufficient that the wrapping and impregnation, or the layer of self-hardening resin, cover the windings only at places where it is not possible to obtain the **creepage distance** or clearance specified for lacquered or enamelled windings.

[e] These **creepage distances** are valid for frequencies up to 30 kHz. For higher frequencies, **creepage distances** shall be in accordance with IEC 60664-4:2005. **Creepage distances** can be reduced in accordance with IEC 60664-1 if the insulation parts are of material group II or lower and/or for **working voltages** ≤ 400 V, however they shall not be lower than the values required in the column "**Working voltage** > 130 V and ≤ 280 V".

Distances through slots or openings in external parts of insulating material are measured to metal foil in contact with the accessible surface; the foil is pushed into corners and the like by means of the test probe B of IEC 61032:1997, but it is not pressed into openings.

*If necessary, a force is applied to any point on internal wiring and bare conductors, other than those of heating elements, to any point on uninsulated metal capillary tubes of **thermostats** and similar devices, and to the outside of metal enclosures, in an endeavour to reduce the **creepage distances** and **clearances** while taking the measurements.*

The force is applied by means of the test probe B of IEC 61032:1997, and has a value of:

*– 2 N for internal wiring and bare conductors and for uninsulated capillary tubes of **thermostats** and similar devices;*

– 30 N for enclosures.

*The way in which **creepage distances** and **clearances** are measured is indicated in Annex A.*

*For machines having parts with **double insulation** where there is no metal between **basic insulation** and **supplementary insulation**, the measurements are made as though a metal foil were present between the two insulations.*

Means provided for fixing the machine to a support are considered to be accessible.

***Creepage distances** and **clearances** within optocouplers are not measured if the individual insulations are adequately sealed, and if air is excluded between individual layers of the material.*

*For parts of different potential, including conductive patterns on printed circuit boards, except for external mains connection, **creepage distances** and **clearances** smaller than the minimum values specified*

in Table 12; or

– for conductive patterns on printed circuit boards as specified below

are allowed, provided

– the requirements of Clause 18 are met if these ***creepage distances*** *and* ***clearances*** *are short-circuited in turn; or*

– for ***electronic circuits****, such* ***electronic circuits*** *comply with 18.6 and 18.8.*

For conductive patterns on printed circuit boards, except at their edges, the minimum ***creepage distances*** *and* ***clearances*** *in Table 12 between parts of different potential may be reduced, as long as the peak value of the voltage stress does not exceed:*

– 150 V per mm with a minimum value of 0,2 mm, if protected against the deposition of dirt;

– 100 V per mm with a minimum value of 0,5 mm, if not protected against the deposition of dirt.

When the limits mentioned above lead to higher values than those of Table 12, the values of Table 12 apply.

NOTE 2 The above values are equal to or larger than the values required by IEC 60664-3:2016.

28.2 Depending on the **working voltage**, the distance through insulation shall be sufficient:

– For **working voltages** up to and including 130 V, the distance through insulation between metal parts shall not be less than 1,0 mm, if they are separated by **supplementary insulation**, and not be less than 1,5 mm, if they are separated by **reinforced insulation**.

– For **working voltages** over 130 V, the distance through insulation between metal parts shall not be less than 1,0 mm, if they are separated by **supplementary insulation**, and not be less than 2,0 mm, if they are separated by **reinforced insulation**.

– For all **working voltages**, the distance through **reinforced insulation** used between enamelled or lacquered windings and accessible metal shall not be less than 1,0 mm.

The required distance through insulation may be achieved through several thicknesses of solid insulation layers that may have intervening air between the layers such that the sum of the thicknesses of the solid insulation equals the required thickness.

This requirement does not apply, if either a) or b) is fulfilled.

a) The insulation is applied in thin sheet form, other than mica or similar scaly material, and consists:

– for **supplementary insulation**, of at least two layers, provided that any one of the layers withstands the electric strength test specified for **supplementary insulation**;

– for **reinforced insulation**, of at least three layers, provided that, when any two of the layers are placed in contact, they withstand the electric strength test specified for **reinforced insulation**.

The test voltage is applied between the outer surfaces of the layer, or of the two layers, as applicable.

b) The **supplementary insulation** or the **reinforced insulation** is inaccessible and meets the following condition:

The insulation, after having been conditioned for seven days (168 h) in an oven maintained at a temperature equal to 50 K greater than the maximum temperature rise determined during the test

of Clause 12 withstands an electric strength test as specified in Annex D, this test being made on the insulation both at the temperature occurring in the oven, and at approximately room temperature.

Compliance is checked by inspection and by measurement.

For optocouplers, the conditioning procedure is carried out at a temperature of 50 K in excess of the maximum temperature rise measured on the optocoupler during the tests of Clause 12 and Clause 18, the optocoupler being operated under the most onerous conditions which occur during these tests.

Annexes

The annexes of IEC 62841-1:2014 are applicable, except as follows:

Annex I
(informative)

Measurement of noise and vibration emissions

NOTE In Europe (EN IEC 62841-4-7), Annex I is normative.

I.2 Noise test code (grade 2)

IEC 62841-1:2014, Clause I.2 is applicable except as follows:

I.2.2 Sound power level determination

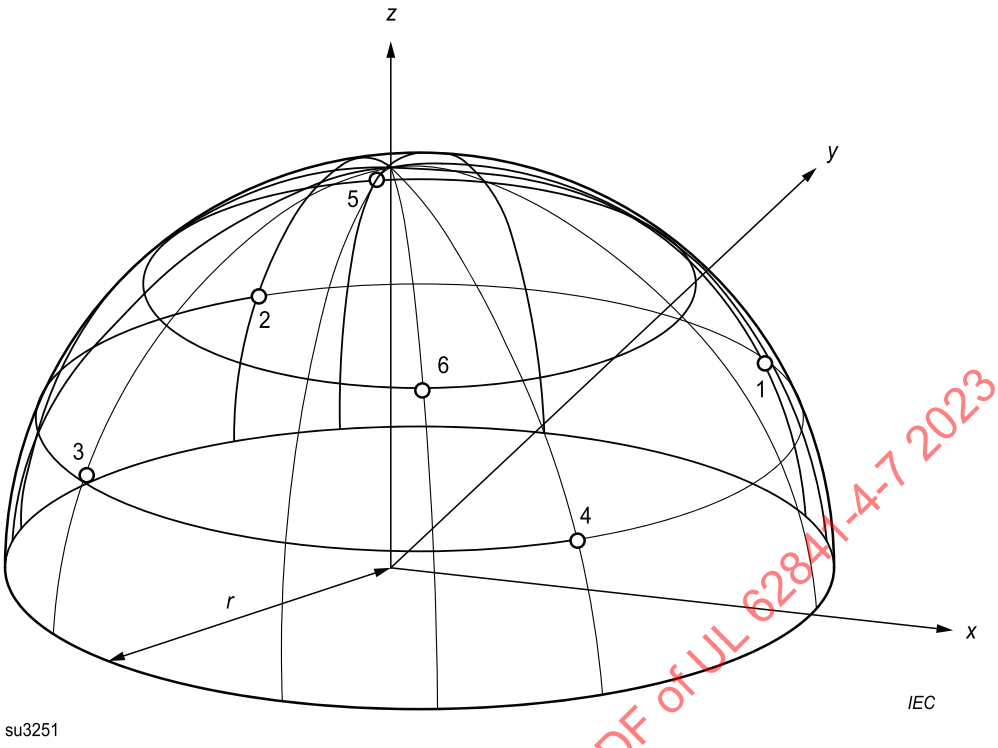
I.2.2.1 General

Replacement:

The sound power level shall be measured using a hemispherical measurement surface according to Figure I.101. The acoustic environment, instrumentation, quantities to be measured, quantities to be determined, and the measurement procedure are specified in ISO 3744:2010.

The sound power level shall be given as A-weighted sound power level in dB reference 1 pW. The A-weighted sound pressure levels, from which the sound power is to be determined, shall be measured directly, and not calculated from frequency band data. Measurements shall be made outdoors or indoors in an essentially free field.

NOTE In Europe, the A-weighted measured and guaranteed sound power levels L_{WA} are determined according to the European Directive 2000/14/EC, as amended.



Key

r radius of hemisphere

Figure I.101

Microphone positions on the hemisphere (see Table I.101)

I.2.2.2 Hand-held power tools

This subclause of IEC 62841-1:2014 is not applicable.

I.2.2.3 Transportable power tools

This subclause of IEC 62841-1:2014 is not applicable.

I.2.2.4 Lawn and garden machinery

Replacement:

The test environment outdoors shall be a flat open space (a slope, if any, not exceeding 5/100), visibly free of sound-reflecting objects (e.g. buildings, trees, poles, sign boards) within a circular area with a radius equal to approximately three times the radius of the hemispherical measurement surface used.

For the determination of sound power level, ISO 3744:2010 shall be used subject to the following modifications:

– the microphone array shall be six microphone positions according to Figure I.101 and Table I.101;

– for outdoor and indoor measurements, the reflecting surface shall be replaced by an artificial surface according to I.2.2.101 or a natural ground surface according to I.2.2.102. Reproducibility of results using natural grass or other organic material is likely to be worse than that required for Grade 2 of accuracy. In

case of dispute, measurements shall be carried out in the open air and on the artificial surface according to I.2.2.101;

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

- *r* = 4 m for machines with a **cutting width** up to 1,2 m; and
- *r* = 10 m for machines with a **cutting width** exceeding 1,2 m. A smaller radius is permitted if it is demonstrated that the results are within 0,5 dB compared with measurements with a hemisphere of *r* = 10 m;

– for measurements outdoors, K_{2A} = 0 dB;

– for measurements outdoors, the environmental conditions shall be within the limits specified by the manufacturers of the measuring equipment. The ambient air temperature shall be in the range from 5 °C to 30 °C and the wind speed shall be less than 5 m/s. A wind screen shall be used whenever the wind speed exceeds 1 m/s;

– for measurements indoors, the environment shall be according to ISO 3744:2010 and the value of K_{2A}, determined without artificial surface and in accordance with Annex A of ISO 3744:2010, shall be ≤ 2 dB, in which case K_{2A} shall be disregarded;

– measurements shall be made using an integrating-averaging sound level meter as defined in IEC 61672-1:2013; alternatively, instruments with the time-weighting characteristics "slow", as defined in IEC 61672-1:2013, may be used.

The machine is placed on the surface in such a way that the projection of the geometrical centre of the main parts (excluding handle, **catcher**, etc.,) coincides with the origin of the coordinate system of the microphone positions. The longitudinal axis of the machine is aligned with the x-axis.

The measurement is carried out without an operator.

NOTE It is likely that the results from conducting tests using an operator will not achieve Grade 2 accuracy.

The A-weighted sound power level, L_{WA}, in dB, shall be calculated in accordance with 8.2.5 of ISO 3744:2010, as follows:

$$L_{WA} = \overline{L_{pA}} + 10\lg\left(\frac{S}{S_0}\right) \text{ dB} \qquad \text{(I.101)}$$

with $\overline{L_{pA}}$ determined from

$$\overline{L_{pA}} = 10\lg\left[\frac{1}{6}\sum_{i=1}^{6} 10^{0,1L'_{pA,i}}\right] - K_{1A} - K_{2A} \text{ dB}$$

where

$\overline{L_{pA}}$ is the surface time averaged sound pressure level according to 8.2.4 of ISO 3744:2010, in dB;

$L'_{pA,i}$ is the A-weighted sound pressure level measured at the i^{th} microphone position, in dB;

K_{1A} is the background noise correction, A-weighted in dB;

K_{2A} is the environmental correction, A-weighted in dB, according to the requirements of this noise test code K_{2A} = 0 dB;

S is the area of the measurement surface, in m^2;

S_0 = 1 m^2.

For the hemispherical measurement surface, the area S of the measurement surface is calculated as follows:

$$S = 2\pi r^2$$

So, from equation (I.101)

where the radius of the hemisphere, r = 4 m

$$L_{WA} = \overline{L_{pA}} + 20 \text{ dB}$$

where the radius of the hemisphere, r = 10 m

$$L_{WA} = \overline{L_{pA}} + 28 \text{ dB}$$

Table I.101
Co-ordinates of microphone positions

Position No.	*x*/*r*[1]	*y*/*r*[1]	*z*/*r*	*z*
1	+0,707 *a*	+0,707 *a*	–	1,5 m
2	–0,707 *a*	+0,707 *a*	–	1,5 m
3	–0,707 *a*	–0,707 *a*	–	1,5 m
4	+0,707 *a*	–0,707 *a*	–	1,5 m
5	–0,27	+0,65	0,71	–
6	+0,27	–0,65	0,71	–

[1] The constant a depends on the measurement radius and is taken from Table I.102.

Table I.102
Values of the constant *a*

Measurement radius *r* m	Constant *a*
4	0,927
10	0,989

If a non-preferred hemisphere radius is used, microphone positions 1 to 4 shall be maintained at a height z of 1,5 m and the value of the constant a shall be determined from

$$a = \frac{\sqrt{r^2 - 1{,}5^2}}{r}$$

I.2.2.101 Requirements for an artificial surface

The artificial surface shall have absorption coefficients as given in Table I.103, measured in accordance with ISO 354:2003.

Table I.103
Absorption coefficients

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

The artificial surface shall be placed on a hard, reflecting surface and have a size of at least 3,6 m × 3,6 m placed at the centre of the test environment. The construction of the supporting structure shall be such that the requirements for the acoustic properties are also met with the absorptive material in place. The structure shall support the weight of an operator during the test and when positioning the machine on the structure and the weight of the machine to avoid compression of the absorbing material.

NOTE 101 See Annex EE for an example of a material and construction which can be expected to fulfil these requirements.

The artificial surface is placed so that the geometrical centre coincides with the origin of the coordinate system of microphone positions.

I.2.2.102 Requirements for a natural ground surface

The test environment, within a circular area with a radius equal to approximately the radius of the hemispherical measurement surface used, shall be covered with high-quality natural grass. Before the measurements are taken, the grass shall be cut with a lawnmower to a height of cut as near as possible to 30 mm. The surface shall be clean of grass clippings and debris and shall be visibly free of moisture, frost, or snow.

I.2.3 Emission sound pressure level determination

This subclause of IEC 62841-1:2014 is applicable, except as follows:

I.2.3.1 Hand-held tools

This subclause of IEC 62841-1:2014 is not applicable.

I.2.3.2 Transportable tools

This subclause of IEC 62841-1:2014 is not applicable.

I.2.3.3 Lawn and garden machinery

Replacement:

The A-weighted emission sound pressure level at the operating position, L_{pA}, shall be determined according to ISO 11201:2010, grade 2, subject to the following modifications:

– the test environment outdoors shall be a flat open space (a slope, if any, not exceeding 5/100), visibly free of sound-reflecting objects (e.g. buildings, trees, poles, sign boards) within a circular area with a radius equal to approximately three times the radius of the hemispherical measurement surface used;

– for outdoor and indoor measurements, the reflecting surface shall be replaced by a natural ground surface according to I.2.2.102 or an artificial surface according to I.2.2.101. Reproducibility of results using natural grass or other organic material is likely to be worse than that required for Grade 2 of accuracy. In case of dispute, measurements shall be carried out in the open air and on the artificial surface according to I.2.2.101;

– for measurements outdoors, K_{2A} = 0 dB;

– for measurements outdoors, the environmental conditions shall be within the limits specified by the manufacturers of the measuring equipment. The ambient air temperature shall be in the range from 5 °C to 30 °C and the wind speed shall be less than 5 m/s. A wind screen shall be used whenever the wind speed exceeds 1 m/s;

– for measurements indoors, the environment shall be according to ISO 3744:2010 and the value of K_{2A}, determined without artificial surface and in accordance with Annex A of ISO 3744:2010, shall be ≤ 2 dB, in which case K_{2A} shall be disregarded.

The test is conducted with an operator or an equivalent dummy who is (1,75 ± 0,05) m tall and shall stand upright and look straight ahead. The microphone is head mounted (200 ± 20) mm to the side of the centre plane of the operator's head, in line with the eyes and on the side where the higher value of the A-weighted emission sound pressure level is observed.

The microphone is aimed with its axis of maximally flat response (as specified by the manufacturer of the microphone) pointing forwards and at an angle of 45° downwards from the horizontal. If a helmet is used to mount the microphone, the shape of the helmet is such that its outer edge is at least 30 mm closer to the head than the microphone.

Tests are repeated to attain the required grade of accuracy, and until three consecutive A-weighted results give values within not more than 2 dB. The arithmetic average of these is the measured A-weighted emission sound pressure level of the machine.

I.2.4 Installation and mounting conditions of the power tools during noise tests

Replacement:

The installation and mounting conditions shall be the same for the determination of both sound power level and emission sound pressure level at the work station.

The machine under test shall be a new, normal production machine equipped with **attachments** which affect the acoustic properties, as specified in 8.14.2. If a **catcher** is provided or available for the machine, it shall be fitted and empty.

Adjustable features (e.g. handle height) are set to suit the operator or dummy.

Prior to commencing testing, the machine shall be set up in a stable condition as specified in 8.14.2.

The **lawn scarifier** or **lawn aerator** is tested in a stationary position without engaging the traction drive, if any.

The **working position** of the **lawn scarifier** or **lawn aerator** is set to the highest position at which the **tines** will still drive when the **operator presence control** is engaged. If this setting still allows the **tines** to make contact with the ground surface, the ground support system of the machine (e.g. wheels) are raised

on support blocks to ensure ground clearance. The blocks are to be as small as is practicable, consistent with safety during the test and are to be well clear of the rotating **tines**.

I.2.5 Operating conditions

Replacement:

The operating conditions shall be the same for the determination of both sound power level and emission sound pressure level at the work station.

The machine is operated at **maximum speed** at no-load for 10 min before the test is commenced. The **lawn scarifier** or **lawn aerator** is tested with the **tines** engaged and at **maximum speed** at no-load.

Three consecutive tests shall be carried out and the result of the test L_{WA} shall be the arithmetic mean, rounded to the nearest decibel, of the three tests.

During measurements, the machine shall operate under stable conditions. Once the noise emission is steady, the measurement time interval shall be at least 15 s. If measurements are made in octave or one-third octave frequency bands, the minimum period of observation shall be 30 s for the frequency bands centred on or below 160 Hz, and 15 s for the frequency bands centred on or above 200 Hz.

NOTE As it is difficult to apply or simulate load to **lawn scarifiers** or **lawn aerators**, laboratories and test results have shown that the process noise has no significant influence on the noise results, the measurements are conducted with no load only.

I.2.9 Declaration and verification of noise emission values

Replacement:

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

The A-weighted sound power level L_{WA} shall be declared using the single-number noise emission value L_{WAd} according to ISO 4871:1996.

NOTE 1 The single-number noise emission value L_{WAd} is equivalent to the guaranteed A-weighted sound power level used in the European Directive 2000/14/EC.

For a standard deviation of reproducibility of the method σ_{R0} of 1,5 dB and for a typical standard deviation of production, the values for the uncertainties, K_{pA} and K_{WA} respectively, are expected to be 3 dB.

The noise emission declaration shall state that the noise emission values have been obtained according to this noise test code. If this statement is not true, the noise declaration shall indicate clearly what the deviations from this standard, and from the basic standards, are.

NOTE 2 If the measured value is the average based on a sample of three machines that has been properly sampled, then K normally is 3 dB. Further guidance on sampling and uncertainty terms is given in ISO 7574-4 and ISO 4871:1996.

Additional noise emission quantities may also be given in the declaration.

If undertaken, the verification shall be performed for a batch of machines, in accordance with 6.3 of ISO 4871:1996. The verification shall be conducted by using the same mounting, installation and operating conditions as those used for the initial determination of noise emission values.

I.3 Vibration

IEC 62841-1:2014, Clause I.3 is applicable except as follows:

I.3.3.2 Location of measurement

Addition:

A maximum of two transducers shall be used for hand-arm vibration. The transducer(s) for the hand-arm vibration measurements shall be placed where an operator holds the handle(s). The operator(s) shall be in the normal operating position. Figure I.102 gives examples for the positions of the transducers for **lawn scarifiers** and **lawn aerators**.

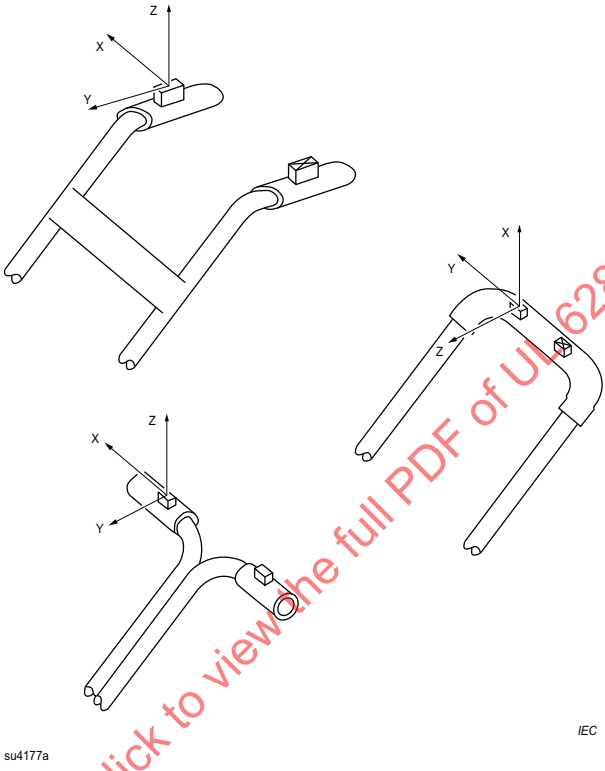


Figure I.102

Examples of positions of transducers for lawn scarifiers and lawn aerators

I.3.5.1 General

Replacement of the last paragraph:

During the measurements, the hands of the operator shall grasp the handle(s) in accordance with 8.14.2 a) 104).

I.3.5.2 Attachment, workpiece and task

Addition:

If a **catcher** is provided or available for the machine, the test is performed with the **catcher** fitted and empty.

The machine is tested for all **tines assemblies** supplied with the machine and including all other **attachments** supplied by the **lawn scarifier** or **lawn aerator** manufacturer giving the highest vibration levels. The configuration of the machine tested shall be recorded.

Prior to commencing testing, the machine shall be set up in a stable condition as specified in 8.14.2.

I.3.5.3 Operating conditions

Replacement:

The **lawn scarifier** or **lawn aerator** is tested in a stationary position, without engaging the **traction drive**, if any, with the **tines** engaged and at **maximum speed** at no-load.

NOTE As it is difficult to apply or simulate load to **lawn scarifiers** and **lawn aerators** in laboratories and test results have shown that the load has no significant influence on the vibration results, the measurements are conducted with no-load only.

The machine shall be operated at normal working modes as specified in 8.14.2, except that the **traction drive**, if any, is not engaged, which shall be maintained for the duration of the test. Those operating conditions shall be used that are representative of the highest vibration values likely to occur at typical and **normal use** of the machine under test.

Adjustable handles of machines shall be set to suit the operator(s).

The **working position** of the **lawn scarifier** or **lawn aerator** is set to the highest position at which the **tines** will still drive when the **operator presence control** is engaged. If this setting still allows the **tines** to make contact with the ground surface, the ground support system of the machine (e.g. wheels) are raised on support blocks to ensure ground clearance. The blocks are to be as small as is practicable consistent with safety during the test and are to be well clear of the rotating **tines**.

Measurements shall be carried out on a surface in accordance with Annex BB.

Before starting the test, the machine shall be operated under these conditions for at least 1 min to warm it up.

I.3.6.1 Reported vibration values

Replacement of the first paragraph:

Three series of five consecutive tests shall be carried out using one operator.

Addition:

Each test measurement is made after the machine has been switched on for a minimum of 2 s or until **maximum speed** of the **tines** is achieved, whichever is longer. The vibration measurement is then conducted over a minimum of 8 s.

I.3.6.2 Declaration of the vibration total value

Replacement:

The vibration total value a_h of the handle with the highest emission and the uncertainty K shall be declared. The uncertainty K shall be declared according to EN 12096.

Annex K
(normative)

Battery tools and battery packs

All clauses of the main body of this document apply unless otherwise specified in this annex. If a clause/subclause is stated in this annex, its requirements replace the requirements of the main body of this document unless otherwise specified. Clauses, subclauses, notes, tables and figures which are additional to those in the main body of this document are numbered starting from 301.

K.3 Terms and definitions

Clause 3 of this document is applicable, except as follows:

Replacement of IEC 62841-1:2014, 3.63:

K.3.63
working voltage
voltage, without the effect of transient voltages, across any insulation or between any parts of different potential when the tool is supplied by (a) **fully charged battery(ies)** and operating at no-load, or with the tool in the "off" condition, whichever is greater

Addition:

K.3.301
disabling device
device that is either a **removable disabling device** or a **code protected disabling device**

K.3.301.1
removable disabling device
detachable part, such as for example a key, which prevents operation of the machine when it is removed

Note 301 to entry: See K.21.302.2.

K.3.301.2
code protected disabling device
device which, when activated, prevents operation of the machine and requires a coded input (such as via a keypad) before it is deactivated and the machine can operate

Note 301 to entry: See K.21.302.3.

K.3.302
switched circuit
circuit that is a low-power circuit when the **power switch** is in the "off" position

Note 301 to entry: The requirements for a low-power circuit are given in Annex H.

K.5.17 *Addition:*

*The mass of the machine includes the heaviest **battery(ies)** mounted on the machine in accordance with K.8.14.2 e) 2).*

K.5.207 *Addition to IEC 62841-1:2014, K.5.207:*

*For tests that are conducted at **maximum speed***

*– the **battery** shall be replaced with a **fully charged battery** as needed in order to maintain the speed of the **tines** to be not less than 90 % of **maximum speed**; or*

*– the machine may be powered by an external power source maintained at the nominal voltage of the **battery**.*

K.7.1 Subclause 7.1 of this document is not applicable.

K.7.2 *Modification:*

Machines with no parts having a **hazardous voltage** between them shall be at least IPX1.

Machines with parts having a **hazardous voltage** between them shall be at least IPX4.

K.8.1 **Lawn scarifiers** and **lawn aerators** shall be marked with the IP number according to the degree of protection against ingress of water. If the first numeral for the IP numbering is omitted, the omitted numeral shall be replaced by the letter X, for example IPX5.

Compliance is checked by inspection.

K.8.1.101 Subclause 8.1.101 of this document is not applicable.

K.8.2 *Modification:*

The safety warnings in the second paragraph of the main body of this document ("For mains supplied machines") are omitted.

Addition:

Lawn scarifiers or **lawn aerators** with

– a **detachable battery pack**, where users are instructed to remove the **detachable battery pack** as indicated in K.8.14.2 b) 302); or

– a **separable battery pack**

shall be marked with the following safety warning:

– "⚠ WARNING – Disconnect battery before maintenance" or one of the product safety labels specified in Figure AA.5.

The term "battery" in the above warning may be replaced with "all batteries" if the machine has more than one **battery**.

Lawn scarifiers or **lawn aerators**, where users are instructed to operate the **removable disabling device** as indicated in K.8.14.2 b) 302), shall be marked with the following safety warning:

– "⚠ WARNING – Remove the disabling device before maintenance" or one of the product safety labels specified in Figure AA.6.

The term "disabling device" in the above warning may be replaced with a term (e.g. "key") as used in the manufacturer's instructions.

Lawn scarifiers or **lawn aerators**, where users are instructed to activate the **code protected disabling device** as indicated in K.8.14.2 b) 302), shall be marked with the following safety warning:

– "⚠ WARNING – Activate the disabling device before maintenance" or one of the product safety labels specified in Figure AA.7.

K.8.14.1.101 Lawn scarifier and lawn aerator safety warnings

For the warnings below, the term "machine" may be replaced by alternate wording (e.g. "scarifier", "lawn rake", "aerator", "verticutter" or "lawn scarifier or aerator").

a) **Do not use the** machine **in bad weather conditions, especially when there is a risk of lightning**. *This decreases the risk of being struck by lightning.*

b) **Thoroughly inspect the area for wildlife where the machine is to be used.** *Wildlife may be injured by the machine during operation.*

c) **Thoroughly inspect the area where the machine is to be used and remove all stones, sticks, wires, bones, and other foreign objects.** *Thrown objects can cause personal injury.*

d) **Before using the machine, always visually inspect to see that the tines and the tines assembly are not worn or damaged.** *Worn or damaged parts increase the risk of injury.*

e) **Check the catcher frequently for wear or deterioration.** *A worn or damaged catcher may increase the risk of personal injury.*

NOTE 301 It is possible to replace the term "catcher" by an alternative term such as "collector" or "bag".

NOTE 302 The warning in item e) above is omitted for machines that are not designed to be used with a **catcher**.

f) **Keep guards in place. Guards must be in working order and be properly mounted.** *A guard that is loose, damaged, or is not functioning correctly may result in personal injury.*

g) **Keep all cooling air inlets clear of debris.** *Blocked air inlets and debris may result in overheating or risk of fire.*

h) **While operating the machine, always wear non-slip and protective footwear. Do not operate the machine when barefoot or wearing open sandals.** *This reduces the chance of injury to the feet from contact with the moving tines.*

i) **While operating the machine, always wear long trousers.** *Exposed skin increases the likelihood of injury from thrown objects.*

j) **Do not operate the machine in wet grass. Walk, never run.** *This reduces the risk of slipping and falling which may result in personal injury.*

k) **Do not operate the machine on excessively steep slopes.** *This reduces the risk of loss of control, slipping and falling which may result in personal injury.*

l) **When working on slopes, always be sure of your footing, always work across the face of slopes, never up or down and exercise extreme caution when changing direction.** *This reduces the risk of loss of control, slipping and falling which may result in personal injury.*

m) **Use extreme caution when reversing or pulling the machine towards you. Always be aware of your surroundings**. *This reduces the risk of tripping during operation.*

n) **Hold the machine by insulated gripping surfaces only, because the tines may contact hidden wiring**. *Tines contacting a "live" wire may make exposed metal parts of the machine "live" and could give the operator an electric shock.*

o) **Do not touch tines and other hazardous moving parts while they are still in motion.** *This reduces the risk of injury from moving parts.*

p) **When clearing jammed material or cleaning the machine, make sure all power switches are off and the battery pack is disconnected.** *Unexpected operation of the machine may result in serious personal injury.*

NOTE 303 For machines with more than one **battery**, it is possible to replace the text "battery pack is" with "battery packs are" in the warning in item p) above.

NOTE 304 The warning in item o) above is omitted for machines where users are not instructed to remove the **detachable battery pack(s)** or **separable battery pack(s)** as indicated in K.8.14.2 b) 302).

q) **When clearing jammed material or cleaning the machine, make sure all power switches are off and remove (or activate) the disabling device.** *Unexpected operation of the machine may result in serious personal injury.*

NOTE 305 Use "remove" or "activate" as appropriate to the type of **disabling device** that is fitted to the machine.

NOTE 306 For **removable disabling devices**, it is possible to replace the term "**disabling device**" with the term used for the **disabling device** (e.g. "key") in the manufacturer's instructions.

NOTE 307 The warning in item q) above is omitted for machines where users are not instructed to operate the **removable disabling device** or activate the **code protected disabling device** as indicated in K.8.14.2 b) 302).

K.8.14.2 b)
Replacement of item 105):

105) Instructions to stop the machine, and operate the **disabling device** or remove the **detachable battery pack(s)** or **separable battery pack(s)**, whichever is applicable, and to make sure that all moving parts have come to a complete stop

– after striking a foreign object, and to inspect the machine for damage and make repairs before restarting and operating the machine;

– if the machine starts to vibrate abnormally, and then to immediately inspect for damage, replace or repair any damaged parts and to check for and tighten any loose parts;

Modification of item 106):

Item 106) of this document is not applicable.

Addition:

301) Instructions for the use and adjustment of any means of support for **separable battery pack(s)** in accordance with K.21.305 and instructions for release or removal.

302) Instructions to operate the **removable disabling device**, activate the **code protected disabling device** or remove the **detachable battery pack(s)** or **separable battery pack(s)**, whichever is applicable, whenever

– performing **user maintenance**;

– cleaning the machine; or

– leaving the machine unattended.

K.12.1 **Battery** machines and **battery** packs shall not attain excessive temperatures.

Compliance is checked by determining the temperature rise of the various parts under the following conditions:

*The test is conducted with the machine placed on an unperforated flat horizontal surface with the **tines** attached. The **traction drive** wheels, if any, are lifted the minimum amount required to avoid contact with the unperforated flat horizontal surface.*

The most unfavourable conditions are determined using the configuration of

*– **attachments**;*

*– **tines**;*

*– **batteries**; and*

*– control settings (e.g. **tines** or **traction drive** on/off)*

in accordance with K.8.14.2, which yields the highest temperature on the surface of the external enclosure.

*The **working position** of the **tines** is adjusted the minimum amount required to avoid contact with the unperforated flat horizontal surface. The machine is operated continuously at no-load*

*– at **maximum speed**; and*

*– with the **traction drive**, if any, adjusted to its most unfavourable speed setting, including zero speed*

*until maximum temperature is reached or the machine no longer operates due to the **battery** being discharged.*

*During the test, **protective devices** shall not operate. The temperature rises shall not exceed the values shown in Table 2.*

K.12.2.1 Subclause 12.2.1 of this document is not applicable.

K.14 Moisture resistance

Clause 14 of this document is applicable, except as follows:

K.14.1 Subclause 14.1 of this document is not applicable.

K.14.2 The enclosure of the machine shall provide the degree of protection against moisture in accordance with the marking of the machine.

Compliance is checked by the appropriate treatment specified in K.14.2.2, with the tool conditions as in K.14.2.1.

K.14.2.1 *The machine is tested with **detachable battery pack(s)** or **separable battery pack(s)** fitted. A second machine is then tested with any **detachable battery pack(s)** or **separable battery pack(s)** removed. The machine is switched off during the test.*

Detachable parts *are removed and subjected, if necessary, to the relevant treatment with the main part. Movable covers that are non-****detachable parts*** *and are not self-restoring are placed in the most unfavourable position.*

NOTE Examples of self-restoring covers include those that are spring loaded or close by gravity.

Batteries *with a classification greater than IPX0 are tested separately according to their rating.*

Air filters are not removed.

K.14.2.2 *Replacement of the last paragraph:*

When the test is carried out with the ***battery*** *installed, during and after the appropriate treatment, the machine shall not start with the* ***power switch*** *in the "off" position with the* ***battery*** *installed.*

When the test is carried out without the ***battery*** *inserted, the* ***battery*** *is inserted at the end of the treatment. The machine shall not start with the* ***power switch*** *in the "off" position with the* ***battery*** *installed.*

Afterwards, having carefully wiped the external enclosure to remove any surplus water, inspection shall show that there is no trace of water on insulation which could result in a reduction of ***creepage distances*** *and* ***clearances*** *between bare conductors below the values specified in K.28.1. For all instances where* ***creepage distances*** *and* ***clearances*** *could be reduced below the values specified in K.28.1, a short circuit is introduced between adjacent conductors simultaneously. The machine is then evaluated for*

– the risk of fire in accordance with IEC 62841-1:2014, K.18.1, item f); and

– the loss of any ***SCF****, unless the machine is rendered into a safe state.*

Batteries *shall not exhibit* ***fire*** *or* ***explosion****.*

K.14.3 to K.14.5 These subclauses of IEC 62841-1:2014 are not applicable.

K.17.2 Subclause 17.2 of this document is not applicable.

K.18.5 Subclause 18.5 of this document is not applicable.

K.18.8 *Addition to Table 4:*

Table 4
Required performance levels

Type and purpose of SCF	Minimum Performance Level (PL)
Any **disabling device** as in K.21.302	Not an **SCF**

K.19.1 Subclause 19.1 of this document is not applicable for covers for **battery(ies)** or **battery** compartments.

K.19.7 *Addition:*

The test is conducted with the most unfavourable ***battery*** *in accordance with IEC 62841-1:2014, K.8.14.2 e) 2).*

K.19.101.3 Parking brake

Addition:

*The test is performed with the heaviest **battery** or **battery** combination mounted on the machine in accordance with IEC 62841-1:2014, K.8.14.2 e) 2).*

K.20.3.2 *The test is carried out with the **lawn scarifier** or **lawn aerator** resting on a smooth horizontal concrete surface. During the test, the machine is not restrained or placed against any other supporting structure.*

*A **lawn scarifier** or **lawn aerator** with any **detachable battery pack** or **separable battery pack** attached, placed in its normal operating position, is impacted with a smooth steel sphere having a diameter of (50 ± 2) mm and weighing (0,55 ± 0,03) kg. If a part of the machine can be impacted from above, the sphere is dropped from a rest position to strike the component. Otherwise, the sphere is suspended by a cord and is allowed to fall from a rest position as a pendulum to strike the area of the machine to be tested. In either case, the vertical travel of the sphere is (1,3 ± 0,1) m.*

*A **guard** that becomes disassembled is acceptable, if it can be reassembled readily to function properly.*

*Deformation of a **guard** or other part is acceptable, if the part can be readily restored to its original shape.*

*Damage to the machine or a portion of the drive system, other than a **guard** is acceptable, if the machine is incapable of **normal operation**.*

*In addition, for **detachable battery packs** or **separable battery packs** with a mass greater than or equal to 3 kg, the test is repeated on the **battery** packs separately on all surfaces of the **battery** pack.*

*In addition, for **detachable battery packs** or **separable battery packs** with a mass less than 3 kg, the **battery** pack shall withstand being dropped three times on a concrete surface from a height of 1 m. The sample shall be positioned to vary the point of impact.*

NOTE 301 In Europe (EN IEC 62841-4-7), the following additional subclause applies:

K.21.18.Z101 Isolation device

Machines with an **integral battery** shall be equipped with an isolation device to prevent the risk of injury from mechanical hazards during servicing or **user maintenance**.

An isolation device shall

– provide disconnection of at least one pole of the **battery** from the serviceable region of the machine;

– be equipped with an unambiguous indication of the state of the disconnection device which corresponds to each position of its manual control (actuator);

– be provided with protection against accidental reconnection.

NOTE 1 Examples of methods to achieve this disconnection include removable jumpers, **integral batteries** that can be disconnected for servicing or **user maintenance**, or an electromechanical **power switch** (**operator presence control**) with a direct mechanical link between the actuator and the contact.

NOTE 2 The risk of accidental reconnection for a **power switch** (**operator presence control**) is addressed by the requirement of 21.104.2. The other examples in NOTE 1 achieve this by the necessary actions for reconnection.

Compliance is checked by inspection and by manual test.

K.21.30 *Replacement of the first paragraph:*

Handle shafts shall be

– of insulating material; or

– if not of insulating material, electrically isolated from the **tines assembly** by material equivalent to **supplementary insulation**; or

– if not of insulating material,

• covered with insulating material having a thickness of at least 1 mm which extends for a distance of 150 mm from handles and handle mounted **operator controls**; and

• electrically isolated by material equivalent to **supplementary insulation** from other conductive **accessible parts** which are within 75 mm of the ground measured as a clearance or from conductive **accessible parts** connected to such parts.

K.21.102 Subclause 21.102 of this document is not applicable.

K.21.301 For machines with **detachable battery packs** or **separable battery packs**, the disconnection means of the **battery** pack(s) shall be easily accessible with the machine in its normal operating position.

Compliance is checked by inspection.

K.21.302 Disabling device

K.21.302.1 General

Machines with

– **integral batteries**; and

– **detachable battery packs** where the mass of any individual **detachable battery pack** in accordance with IEC 62841-1:2014, K.8.14.2 e) 2) exceeds 5 kg

shall be provided with a **disabling device**.

Machines with

– **detachable battery packs** where the mass of any individual **detachable battery pack** in accordance with IEC 62841-1:2014, K.8.14.2 e) 2) does not exceed 5 kg; and

– **separable battery packs**, including those mounted on the machine

may be provided with a **disabling device**, provided it is identified as a **disabling device** in K.8.14.2 b) 302.

Any **disabling device** shall prevent operation of the **tines** and **traction drive**, if any, when it is removed or operated. The **disabling device** shall not be easily overridden.

The **disabling device** shall be according to either K.21.302.2 or K.21.302.3.

Compliance is checked by inspection.

NOTE 301 In Europe (EN IEC 62841-4-7), the following additional text applies:

In addition, this requirement may be fulfilled by a single device that also fulfils the requirements of an isolation device as specified in K.21.18.Z101.

K.21.302.2 Removable disabling device

When the **disabling device** is removed, it shall not be possible for the **tines** and **traction drive**, if any, to operate.

The **removable disabling device** shall not be permanently attached to the machine.

Compliance is checked by inspection and by manual test.

K.21.302.3 Code protected disabling device

When the machine is disabled by operating the **code protected disabling device**, there shall be a clear and lasting indication that the machine is disabled and it shall not be possible for the **tines** and **traction drive**, if any, to be operated until a specific "key sequence" (e.g. an alpha and/or numerical code of at least 4 characters) has been entered into the key pad.

The machine is not considered to be operating when displaying, communicating, transmitting or storing data (e.g. error codes) whilst the machine is disabled by the **code protected disabling device**.

It shall only be possible to de-activate the **code protected disabling device** from the machine.

It shall not be possible to de-activate the **code protected disabling device** from any remote device.

Compliance is checked by inspection and by manual test.

K.21.303 Except for **batteries** charged by contactless means e.g. solar panels, it shall not be possible to operate the machine whilst the **battery** is being charged, unless the requirements of Annex L are fulfilled.

Compliance is checked by inspection, by practical test and, if applicable, by the requirements of Annex L.

K.21.304 In order to reduce the risk of injury to the operator due to loss of control of the machine, **lawn scarifiers** and **lawn aerators** provided with a **separable battery pack** intended to be supported on the body of an operator in accordance with K.8.14.2 shall be provided with a means to disconnect the **separable battery pack** without operator intervention.

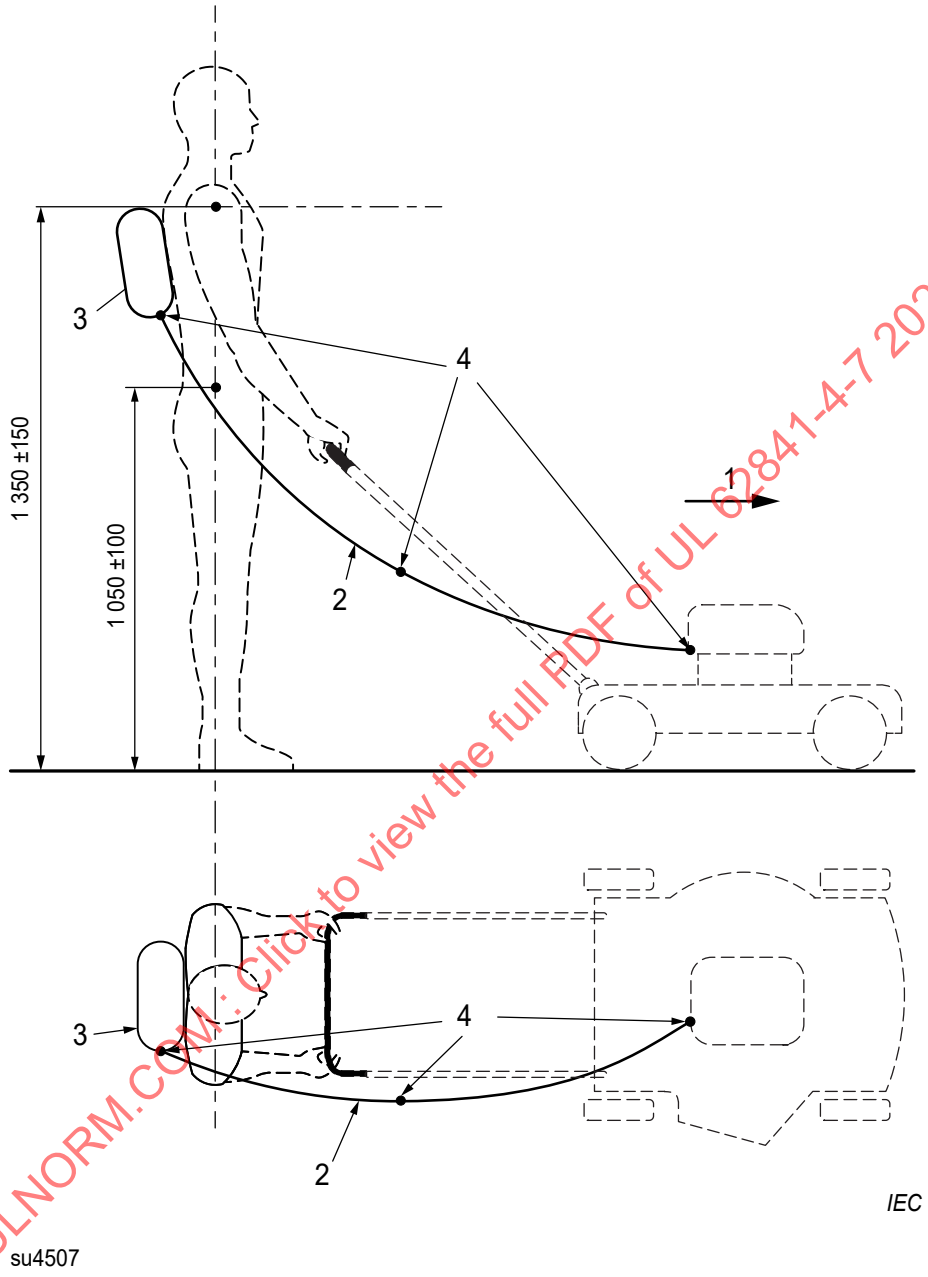
Compliance is checked by the following test.

*A force of not greater than 200 N is gradually applied to the **lawn scarifier** or **lawn aerator** in the direction of forward motion of the **lawn scarifier** or **lawn aerator**. The **separable battery pack** shall be positioned as it would be supported on an operator, as described in 8.14.2, who is positioned as shown in Figure K.301. The **separable battery pack** shall disconnect from the **lawn scarifier** or **lawn aerator**. The connection is not required to be operational after this test.*

*Following the test, the machine and **battery** pack shall not catch fire or explode and shall meet the requirements of IEC 62841-1:2014, Clause K.9, Clause K.19 and K.28.1.*

*Damage to the finish, small dents and cracks which do not reduce **creepage distances** or **clearances** below the values specified in K.28.1, or small chips are neglected.*

Dimensions in millimetres



Key

1 direction of applied force

2 **separable battery pack** cord

3 **separable battery pack**

4 examples of connection points

Figure K.301

Examples of separable battery pack connection points and direction of applied force

K.21.305 **Separable battery packs** that are intended to be supported on the body of an operator in accordance with K.8.14.2 b) 301) shall be provided with a means of support or attachment.

This requirement may be fulfilled by providing a shoulder harness, belt harness or other means of support or attachment.

Any shoulder or belt harness shall be adjustable to the size of the operator and its operation shall be in accordance with K.8.14.2 b) 301).

Shoulder or belt harnesses shall be:

– designed in a way for easy removal; or

– equipped with a quick release mechanism that ensures that the **separable battery pack(s)** can be removed or released quickly from the operator.

The quick release mechanism shall be positioned either at the connection between the **separable battery pack(s)** and harness or between the harness and operator. The quick release mechanism shall only allow separation by deliberate action of the operator. The quick release mechanism shall be designed to open while under the weight of the **separable battery pack(s)**. It shall require the use of only one hand and have no more than two release points.

NOTE 301 An example of a release point is a buckle that requires squeezing between a thumb and finger before releasing, e.g. side release buckles.

A double shoulder harness is considered to be designed in a way for easy removal, if the left and right shoulder straps are not connected to each other in front of the operator's body. If straps to connect between the left and right shoulder straps are provided, it is also considered to be designed in a way for easy removal when the straps connecting between the left and right shoulder straps can be released under the load of the **separable battery pack(s)** by using one hand and have no more than two release points.

The release mechanism shall only allow separation by deliberate action of the operator.

*Compliance is checked by inspection and by functional test using the heaviest **separable battery pack(s)** identified in IEC 62841-1:2014, K.8.14.2 e) 2).*

K.23.1.10 **Power switches** shall have adequate breaking capacity.

*Compliance is checked by subjecting a switch to 50 operation cycles of making and breaking the locked output mechanism current of the **fully charged battery**-operated machine. Each "on" period having a duration of not more than 0,5 s and each "off" period having a duration of at least 10 s.*

*After this test the **power switch** shall have no electrical or mechanical failure. If the switch operates properly in the "on" and "off" positions at the end of the test, it is considered to have no mechanical or electrical failure.*

K.23.1.10.1 Subclause 23.1.10.1 of this document is not applicable.

K.23.1.201 *Replacement of IEC 62841-1:2014, K.23.1.201:*

Power switches (**operator presence controls**) shall withstand, without excessive wear or other harmful effect, the mechanical, electrical, and thermal stresses occurring in the tool.

NOTE 301 **Power switches** for **lawn scarifiers** and **lawn aerators** are covered by the **operator presence control** specified in 21.104.2.

*Compliance is checked by subjecting a **power switch** (**operator presence control**) to 10 000 cycles of operation making and breaking the current encountered in the **fully charged battery** machine operated at no-load. The switch is operated at a uniform rate of 30 operations per minute. During the test, the switch shall operate correctly. After this test, the **power switch** (**operator presence control**) shall have no electrical or mechanical failure. If the switch operates properly in the "on" and "off" positions at the end of the test, it is considered to have no mechanical or electrical failure.*

K.23.301 **Cells** employed in machines or **cells** employed in **battery** packs shall be sealed.

Compliance is checked by inspection.

NOTE 301 The term sealed is understood to indicate that the **cell** contents are not at atmospheric pressure. It does not preclude the use of vents to prevent excessive internal pressure.

K.24 Supply connection and external flexible cords

Clause 24 of this document is not applicable, except as follows:

K.24.301 External flexible cables or cords connecting machines to **separable battery packs** and **interconnection cords** shall have a cord anchorage to prevent strain on the conductors, including twisting, at the terminals and protect the insulation of the conductors from abrasion.

It shall not be possible to push the cord into any enclosure to such an extent that the cord or internal parts could be damaged.

Compliance is checked by inspection, by manual test and by the following test.

A mark is made on the cord while it is subjected to the pull force specified in Table 301, at a distance of approximately 20 mm from the cord anchorage or other suitable point.

The cord is then pulled, without jerking, for 1 s in the most unfavourable direction with a force as specified in Table K.301. The test is carried out 25 times.

The cord, unless on an automatic cord reel, is then subjected to a torque as specified in Table K.301 that is applied as close as possible to the enclosure for 1 min.

After the tests, the cord shall not

– demonstrate tearing of the sheath, covering or sleeving; or

– demonstrate breakage of more than 10 % of the strands of any conductor; or

– show appreciable strain at the terminals; or

– be longitudinally displaced by more than 2 mm.

Table K.301
Pull and torque value

Cord type	Pull N	Torque Nm
External flexible cables or cords connecting machines to **separable battery packs**	100	0,35
Interconnection cords	100	Not applicable

K.24.302 If a machine is supplied with a **separable battery pack**, it shall be possible for the operator to disconnect the **separable battery pack** from the machine without the use of a tool during **normal use**.

Compliance is checked by inspection.

K.24.303 External flexible cables or cords used on machines with **separable battery packs** and **interconnection cords** shall comply with 24.4 or

– have an insulation of the conductor that is adequate for its **working voltage** and temperature; and

– have a covering or sleeving.

Compliance is checked by inspection.

K.28 Creepage distances, clearances and distances through insulation

K.28.1 **Creepage distances** and **clearances** shall not be less than the values in millimetres shown in Table K.1. The **clearances** specified do not apply to the air gap between the contacts of thermal controls, **protective devices**, switches of micro-gap construction, and the like, or to the air gap between the current-carrying members of such devices where the **clearances** vary with the movement of the contacts. **Creepage distances** and **clearances** also do not apply to the construction of **battery cells** or to the interconnections between **cells** in a **battery** pack. The values specified in Table K.1 do not apply to cross-over points of motor windings.

The values in Table K.1 are equal to or larger than the values required by IEC 60664-1, when

– an overvoltage category I;

– a material group III;

– a pollution degree 1 for parts protected against deposition of dirt and for lacquered or enamelled windings;

– a pollution degree 3 for other parts; and

– inhomogeneous electric field

are applied.

Protection against deposition of dirt may be achieved through the use of

– encapsulation with a minimum thickness of 0,5 mm; or

– protective coatings that prevent the combined deposition of fine particles and moisture on surfaces between conductors. Requirements for these types of protective coatings are described in IEC 60664-3:2016; or

– enclosures that prevent the ingress of dust by means of filters or seals, provided that no dust is generated within the enclosure itself.

NOTE 1 An example of encapsulation is potting.

Table K.1
Minimum creepage distances and clearances between parts of different potential

Dimensions in millimetres

Conditions	Working voltage ≤ 15 V		Working voltage > 15 V and ≤ 32 V		Working voltage > 32 V and ≤ 130 V		Working voltage > 130 V and ≤ 280 V		Working voltage > 280 V and ≤ 480 V	
	Creepage distance	Clearance	Creepage distance	Clearance	Creepage distance	Clearance	Creepage distance	Clearance	Creepage distance	Clearance
Switched circuit										
– protected against deposition of dirt	0,8	0,8	1,0	1,0	1,0	1,0	2,0	2,0	2,0	2,0
– not protected against deposition of dirt	0,8 [a]	0,8	1,5	1,5	2,0 [a]	1,5	3,0 [a]	2,5	8,0	3,0
Non-switched circuit										
– protected against deposition of dirt	0,8	0,8	1,5	1,5	1,5	1,5	2,0	2,0	2,0	2,0
– not protected against deposition of dirt	1,1	0,8	1,5	1,5	2,5	1,5	4,0	2,5	8,0	3,0

[a] These **creepage distances** are slightly lower than suggested by IEC 60664-1. **Creepage distances** between parts of different potential (functional insulation) are only associated to fire hazard in the machine, not to electric shock hazard. As products in the scope of IEC 62841 are products supervised during normal use, lower distances are justified.

For parts of different potential in **switched circuits** only, including conductive patterns on printed circuit boards, **creepage distances** and **clearances** smaller than the minimum values specified

– in Table K.1; or

– for conductive patterns on printed circuit boards as specified in the next paragraph

are allowed, provided shorting of the two parts does not result in the machine starting or in a risk of fire in the machine as specified in IEC 62841-1:2014, K.18.1.

For conductive patterns on printed circuit boards, except at their edges, the minimum **creepage distances** and **clearances** in Table K.1 between parts of different potential may be reduced, as long as the peak value of the voltage stress does not exceed:

– 150 V per mm with a minimum value of 0,2 mm, if protected against the deposition of dirt;

– 100 V per mm with a minimum value of 0,5 mm, if not protected against the deposition of dirt.

When the limits mentioned in the above paragraph lead to higher values than those of Table K.1, the values of Table K.1 apply.

NOTE 2 The above values are equal to or larger than the values required by IEC 60664-3:2016.

For parts having a **hazardous voltage** between them, the sum total of the measured distances between each of these parts and their nearest accessible surface shall not be less than the values shown in Table K.2.

NOTE 3 IEC 62841-1:2014, Figure K.1 provides clarification on the measurement method.

Table K.2
Minimum total sum of creepage distances and clearances to accessible surfaces

Dimensions in millimetres

Hazardous voltage with a working voltage of					
≤ 130 V		> 130 V and ≤ 280 V		> 280 V and ≤ 480 V	
Creepage distance	Clearance	Creepage distance	Clearance	Creepage distance	Clearance
5,0	1,5	8,0	3,0	16,0	4,0

Creepage distances and **clearances** for **working voltages** greater than those shown in this Subclause K.28.1 shall be determined from the application of IEC 60664-1.

Compliance is checked by measurement.

*The way in which **creepage distances** and **clearances** are measured is indicated in IEC 62841-1:2014, Annex A.*

Distances through slots or openings in external parts of insulating material are measured to the metal foil in contact with the accessible surface; the foil is pushed into corners and the like by means of the standard test probe B of IEC 61032:1997, but is not pressed into openings.

*The sum total of distances measured between parts operating at **working voltage** that is a **hazardous voltage** and accessible surfaces is determined by measuring the distance from each part to the accessible surface. The distances are to be added together to determine the sum total. See IEC 62841-1:2014, Figure K.1.*