



BSI Standards Publication

## Garden equipment - Safety requirements for combustion-engine-powered lawnmowers

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Part 1: Terminology and common tests

## National foreword

This British Standard is the UK implementation of EN ISO 5395-1:2013+A1:2018. It is identical to ISO 5395-1:2013, incorporating amendment 1:2017. It supersedes BS EN ISO 5395-1:2013, which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to ISO text carry the number of the ISO amendment. For example, text altered by ISO amendment A1 is indicated by A1 A1.

The UK participation in its preparation was entrusted to Technical Committee AGE/20, Powered lawn and garden equipment.

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

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English Version

**Garden equipment - Safety requirements for combustion-engine-powered lawnmowers - Part 1: Terminology and common tests (ISO 5395-1:2013)**

Matériel de jardinage - Exigences de sécurité pour les tondeuses à gazon à moteur à combustion interne - Partie 1: Terminologie et essais communs (ISO 5395-1:2013)

Gartengeräte - Sicherheitsanforderungen für verbrennungsmotorisch angetriebene Rasenmäher - Teil 1: Begriffe und allgemeine Prüfverfahren (ISO 5395-1:2013)

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**CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels**

## European foreword

This document (EN ISO 5395-1:2013) has been prepared by Technical Committee ISO/TC 23 “Tractors and machinery for agriculture and forestry” in collaboration with Technical Committee CEN/TC 144 “Tractors and machinery for agriculture and forestry” the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 2014, and conflicting national standards shall be withdrawn at the latest by September 2014.

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

This document supersedes EN 836:1997+A4:2011.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive.

For relationship with EU Directive, see informative [Annex ZA](#), which is an integral part of this document.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

### Endorsement notice

The text of ISO 5395-1:2013 has been approved by CEN as EN ISO 5395-1:2013 without any modification.

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## Foreword to amendment A1

This document (EN ISO 5395-1:2013/A1:2018) has been prepared by Technical Committee ISO/TC 23 “Tractors and machinery for agriculture and forestry” in collaboration with Technical Committee CEN/TC 144 “Tractors and machinery for agriculture and forestry” the secretariat of which is held by AFNOR.

This Amendment to the European Standard EN ISO 5395-1:2013 shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2018, and conflicting national standards shall be withdrawn at the latest by November 2018.

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This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative [Annex ZA](#), which is an integral part of this document.

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**Endorsement notice**

The text of ISO 5395-1:2013/Amd 1:2017 has been approved by CEN as EN ISO 5395-1:2013/A1:2018 without any modification.

## Annex ZA (informative)

### Relationship between this European Standard and the essential requirements of Directive 2006/42/EC aimed to be covered

This European Standard has been prepared under a Commission's standardization request "M/396 Mandate to CEN and CENELEC for Standardization in the field of machinery" to provide one voluntary means of conforming to essential requirements of Directive 2006/42/EC of the European Parliament and of the Council of 17 May 2006 on machinery, and amending Directive 95/16/EC (recast).

Once this standard is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of this standard given in [Table ZA.1](#) confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding essential requirements of that Directive, and associated EFTA regulations.

**Table ZA.1 — Correspondence between this European Standard and Annex I of Directive 2006/42/EC**

| Essential Requirements of Directive 2006/42/EC                                 | Clause(s)/sub-clause(s) of this EN | Remarks/Notes                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------------------------------------------------------------------|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Within the limits of the scope all relevant essential requirements are covered | All normative clauses              | <p>The main function of EN ISO 5395-1 is to provide test procedures for the verification of the requirements of EN ISO 5395-2 or EN ISO 5395-3, as appropriate.</p> <p>Compliance with EN ISO 5395-1 together with either EN ISO 5395-2 or EN ISO 5395-3, as appropriate, is necessary to achieve presumption of conformity with the relevant essential requirements of Directive 2006/42/EC.</p> |

**WARNING 1** — Presumption of conformity stays valid only as long as a reference to this European Standard is maintained in the list published in the Official Journal of the European Union. Users of this standard should consult frequently the latest list published in the Official Journal of the European Union.

**WARNING 2** — Other Union legislation may be applicable to the product(s) falling within the scope of this standard.

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## Foreword

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

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

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

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

ISO 5395-1 was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 144, *Tractors and machinery for agriculture and forestry* in collaboration with ISO Technical Committee TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 13, *Powered lawn and garden equipment*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition of ISO 5395-1, together with ISO 5395-2 and ISO 5395-3, cancels and replaces ISO 5395:1990, which has been technically revised. These three parts also incorporate the Amendment ISO 5395:1990/Amd.1:1992.

ISO 5395 consists of the following parts, under the general title *Garden equipment — Safety requirements for combustion-engine-powered lawnmowers*

- *Part 1: Terminology and common tests*
- *Part 2: Pedestrian-controlled lawnmowers*
- *Part 3: Ride-on lawnmowers with seated operator*

## Introduction

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

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

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

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# Garden equipment - Safety requirements for combustion-engine-powered lawnmowers —

## Part 1: Terminology and common tests

### 1 Scope

This part of ISO 5395 specifies terminology and common test methods used for verification of safety requirements for combustion engine powered rotary lawnmowers and cylinder lawnmowers including pedestrian-controlled (with or without sulky) and ride-on types (hereafter named “lawnmower”), and equipped with:

- metallic cutting means and/or;
- non-metallic cutting means with one or more cutting elements pivotally mounted on a generally circular drive unit, where these cutting elements rely on centrifugal force to achieve cutting, and have a kinetic energy for each single cutting element of 10 J or more.

This document does not apply to:

- robotic and remote-controlled lawnmowers, flail mowers, grassland mowers, sickle bar mowers, towed/semi-mounted grass cutting machines, and scrub-clearing machines;
- cutting-means assembly when used in combination with an agricultural tractor;
- electrically powered and battery-powered lawnmowers.

NOTE IEC 60335-1[1] together with IEC 60335-2-77[2] give requirements for pedestrian-controlled walk-behind electrically powered lawnmowers.

This document is not applicable to lawnmowers which are manufactured before the date of publication of this document.

### 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1032:2003+A1:2008, *Mechanical vibration — Testing of mobile machinery in order to determine the vibration emission value*

IEC 61672-1:2002, *Electroacoustics — Sound level meters — Part 1: Specifications*

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

ISO 683-9:1988, *Heat-treatable steels, alloy steels and free-cutting steels — Part 9: Wrought free-cutting steels*

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 4871, *Acoustics — Declaration and verification of noise emission values of machinery and equipment*

ISO 5008:2002, *Agricultural wheeled tractors and field machinery — Measurement of whole-body vibration of the operator*

ISO 5008:2002/Cor 1:2005, *Agricultural wheeled tractors and field machinery — Measurement of whole-body vibration of the operator — Technical Corrigendum 1*

ISO 5349-1, *Mechanical vibration — Measurement and evaluation of human exposure to hand-transmitted vibration — Part 1: General requirements*

ISO 5395-2:2013, *Garden equipment — Safety requirements for combustion-engine-powered lawnmowers — Part 2: Pedestrian-controlled lawnmowers*

ISO 5395-3:2013, *Garden equipment — Safety requirements for combustion-engine-powered lawnmowers — Part 3: Ride-on lawnmowers with seated operator*

ISO 8041, *Human response to vibration — Measuring instrumentation*

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*

ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction*

ISO 16063 (all parts), *Methods for the calibration of vibration and shock transducers*

ISO 20643:2005, *Mechanical vibration — Hand-held and hand-guided machinery — Principles for evaluation of vibration emission*

ISO 20643:2005/Amd.1:2012, *Mechanical vibration — Hand-held and hand-guided machinery — Principles for evaluation of vibration emission — Amendment 1: Accelerometer positions*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12100 and the following apply.

#### 3.1 attachment

device designed for mounting only on a specific machine to perform a specific task related to mowing and not intended to be universally adaptable to other lawnmowers

#### 3.2 brake steering

steering achieved by applying a decelerating force to the traction drive on one side of the lawnmower with the drive to the other side still applied

#### 3.3 clutch steering

steering achieved by disconnecting the traction drive to one side of the lawnmower with the drive to the other side still fully engaged

#### 3.4 cutting means

mechanism or part of the lawnmower that is designed to perform the cutting action

#### 3.5 cutting-means assembly

cutting means together with the cutting-means enclosure, including cutting-means shaft(s) and guide wheels/slides

### 3.6

#### **cutting-means control**

device to disengage the cutting means from its drive and stop the cutting-means motion while keeping the engine running

### 3.7

#### **cutting-means enclosure**

part or assembly, including the discharge chute and guard for grass catcher opening, designed to prevent unintended contact with the cutting means

### 3.8

#### **cutting-means tip circle**

path determined by the outer-most point of the cutting-means cutting edge as it rotates about its axis

### 3.9

#### **cutting-means stopping time**

interval from the instant of release of the cutting-means operator-presence control or disengagement of the cutting-means control until the cutting means have stopped

### 3.10

#### **cutting width**

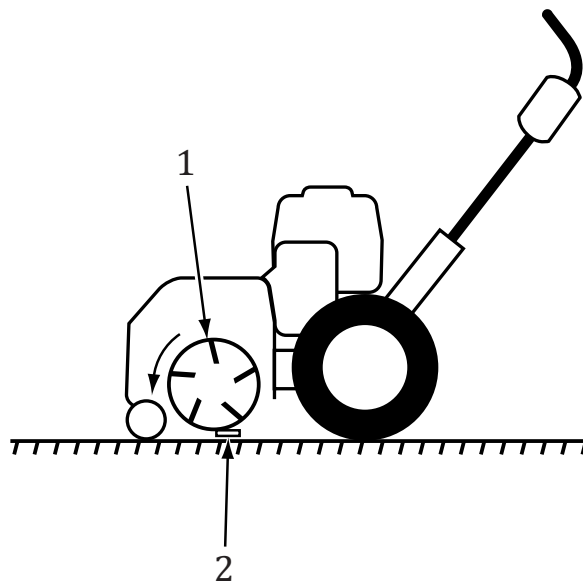
total distance across the cutting-means path at a right angle to the direction of travel

### 3.11

#### **cylinder lawnmower**

lawnmower with one or more cutting means, rotating about an axis parallel to a supporting surface, that provide a shearing action with a fixed cutter bar

Note 1 to entry: See example in [Figure 1](#).



#### **Key**

- 1 cutting means
- 2 cutter bar

**Figure 1 — Example of cylinder lawnmower cutting means**

### 3.12

#### **discharge chute**

portion of the cutting-means enclosure, extending outward from the discharge opening, designed to control the ejection of material from the cutting means

### 3.13

#### **discharge opening**

opening in the cutting-means enclosure through which cut grass is ejected

### 3.14

#### **flail mower**

mower with a multiplicity of free-swinging cutting elements that rotate about a horizontal axis, which cuts the grass by impact and mulches it with the same tools

[SOURCE: ISO 17101-1:2012, definition 3.2]

### 3.15

#### **grass catcher**

part or combination of parts, intended to be used with the lawnmower, which provides a means for collecting grass clippings

[SOURCE: ISO 11094:1991, modified]

### 3.16

#### **grassland mower**

mower with a cutting means rotating about a vertical axis for cutting or mulching high grass, having a minimum cutting height of 50 mm, the cutting-means enclosure of which is not fully enclosed

### 3.17

#### **hydrostatic bypass valve**

device designed to allow a hydrostatically-driven lawnmower to be moved without the engine running

### 3.18

#### **lever steer lawnmower**

lawnmower in which steering, traction-drive engagement, and speed-control functions are combined and controlled by hand-operated lever(s), which can also control the braking function

### 3.19

#### **maximum operating engine speed**

highest engine speed that can be attained with the operator control and with the cutting means engaged

### 3.20

#### **mulching lawnmower**

rotary lawnmower which returns clippings to the lawn without a discharge opening

### 3.21

#### **nominal power**

power at the maximum operating engine speed

Note 1 to entry: The power is expressed in kilowatts (kW).

### 3.22

#### **normal operation**

use of the machine, by the operator, which is reasonably foreseeable and which is consistent with such activities as starting, cutting grass, stopping, fuelling, connecting to (or disconnecting from) a power source, emptying the grass catcher, driving and mounting or dismounting ride-on machines

### 3.23

#### **normal use**

normal operation, routine maintenance, servicing, cleaning, transporting, storage, attaching or removing attachments, and making routine adjustments

### **3.24**

#### **operator position**

position of the operator holding the handles behind a pedestrian-controlled lawnmower or riding and holding the steering device on a ride-on lawnmower or pedestrian-controlled lawnmower equipped with a sulky

### **3.25**

#### **operator-presence control**

##### **OPC**

device that automatically interrupts power to a drive when the operator's actuating force is removed

### **3.26**

#### **parking brake**

device to prevent a stopped machine from moving

### **3.27**

#### **pedestrian-controlled lawnmower**

lawnmower, with or without traction drive, designed to be controlled by the operator walking behind the machine or from an attached sulky

### **3.28**

#### **pivoting handle**

handle which is foldable for storage or park position

### **3.29**

#### **lawnmower**

lawn-cutting machine, powered by a combustion engine, where the cutting means operates in a plane approximately parallel to the ground and which uses the ground to determine the height of cut by means of wheels, air-cushion or skids, etc.

### **3.30**

#### **ride-on lawnmower**

self-propelled lawnmower on which an operator rides

### **3.31**

#### **robotic lawnmower**

unattended lawnmower that operates automatically

### **3.32**

#### **roll-over protective structure**

##### **ROPS**

structure designed to minimize the likelihood of crushing injury to the operator resulting from accidental roll over of the machine with the operator in the normal operator position

### **3.33**

#### **rotary lawnmower**

lawnmower in which one or more cutting means, cutting by impact, rotate about an axis perpendicular to the cutting plane

### **3.34**

#### **scrub-clearing machine**

powered mower, with cutting means rotating about a vertical axis, designed for cutting scrub and woody vegetation, with no ground support forward of the cutting means and supported on either side by skids, not wheels

### **3.35**

#### **service brake system**

means for decelerating and stopping a machine from its ground travel speed

### **3.36**

#### **sickle bar mower**

powered mower that reciprocates a knife or knives to provide a shearing action with a stationary cutter bar or movable knife

### **3.37**

#### **stability**

ability of a lawnmower to resist overturning as a result of static or dynamic forces arising in normal use, e.g. travelling on slopes

[SOURCE: ISO 5053:1987, modified]

### **3.38**

#### **stopping distance**

distance travelled between the point of the first application of the service brake control and the point at which the machine motion stops

### **3.39**

#### **sulky**

removable trailing platform with wheels, rollers or skids designed to carry an operator while controlling a self-propelled pedestrian-controlled lawnmower

### **3.40**

#### **swing-over handle**

handle which allows two opposite operator positions without turning the machine

### **3.41**

#### **throw line**

steepest line in a vertical plane, tangential to the periphery of the cutting cylinder in the direction of rotation, which does not intersect a guard or other components of a cylinder lawnmower

### **3.42**

#### **transport position**

designated position of the cutting means during movement between work locations

### **3.43**

#### **zero-turn lawnmower**

ride-on lawnmower that can pivot 360° about the midpoint between the drive wheels

## **4 Common test methods**

**4.1** If not otherwise specified within this document, the tests may be carried out in any order and on separate machines, cutting-means enclosures, and cutting-means components.

When the order in which tests should be carried out and the number of permitted machines are not defined in this part of ISO 5395, these conditions should be determined by agreement between the persons carrying out the tests and the manufacturer. Descriptions of a number of common test methods applicable to both pedestrian-controlled lawnmowers and ride-on lawnmowers are included in the annexes of this part of ISO 5395.

**4.2** The following test methods are applicable to rotary lawnmowers only:

- cutting-means impact test as given in [Annex B](#);
- foot protection test as given in [Annex C](#);
- structural integrity test as given in [Annex D](#);
- thrown object test as given in [Annex E](#).

**4.3** The following test methods are applicable to both rotary lawnmowers and cylinder lawnmowers:

- cutting-means stopping time and durability test as given in [Annex A](#);
- noise test code as given in [Annex F](#);
- whole-body vibration and hand-arm vibration at the handles as given in [Annex G](#);
- determination of hot surfaces as given in [Annex H](#).

## Annex A (normative)

### Lawnmower cutting-means stopping time test

#### A.1 General

This annex specifies the method to measure the stopping time of cutting means.

#### A.2 Test object

The test shall be carried out on a lawnmower equipped with the cutting means to be tested. If the lawnmower has alternative cutting means available, it shall be tested with the cutting means which produces the longest stopping time.

#### A.3 Apparatus

**A.3.1 Rotational speed indicator**, with a rotating speed reading inaccuracy of  $\pm 2,5$  %.

**A.3.2 Time recording device.**

**A.3.2.1 Stopwatch**, in cases where the results obtained are at least 0,3 s less than the allowed cutting-means stopping time.

**A.3.2.2 Automatic time recording device**, with an inaccuracy of  $\pm 2,5$  % of the maximum allowed stopping time and including devices according to [A.3.2.2.1](#) and [A.3.2.2.2](#).

**A.3.2.2.1 Device**, for registering the moment of release of the cutting-means operator-presence control or operation of the control.

**A.3.2.2.2 Device**, for registering the movement of the cutting means with at least 36 inputs per revolution.

#### A.4 Test condition and lawnmower preparation

The ambient temperature shall be between 15 °C and 35 °C.

The lawnmower shall be mounted and instrumented in such a manner that the results of the test are not affected. If an external starting device is used, it shall not influence the results.

Prior to the test the lawnmower shall be assembled and adjusted according to the instruction handbook.

Knives of cylinder lawnmowers shall be lubricated. For cylinder lawnmowers, the rotating cutting cylinder(s) and/or the stationary cutting edge(s) shall be adjusted such that either:

- a sheet of Kraft paper, of nominal 80 g/m<sup>2</sup> construction, is cut at least along 50 % of the width of cut, or
- the gap between moving and stationary cutting means at standstill does not exceed 0,15 mm over the whole width of cut when checked with calibrated strip gauges.

The lawnmower shall be operated for 15 min. During this 15 min period, the cutting-means control shall be operated 10 times at maximum operating engine speed.

For cylinder lawnmowers, care shall be taken to avoid overheating the cutting means by operating continuously (without cutting grass) and therefore appropriate interruptions for cooling and lubrication can be introduced.

## A.5 Cutting-means stopping time

Stopping time is measured from the moment of release of the OPC or disengagement of the cutting-means control to when the cutting means are deemed to have stopped, which for an automatic time recording device is the time at which the automatic time recording device received its last input.

An automatic time recording device shall be used when measurement by other means can result in a measured stopping time within 0,3 s of the maximum permitted stopping time.

## A.6 Test procedure

The lawnmower shall be operated at maximum operating engine speed. The maximum operating engine speed shall be checked before testing. If the measured maximum operating engine speed is outside the value specified in the instruction handbook, the engine speed shall be adjusted in accordance with the manufacturer's instructions.

The means of operating the lawnmower during the test shall be such that the OPC or the cutting-means control is released abruptly from the full "on" position and it returns to the "idle" or "off" position by itself.

The lawnmower cutting means shall be subjected to 5 000 stop/start cycles. The 5 000 test cycles are not required to be continuous. The lawnmower shall be maintained and serviced in accordance with the manufacturer's instructions throughout the test. There shall be no maintenance or adjustment after 4 500 cycles have been completed.

For lawnmowers with an engine stop OPC and separate cutting-means control, only the separate cutting-means control (not the engine stop OPC) shall be tested 5 000 cycles according to this section.

Each cycle shall consist of the following sequence:

- a) accelerate the cutting means from rest to the maximum operating engine speed;
- b) hold it at this speed for a short time to ensure that it is stable;
- c) disengage/release the cutting-means control;
- d) allow a short time at rest before commencing the next cycle.

This test is not representative of normal operation and therefore the cycle times shall be set to avoid unnecessary wear or damage to the lawnmower.

The cutting-means stopping time shall be measured for each of the following:

- the first five cycles of the 5 000 cycle test sequence (not including the 10 preparatory operations); and
- each of the last five cycles prior to any brake maintenance or adjustment carried out during the test; and
- the last five cycles of the 5 000 test cycles.

No other cutting-means stopping times need to be recorded.

If the test sample fails to complete the full number of cycles but otherwise meets the requirements of this test, either the lawnmower can be repaired, if the brake mechanism is not affected, and the test