BRITISH STANDARD

BS EN 15503:2009
+A2:2015

Garden equipment — Garden blowers, vacuums and blower/ vacuums — Safety

ICS 65.060.70

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BSI
British Standards

National foreword

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The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to CEN text carry the number of the CEN amendment. For example, text altered by CEN 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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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 November 2009

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Amendments/corrigenda issued since publication

Date	Comments
31 March 2014	Implementation of CEN amendment A1:2013
31 January 2016	Implementation of CEN amendment A2:2015

ISBN 978 0 580 82482 1

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 15503:2009+A2

December 2015

ICS 65.060.70

Supersedes EN 15503:2009+A1:2013

English Version

Garden equipment - Garden blowers, vacuums and blower/vacuums - Safety

Matériel de jardinage - Souffleurs, aspirateurs et aspirateurs-souffleurs de jardin - Sécurité

Gartengeräte - Blasgeräte, Sauggeräte und Blas-/Sauggeräte für den Garten - Sicherheit

This European Standard was approved by CEN on 22 September 2009 and includes Amendment 1 approved by CEN on 7 September 2013 and Amendment 2 approved by CEN on 7 November 2015.

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Ref. No. EN 15503:2009+A2:2015 E

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European foreword

This document (EN 15503:2009+A2:2015) has been prepared by 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of an identical text or by endorsement, at the latest by June 2016, and conflicting national standards shall be withdrawn at the latest by June 2017.

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This document includes Amendment 1 approved by CEN on 2013-09-07 and Amendment 2 approved by CEN on 2015-11-07.

This document supersedes ⟦A2⟩ EN 15503:2009+A1:2013 ⟨A2⟧.

The start and finish of text introduced or altered by amendment is indicated in the text by tags ⟦A1⟩ ⟨A1⟧ and ⟦A2⟩ ⟨A2⟧.

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).

⟦A1⟩ For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document. ⟨A1⟧

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Introduction

This European Standard is a type C standard as stated in EN ISO 12100.

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

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

1 Scope

This European Standard specifies the safety requirements and their verification for the design and construction of hand-held combustion engine powered and back-pack combustion engine powered, garden vacuums and garden blower/vacuums with or without shredding means and garden blowers, designed for one operator only. In addition, it specifies the type of information on safe working practices (including residual risks) to be provided by the manufacturer.

Throughout this European Standard the term 'machine' is used to mean all the types of garden blowers and vacuums covered by it.

This European Standard deals, with all hazards, hazardous situations and events relevant to these machines when they are used as intended and under the conditions foreseen by the manufacturer (see Clause 4), except for:

— vibration of backpack machines;

— structural integrity for blowers and blower vacuums;

— strength for harnesses and back-pack supports.

This European Standard is not applicable to:

— walk-behind, hand-guided (support-wheeled) and ride-on machines;

— mains driven and battery powered blowers and vacuums of combinations thereof;

NOTE EN 60335-1 [1] and IEC 60335-2-100 [2] give the safety requirements for mains driven blowers and blower vacuums, vacuum cleaners for household and industrial use.

This European Standard is not applicable to machines which are manufactured before the date of its publication as EN.

2 Normative references

〚A1〛 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. 〚/A1〛

EN 1088〚A1〛 *deleted text* 〚/A1〛, *Safety of machinery — Interlocking devices associated with guards — Principles for design and selection*

EN 14930:2007, *Agricultural and forestry machinery and gardening equipment — Pedestrian controlled and hand-held machines — Determination of accessibility of hot surfaces*

EN ISO 3744:2009, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Engineering method in an essentially free field over a reflecting plane (ISO 3744:1994)*

EN ISO 4871:2009, *Acoustics — Declaration and verification of noise emission values of machinery and equipment (ISO 4871:1996)*

EN ISO 11201:2009, *Acoustics — Noise emitted by machinery and equipment — Measurement of emission sound pressure levels at a work station and at other specified positions — Engineering method in an essentially free field over a reflecting plane (ISO 11201:1995, including Cor 1:1997)*

〈A1〉 EN ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction* 〈A1〉

EN ISO 13849-1:2008, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design (ISO 13849-1:2006)*

EN ISO 13857:2008, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs (ISO 13857:2008)*

EN ISO 22867:2008, *Forestry machinery — Vibration test code for portable hand-held machines with internal combustion engine — Vibration at the handles (ISO 22867:2004, including Cor 1:2006)*

EN ISO 22868:2008, *Forestry machinery — Noise test code for portable hand-held machines with internal combustion engine — Engineering method (Grade 2 accuracy) (ISO 22868:2005)*

IEC 60068-2-75:1997, *Environmental testing — Part 2: Tests — Test Eh: Hammer tests*

IEC 61032:1997, *Protection of persons and equipment by enclosures — Probes for verification*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in 〈A1〉 EN ISO 12100:2010 〈A1〉 and the following apply:

3.1
garden blower
machine which moves debris by the force of blasting air

3.2
back-pack powered blower
garden blower designed to have the power source carried on the operator's back by means of a supporting device consisting of a frame and harness

3.3
back-pack powered vacuum
garden vacuum designed to have the power source and collector carried on the operator's back by means of a supporting device

3.4
debris
organic material of vegetable origin such as leaves and grass clippings

3.5
debris collector
part or combination of parts of the machine designed to contain the debris

3.6
dirty fan construction
construction where the debris being collected passes the air-moving fan

3.7
garden vacuum
machine which collects debris into a debris collector by means of air suction

3.8
guard
physical barrier, designed as part of the machine, to provide protection

3.9
handle
part of the machine designed for holding or carrying the machine during normal use

3.10
hand-held garden blower
garden blower designed to be held by hand, possibly assisted by a harness

3.11
hand-held garden vacuum
garden vacuum held by hand, possibly assisted by a harness

3.12
normal operation
use of the machine which is reasonably foreseeable, and which is consistent with operating, i.e. starting, stopping and re-fuelling

3.13
normal use
normal operation, plus routine maintenance, servicing, cleaning, transporting, attaching or removing accessories, and making ordinary adjustments as determined by the manufacturer's instructions

3.14
operator control
part of the machine requiring operator actuation

3.15
shredding means
means designed to cut debris into smaller pieces

3.16
throttle locking device
device for temporarily arresting the throttle in a partially open position, to aid (assist) starting

3.17
throttle setting device
arrest device allowing the throttle to be temporarily fixed in and released from any required position to ease working with the machine over a period of time

〚A2〛

3.18
tortuous path
design principle which prevents access for fingers by requiring their joints and those of wrist and elbow to adopt orientations/articulations which are beyond their natural range of movements 〈A2〉

4 List of significant hazards

For the purposes of this European Standard, Table 1 gives, for defined danger zones, all the significant hazards, the significant hazardous situations and events covered by this European Standard, that have been identified by risk assessment as being significant for this type of machine, and which require specific action to eliminate or to reduce the risk

The attention is drawn to the necessity to verify that the safety requirements specified in this European Standard apply to each significant hazard presented by a given machine and to validate that the risk assessment is complete with particular attention to:

— the intended use of the machine including maintenance, setting and cleaning and its reasonably foreseeable misuse;

— the identification of all significant hazards associated with the machine.

Table 1 — List of significant hazards associated with hand-held integrally powered garden vacuums and garden blower/vacuums with or without shredding means and garden blowers

Ref. Nr.	Hazard	Location or event	Reference of this European Standard
Hazards, hazardous situations and hazardous events			
1	**Mechanical hazards** due to		
1.1	Inadequacy of mechanical strength	Ejection of sucked up parts or broken parts through fan housing Weakening fan housing by overheating of motor compartment	5.4, 5.5,
1. 2	Shearing, cutting, severing, entanglement, drawing-in or trapping hazard	Contact with shredding means or fan	5.1, 5.6.1, 6.1, 6.2, 6.3 and Annex C
2	**Electrical hazards** due to:		
2.1	Contact with live parts under high voltage	Contact with HT ignition parts	5.11.2
3	**Thermal hazards**, resulting in:		
3.1	Burns, scalds and other injuries by a possible contact of persons with objects or materials with an extreme high or low temperature, by flames or explosions and also by the radiation of heat sources	Contact with cylinder or exhaust pipe	5.3
4	**Hazards generated by noise**, resulting in:		
4.1	Hearing loss (deafness), other physiological disorders (e.g. loss of balance, loss of awareness) Interference with speech, communication and warning signals.	Noise emitted by the machine Operator not being aware of surrounding or not noticing important information	5.8, 6.1, 6.2, 6.3 and Annex A
5	**Hazards generated by vibration**		

Ref. Nr.	Hazard	Location or event	Reference of this European Standard
5.1	Use of hand-held machines resulting in a variety of neurological and vascular disorders	Vibrations transmitted by the machine	5.9, 6.1 and Annex B
6	**Hazards generated by materials and substances** (and their constituent elements) used by the machinery		
6.1	Hazards from contact with or inhalation of harmful fluids, gases, mists, fumes, and dusts	Contact with fuel Inhalation of exhaust fumes	5.10
6.2	Fire or explosion hazard	Fuel coming into contact with hot parts	5.11
A1 **7** A1	**Hazards requiring application of ergonomic principles in machinery design** from:		
7.1	Unhealthy postures or excessive effort	Heavy and voluminous machines	5.6.3, 5.13.2 and 6.1
7.2	Inadequate consideration of hand-arm or foot-leg anatomy	Handling of machine and position of handgrips	5.6.2
7.3	Neglected use of personal protective equipment	Ejection of particles from the discharge opening of the machine Hot parts of the machine Noise emitted from the machine	6.1 and Annex C
7.4	Inadequate design, location or identification of manual controls	Handgrips and throttle setting device	5.6.1, 6.2
8	**Unexpected start-up, unexpected over-run/over-speed** from:		
8.1	Errors made by the operator (due to mismatch of machinery with human characteristics and abilities)	Use of a machine without a harness	6.1
9	**Break-up during operation**	Broken fan and/or shredding means	5.5
10	**Ejected objects**	Objects ejected from the discharge opening of the machine	5.5

5 Safety requirements and/or protective measures

5.1 General

The machine shall comply with the safety requirements and/or protective measures of this Clause.

In addition, the machine shall be designed according to the principles of EN ISO 12100 for relevant but not significant hazards, which are not dealt with by this document (e.g. sharp edges of the machine frame).

A1 NOTE For guidance in connection with risk reduction by design, see 6.2 of EN ISO 12100:2010 and for safeguarding measures, see 6.3 of EN ISO 12100:2010. A1

Parts are considered stable when conditioned in the location where testing is carried out for a period of 24 hours and the ambient temperature is maintained at not less than 15°C.

Machines shall also be marked according to 6.2 and carry warnings according to 6.3.The instruction handbook to be provided with the machine shall comply with 6.1.

5.2 All machines

〚A2〛 Infeed openings and discharge openings shall be guarded to prevent contact with hazardous moving parts during normal operation:

a) For straight line access, compliance with EN ISO 13857:2008, 4.2.4.1 and 4.2.4.3;

b) For protection provided by a tortuous path, there shall be no contact with hazardous moving parts when applying both arm probes of Figure D.1 as described in Annex D. 〚A2〛

〚A2〛 Guards shall be either:

a) fixed guards, detachable only with the use of a tool; or

b) interlocking guards detachable without tools; or

c) Automatically closing guards that are retained automatically in the closed position and shall only be removed or released by the use of a tool.

When the guard needs to be removed as part of routine cleaning, setting or maintenance procedures that are described in the instruction handbook and intended to be performed by the user, their fixing system shall be permanently attached to the guard and/ or the machine.

The safety-related control system of interlocked guards shall conform to well-tried principles and apply well-tried components.

A "well-tried component" for a safety-related application is a component which has been either

a) widely used in the past with successful results in similar applications, or

b) made and verified using principles which demonstrate its suitability and reliability for safety related applications.

Newly developed components and safety principles may be considered as equivalent to "well-tried" if they fulfil the conditions of b). 〚A2〛

Compliance is checked by inspection and measurement.

5.3 Hot parts guarding

Any metallic surface of the machine that has a temperature of over 80 ºC, or plastic part that has a temperature of over 94 ºC, shall be considered as a hot surface.

Such surfaces shall be guarded or designed so that the test acceptance in EN 14930 is met.

Surface temperature and compliance shall be determined in accordance with EN 14930.

The inside and the end of the exhaust pipe are not considered accessible hot parts and therefore do not have to pass the test of EN 14930.

5.4 Fan housing strength and rigidity

5.4.1 Requirements

The fan housing including all detachable and movable guards shall have adequate mechanical strength and be constructed to withstand such rough handling that may be expected in normal use.

Compliance shall be checked by the test in 5.4.2.

5.4.2 Fan housing strength and rigidity test of hand-held and backpack powered machines

The machine is rigidly supported and three blows are applied to every point of the fan housing that is likely to be weak with an impact energy of 1,0 J ± 0,05 J by means of the spring hammer as specified in IEC 60068-2-75:1997.

To ensure that the machine is rigidly supported, it may be placed against a solid wall of brick, concrete or similar material. In that case a sheet of polyamide is tightly fixed to the wall, care being taken to ensure that there is no appreciable air gap between the sheet and the wall. The sheet shall have a Rockwell hardness of HR 100, a thickness of at least 8 mm and be sufficiently large to ensure that all parts of the machine are supported.

No parts of the fan housing that are necessary for compliance with the requirements of this European Standard shall have become detached and no visible cracks shall have developed in these parts. It is not necessary for the machine to be operable after the test but, if it is operable, then immediately following this test, it shall be run at its maximum speed for 30 s and again, no parts of the machine that are necessary for safe operation shall become detached and no visible cracks shall have developed in these parts.

If there is doubt as to whether a defect has occurred by the application of the preceding blows, this defect is neglected and the group of three blows is applied to the same place on a new sample which shall then withstand the test.

If an inner cover is protected by a decorative cover, the test shall be done with the decorative cover removed

Damage to the finish, small dents and small chips that do not adversely affect the function of the guard are ignored.

Cracks not visible to the naked eye are ignored.

5.5 Structural integrity of vacuums

5.5.1 Requirements

The machine shall have sufficient structural integrity to withstand the rigours of normal operation and break- up of the fan.

No part of the machine shall have become detached and there shall be no visible holes, tears or cracks in the enclosure surrounding moving parts or in the debris collector.

Compliance shall be checked by the test in 5.5.2.

5.5.2 Structural integrity test

A structural integrity test shall be carried out on all machines by vacuuming up ceramic prisms with triangular sides and a prism height of 6,5 mm ± 0,8 mm and a mass of 0,4 g ± 0,02 g (see Figure 1).

For machines the vacuum power of which is not capable of sucking up a sample prism the test does not apply.

If the machine has a removable facility for shredding, the machine shall be tested with and without this facility.

One kilogram of the ceramic prisms shall be placed closely packed together in a single layer on a smooth flat hard surface. The machine shall be run at the maximum attainable speed. The in feed opening shall be held as closely as possible to the prisms The prisms shall be sucked up as quickly as possible for 30 s. The prisms shall be collected in the debris collector.

After the ceramic prisms have been ingested the machine shall be run for 30 s more before being turned off.

5.6 Handles and controls

5.6.1 Controls

5.6.1.1 All controls

All controls shall have the function, direction and/or method of operation clearly identified by a durable label or mark.

Detailed instructions on the operation of the control(s) shall be provided in the instruction handbook.

Compliance shall be checked by inspection.

NOTE EN 60073 [3] and EN 894-1 [4] gives general technical information on marking and identification and ergonomics of controls.

5.6.1.2 Throttle control

If an operator throttle control is provided it shall be integrated with a handle. This throttle control shall be positioned so that it can be operated and released when holding the handle to which it is mounted. When it is released this control shall automatically return to the 'idle' position unless a throttle lock or throttle setting device is engaged. Inadvertent operation of the throttle device shall be prevented by the way it is integrated with the handle. Compliance shall be checked by inspection and functional test.

5.6.1.3 Throttle lock

If a throttle lock for the throttle control is provided, it shall be such that the lock has to be engaged manually and is automatically released when the throttle control is operated. Compliance shall be checked by functional test.

5.6.1.4 Throttle setting device

〚A1〛 If a throttle setting device is provided, it shall be so positioned that it can be operated and released while holding the handle(s) during normal operation. Compliance shall be checked by functional test. 〚A1〛

5.6.1.5 Engine stopping device

Machines shall have a control for stopping the engine, which can be operated without releasing the hold of the handle(s). The engine-stopping device shall not depend upon sustained manual pressure for its operation. The stop position shall be clearly marked. The control shall have a contrasting colour against its background.

Compliance shall be checked by inspection and functional test.

5.6.2 Handles

Machines shall have at least one handle.

Where appropriate the part of the handle containing the machine control actuator shall be counted as part of the handle gripping length. Finger grip or similar superimposed profiles shall not affect the method of calculating handle gripping length.

The gripping length of any handle required by this European Standard shall be at least 100 mm.

The gripping length of a bail or closed handle shall comprise any length that is straight or curved at a radius of more than 100 mm together with any blend radius but not more than 10 mm at either or both ends of the gripping surface.

If a straight handle is supported centrally (i.e. 'T' type) the gripping length shall be calculated as follows:

a) for handles with a periphery (not included the support) less than 80 mm the gripping length is the sum of the two parts either side of the support;

b) for handles with a periphery (not including the support) of 80 mm or more the gripping length is the complete length from end to end.

Compliance is checked by inspection and measuring.

5.6.3 Harness for machines other than those with back-pack power unit

Machines with a mass of more than 6 kg with an empty fuel tank shall be equipped with at least a single shoulder harness. A double shoulder harness shall be provided for all machines exceeding 7,5 kg with an empty fuel tank.

Single shoulder harnesses shall be designed in a way or be equipped with a quick release mechanism, so that the machine can be released quickly from the operator in the event of emergency. Double shoulder harnesses shall always have a quick release mechanism. The quick release mechanism shall only allow separation by deliberate action of the operator. The harness shall be adjustable to the size of the operator.

Machines exceeding 7,5 kg shall be supplied with a pad at the points of contact between the machine and the body.

Compliance is checked by inspection and functional test.

5.7 Starting device

Machines shall not be equipped with a starter operated by means of a loose rope.

Compliance is checked by inspection

5.8 Noise

5.8.1 Reduction by design and protective measures

The machine shall be so designed and constructed that risks resulting from the emission of airborne noise are reduced to the lowest level taking account of technical progress and the availability of means of reducing noise, in particular at source. The main sources causing noise for the machines covered are:

— air intake system;

— motor/engine cooling system;

— fan;

— vibrating surfaces;

— shredding means.

NOTE EN ISO 11688-1 [5] gives general technical information on widely recognized technical rules and means for the design of machines of low-noise emission.

5.8.2 Reduction by information

Information on residual risks, after technical measures to control noise emission at the design stage have been implemented, shall be given in the instruction handbook.

5.8.3 Noise emission measurement

For the measurement of the emission sound pressure level at the operator's position and the sound power level, the methods given in Annex A shall be used.

5.9 Vibration

5.9.1 Reduction by design and protective measures

The machine shall be designed so as to generate vibration levels as low as practicable. The main sources causing vibrations are the dynamic forces from engine, fan unbalanced moving parts, impact in gear sprockets, bearings and other mechanisms and the interaction between operator and machine.

NOTE CR 1030-1 [6] gives general technical information on widely recognized technical rules and means and can be used as a guideline for the design of reduced hand-arm vibration machines.

5.9.2 Reduction by information

Information on residual risks, after technical measures to control vibration emission at the design stage have been implemented, shall be given in the instruction handbook.

5.9.3 Vibration measurement

The weighted acceleration sum shall be measured and calculated in accordance with Annex B.

NOTE There may be significant vibration transmitted to the operator's body from the power source through the backpack power-unit harness. This is not covered by this European Standard. There is no measuring method currently available.

5.10 Protection from exhaust fumes

The exhaust shall be directed downwards or away from the operator when the machine is in the normal working position. The normal working position shall be described in the instruction handbook.

Compliance shall be checked by inspection.

5.11 Electrical requirements

5.11.1 General

Insulated electric wires shall be protected against abrasive contact with metal surfaces and shall be resistant to, or protected against, vibration and contact with lubricant and fuel.

Compliance shall be checked by inspection.

5.11.2 Ignition circuit

5.11.2.1 Requirement

Ignition interruption or short circuiting shall be provided on the low voltage side.

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

Compliance shall be checked by inspection and by the test of 5.11.2.2.

5.11.2.2 Test method

The requirements shall be checked by inspection and using the test probe B of IEC 61032:1997.

Test acceptance: the test probe shall not make contact with high voltage parts of the circuit including spark plug terminals

5.12 Fuel tank openings

The fuel tank opening shall be at least 20 mm diameter and the cap shall have a retainer. The design of the cap shall be such that no leakage occurs in all working positions while the machine is running and during transport.

The filler opening shall be located in such a way that the filling of the tank with a funnel is not obstructed by other components. Seepage from fuel tank ventilation systems is not regarded as leakage.

Compliance shall be checked by inspection and functional test.

5.13 Additional requirements for back-pack powered units

5.13.1 Handgrip

The backpack unit shall be equipped with a handgrip surface or structure specifically designed for the operator's hand to allow the operator to grasp the back-pack power unit to place it on his back or take it off.

Compliance shall be checked by inspection and functional test.

5.13.2 Back-pack support and harness

The harness shall be designed to prevent slipping and be adjustable so that pressure can be evenly distributed on the operator.

Harnesses of backpack units shall be equipped with a quick release mechanism ensuring the unit to be released quickly from the operators in the event of emergency. The quick release mechanism shall only allow separation by deliberate action of the operator.

Compliance shall be checked by inspection and by functional test.

6 Information for use

6.1 Instruction handbook

〈A1〉 Each machine shall be provided with information and instructions for normal use including warnings against particular hazards of use and instructions for operating, servicing and maintenance that comply as appropriate with 6.4.5 of EN ISO 12100:2010. 〈A1〉 The importance of reading the instruction handbook thoroughly before using the machine shall be stressed on the front of the instruction handbook.

The instructions shall include all operations that are meant to be performed by the user. The instructions shall be simple and clear such that they are suitable for unskilled users. They shall include:

— instructions and, where appropriate, drawings, for the proper assembly and disassembly of the machine for use, if the machine is not supplied in a completely assembled form;

— instructions and, where appropriate, drawings, for the intended use of the machine including the limits of use and reasonably foreseeable misuse;

— instructions and, where appropriate, drawings, for the designated operating positions and the correct and safe operation of the machine such as blowing away/vacuuming debris safely, transport, safe handling of fuel and clearing blockages;

— instructions and, where appropriate, drawings, for proper adjustment and any necessary user maintenance of the machine, including timescales;

— information on the non-user maintenance as recommended replacement or repair of, or service attention to, critical components;

— a warning of the danger of rotating parts;

— a warning that the machine is not suitable for use by children;

— a warning to keep children, other bystanders and pets away from the machine while operating;

— a warning not to operate the machine near open windows, etc.;

— explanations of any safety sign~~s~~ affixed to the machine and a repeat of all other information except the serial number;

— for machines with bagging facility, instructions on attaching and detaching the bag from the machine;

— instruction on low-vibration and low-noise operating modes, and/or limited time of operation to prevent damage from vibration and/or damage to the ears;

— instruction on the choice and use of personal protection equipment (PPE);

— a warning indicating that these machines are extremely noisy and require the use of ear protection;

— the operating method to be followed in the event of accident or breakdown; if a blockage is likely to occur, the operating method to be followed so as to enable the equipment to be safely unblocked;

— the specifications of the spare parts to be used, when these affect the health and safety of operators;

— recommendation to operate the machine only at reasonable hours – not early in the morning or late at night when people might be disturbed;

— recommendation to use rakes and brooms to loosen debris before blowing/vacuuming;

— recommendation to slightly dampen surfaces in dusty conditions or use mister attachment;

— recommendation to use the full blower nozzle extension so the air stream can work close to the ground.

The instruction handbook and the technical documentation describing the machine shall:

— give the A-weighted emission sound pressure level at the operator position as measured according to Annex A, where this exceeds A-weighted 70 dB; where this level does not exceed A-weighted 70 dB, this fact shall be indicated;

— give the sound power level emitted by the machinery as determined according to Annex A, where the A-weighted emission sound pressure level at the operator position exceeds A-weighted 85 dB;

— give the sound power level emitted by the machinery as determined according to European Directive 2000/14/EC [7];

— the uncertainty of measurement;

NOTE 1 Annex A.6 gives information concerning measurements uncertainties.

— the vibration total value to which the hand-arm system is subjected as determined according to Annex B, if it exceeds 2,5 m/s^2; where the value does not exceed 2,5 m/s^2, this shall be indicated;

— the uncertainty of measurement.

NOTE 2 B.6 gives information concerning measurement uncertainties

Both for noise and vibration values shall be either those actually measured for the machinery in question or those established on the basis of measurements taken for technically comparable machinery, which is representative of the machinery to be produced.

The operating conditions during measurement and the methods used for measurement, and the reference to Annex A and Annex B, respectively, of this European Standard shall be specified.

NOTE 3 Information in the sales literature on noise and vibration emissions shall not contradict the information given in the information for use.

Compliance shall be checked by inspection.

6.2 Marking

All machines shall be marked legibly and indelibly with the following minimum information:

— the business name and full address of the manufacturer and, where applicable, his authorised representative;

— designation of the machinery;

— the year of construction, that is the year in which the manufacturing process is completed;

— designation of series or type;

— serial number, if any.

Controls shall have their function, direction and/or method of operation clearly identified.

NOTE ISO 3767-1 [8], ISO 3767-3 [9], ISO 3767-4 [10] and ISO 3767-5 [11] give useful information on symbols.

6.3 Warnings

All machines shall be marked legibly and indelibly with the following warnings by text and/or pictorials:

— be in one of the official languages of the country in which the machine is to be sold;

— be easily legible and – if applied for warning purposes – located as close as practicable to the relevant hazard. If colours are used they shall be contrasting (i.e. black on yellow, or on red or

orange if general background is yellow, but not on green or blue). If the marking is cast, embossed or stamped, colours are not required;

— a warning of the relevant hazard on guards intended to be opened by the operator and that remains visible after the guard is opened or removed;

— a warning to read the user instructions;

— a warning to keep bystanders away;

— a warning to wear eye and ear protection.

If pictorials are used, they shall be explained in the instruction handbook. Examples of pictorials are given in Annex C.

Compliance shall be checked by inspection.

6.4 Durability of markings and warnings

Marking provided for identification and directional or warning information shall:

— have a durable bond with the base material surface;

— be water resistant and designed to be permanently legible;

— not curl at the edges;

— not be affected by fuel or lubricant.

Compliance shall be checked by inspection and by the following test.

Unless cast, embossed or stamped, all marking required by 6.2 and 6.3 shall be rubbed by hand for 15 s with a piece of cloth soaked in water and again for 15 s with a piece of cloth soaked in petrol.

The petroleum to be used for the test is aliphatic solvent hexane having a maximum aromatics content of 0,1% by volume, a kauri – butanol value of 29, an initial boiling point of approximately 65 °C, a dry point of approximately 69 °C and a specific mass of approximately 0,66 kg/l.

The marking shall remain easily legible. It shall not be easily possible to remove any label, nor shall any label show any sign of curling.

Dimensions in millimetres

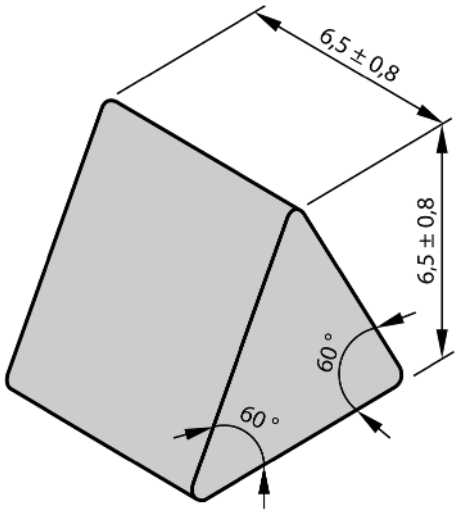


Figure 1 — Ceramic prism

Annex A
(normative)

Noise test code – Engineering method (Grade 2 of accuracy)

A.1 General

The specifications given in Clauses 3 to 7 of EN ISO 22868:2008 apply together with this Annex.

A.2 Machine conditions

Measurements shall be carried out on a machine in all its operating configurations for normal use.

If needed, the machine to be tested shall have the engine run-in prior to the test. Instructions for such a run-in of the engine shall be given in the instruction handbook.

The machine shall be warmed up until stable conditions are reached before the test is commenced.

The carburettor shall be set according to the instruction handbook.

The engine speed for racing modes shall be kept constant to within ± 2,0 $r.s^{-1}$ and for idling mode constant to within ± 3,5 $r.s^{-1}$.

No alterations to the initial settings are permitted once measurements have commenced.

A.3 Mounting and orientation of the machine

A.3.1 Mounting of the machine on the test fixture

Use a fixture, which holds the machine in the intended position and does not cause any reflections.

NOTE A flexible mount is recommended to avoid any structural resonance.

a) Machine with a suspension point:

The machine shall be attached to the test fixture so that the suspension point is (775 ± 10) mm above the ground. The lowest point of the air nozzle shall be so that *H* is (50 ± 25) mm above the ground, see Figure A.1. If the suspension point is adjustable select the position so that dimension *H* is within the required range.

b) Machine without suspension point:

The machine shall be attached to the test fixture so that the middle of the grip position of the handle to which the throttle trigger is fitted is (775 ± 10) mm above the ground. The lowest point of the air nozzle shall be so that *H* is (50 ± 25) mm above the ground. See Figure A.2.

c) Machine with a backpack power unit:

The assembly with the air nozzle shall be attached to the test fixture as described in b). The backpack power unit shall be attached to a test fixture for the shoulder harness so that the lower edge of the back-padding is (1030 ± 25) mm above the ground.

The backpack unit shall be located so that the handle is (300 ± 25) mm to the right of that vertical centre line of the backpack unit and (200 ± 25) mm in front of the vertical centre line through the fixture for the shoulder harness. See Figure A.2.

A.3.2 Orientation of the machine for the A-weighted sound power level measurement

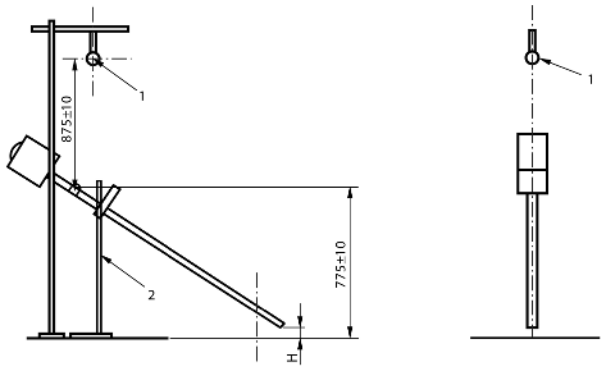
The machine shall be oriented so that the air nozzle is pointing along and over the x-axis and the centre of the engine is above the centre point for the hemisphere.

A.3.3 Position of the microphone for the A-weighted sound pressure level measurement

a) For machines with a suspension point the microphone shall be located (875 ± 10) mm vertically above the suspension point. See Figure A.1.

b) For machines without suspension point the microphone shall be located (875 ± 10) mm vertically above the centre of the handle to which the throttle control is fitted. See Figure A.2.

Dimensions in millimetres

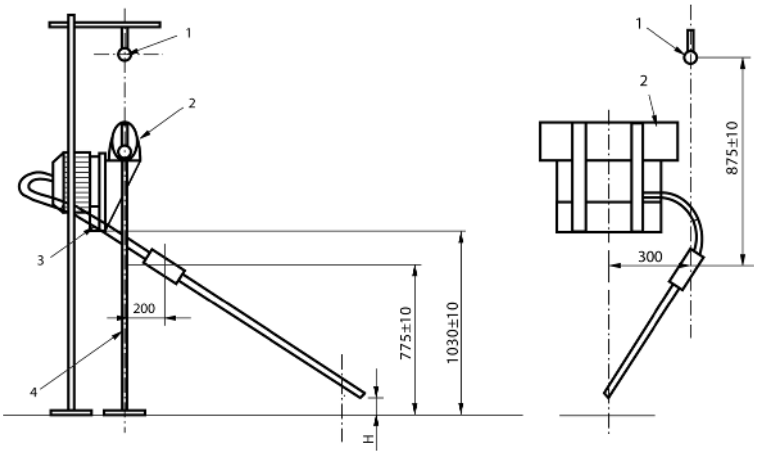


1 Lateral position of the microphone (for operator's position)

2 Test fixture

Figure A.1 —Test set-up for machines with integrated power source

Dimensions in millimetres



1 Lateral position of the microphone (for operator's position)

2 Fixture for the shoulder harness

3 Lower edge of the back-padding

4 Test fixture

Figure A.2 — Test set-up for backpack machines

A.4 Test procedure

A.4.1 General

Noise emission quantities shall be determined for two different operating conditions, i.e. idling and racing.

The test procedure shall be as follows:

a) a minimum of four measurements shall be performed with a short break with a significant change of speed between the measurements. Each measurement at idle shall be separated by a short period of racing and vice versa. Stable speed conditions shall be obtained before testing is continued;

b) at least four separate periods of noise data shall be obtained, totalling at least 20 s; and

c) each signal duration used shall be at least 2 s, over which the engine speed for racing mode is within ± 2,0 $r.s^{-1}$, and for idling mode within ± 3,5 $r.s^{-1}$.

The collection of data for idling and racing does not need to be carried out in any fixed sequence.

The range of the values noted for each operating condition shall not be greater than 2 dB. If this range is exceeded, then the tests shall be repeated until four consecutive results fall within a range of 2 dB. The final value to be retained for each microphone position is the arithmetical mean of these four successive values satisfying the above criterion.

For all conditions as specified below (A.4.2 and A.4.3), this procedure shall be followed both when measuring A-weighted sound power levels and A-weighted emission sound pressure levels.

When determining the A-weighted sound power level this procedure shall be applied to the sound pressure levels averaged over the 6 microphone positions

A.4.2 Idling

Measurements shall be made at the engine idling speed achieved when the throttle trigger is released.

A.4.3 Racing

The speed of the engine shall be controlled by the throttle trigger.

Measurements shall be made with the fully open throttle.

If the engine has a speed limiter the measurement shall be made at the maximum speed achievable.

If the engine does not run with a stable speed the test shall be carried out at the maximum possible stable speed. In this case the speed shall be kept at least 8 $r.s^{-1}$ below the governed speed. This information shall be recorded

A.5 Information to be reported

A.5.1 General

The following information, when applicable, shall be recorded for all measurements made in accordance with the requirements of this European Standard.

A.5.2 Machine under test

a) Description of the machine including its engine displacement, type and serial number, blower or vacuum equipment used;

b) Operating conditions, as listed in Tables A.1 and A.2 during acoustical evaluation.

A.5.3 Acoustic environment

Description of the test environment:

— if outdoors, a sketch showing the location of the machine with respect to the surrounding terrain including a physical description of the test environment; the nature of the ground plane shall be described;

— if indoors, a description of the physical treatment of walls, ceiling and floor; a sketch showing the location of the machine and room contents;

— value of K_{2A}.

A.5.4 Instrumentation

a) Equipment used for the measurements, including name, type, serial number and brand/manufacturer;

b) Method used to calibrate the instrumentation system;

c) Date and place of the most recent calibration of the acoustical calibrator.

A.5.5 Acoustical and other data

a) The A-weighted sound pressure levels of the background noise at the microphone positions;

b) Measurement values and mean values in accordance with Tables A.1, A.2 and A.3;

c) Remarks on subjective impression of noise (audible discrete tones, impulsive character, special content, temporal characteristics, etc.);

d) Air temperature and wind speed;

e) Date and place of the measurements;

f) Equivalent sound levels for work cycles in accordance with A.5.6.

Table A.1 — A-weighted emission sound pressure level (L_{pA}) determination — Table for recording measured values, mean values and emission values

Operating condition	**Engine speed** **r. s^{-1}**	**Measured A - weighted sound pressure levels** L'_{pA} **dB** **Test No**					**Arithmetic mean value** $\overline{L'_{pAX}}$ **dB**	**Correc-tion factor** K_{1A}	**A-weighted emission sound pressure level** L_{pAX} **dB**
		1	2	3	4	*n*			
Idling (Id)									
Racing (Ra)									

NOTE The emission sound pressure level for the respective operating condition *X* is calculated from:

$$L_{pAX} = \overline{L'_{pAX}} - K_{1A}$$

where

K_{1A} is the background noise correction according to EN ISO 11201.

Table A.2 — Table for recording measurement results for the sound power level determination

Test	Operating condition	Engine speed $r.s^{-1}$	L'_{pA1} dB	L'_{pA2} dB	L'_{pA3} dB	L'_{pA4} dB	L'_{pA5} dB	L'_{pA6} dB	$\overline{L'_{pA}}$ dB
1	Idling (Id)								
	Racing (Ra)								
2	Idling (Id)								
	Racing (Ra)								
3	Idling (Id)								
	Racing (Ra)								
4	Idling (Id)								
	Racing (Ra)								
N	Idling (Id)								
	Racing (Ra)								
Average sound pressure levels $\overline{L'_{pAX}}$	Idling (Id)					$\overline{L'_{pAId}}$ = dB			
	Racing (Ra)					$\overline{L'_{pARa}}$ = dB			

NOTE

L'_{pA1} to L'_{pA6} are the measured time-averaged sound pressure levels at the corresponding microphone positions.

$\overline{L'_{pA}}$ is the averaged sound pressure level as defined in 8.1, Equation 4 of EN ISO 3744:2009.

$\overline{L'_{pAX}}$ is the arithmetic average of the values for $\overline{L'_{pA}}$ for the respective operating condition.

Individual values for L'_{pA} should only be reported if available. The test procedure may include automatic averaging.

A.5.6 Calculated equivalent sound levels for work cycles

The equivalent A-weighted emission sound pressure level ($L_{p\mathrm{Aeq}}$) shall be determined as follows:

$$L_{pAeq} = 10\lg\left(\frac{1}{7}10^{0,1L_{pAId}} + \frac{6}{7}10^{0,1L_{pARa}}\right) \text{dB (A-weighted)}$$

where

$L_{p\mathrm{AId}}$ is the emission sound pressure level for the idling operating condition;

$L_{p\mathrm{ARa}}$ is the emission sound pressure level for the racing operating condition.

The equivalent A-weighted sound power level ($L_{W\mathrm{Aeq}}$) shall be determined as follows:

$$L_{WAeq} = L_{WARa} \text{ dB (A-weighted)}$$

where

$L_{WA\mathrm{Ra}}$ is the sound power level for racing operating condition.

Table A.3 — A-weighted sound power level determination – Table for reporting sound power data

Operating Conditions	Average sound pressure level $\overline{L'_{pAX}}$ dB	Correction factor K_1	Surface sound pressure level $\overline{L_{pAf}}$ dB	Surface level L_s dB	Sound power level L_{WA} dB
Idling	$\overline{L'_{pAId}}$ =				
Racing	$\overline{L'_{pARa}}$ =				

NOTE 1 $\overline{L'_{pAX}}$ is the arithmetic average of the values for $\overline{L'_{pA}}$ given in Table A.2 for the respective operating condition.

NOTE 2 $\overline{L_{pAf}} = \overline{L'_{pAX}} - K_1$; where $\overline{L'_{pAX}}$ is replaced by $\overline{L'_{pAId}}$, or $\overline{L'_{pARa}}$ respectively.

NOTE 3 $L_{WA} = \overline{L_{pAf}} + L_s$ *where*

$L_S = 10 \lg \frac{S}{S_o}$ in dB with $S_0 = 1\mathrm{m}^2$ and S = surface of the hemisphere in m^2.

A.6 Declaration of noise emission data

Noise declaration is the responsibility of the manufacturer. Noise emission values – A-weighted emission sound pressure levels at the operator's position and the A-weighted sound power level – shall be declared by a single number declaration according to EN ISO 4871. The noise emission values shall be declared separately for idling and for racing.

The noise declaration shall include a reference to this noise test code and to the basic standard used (EN ISO 3744 and/or EN ISO 11201). Deviations, if any, from this test code and/or the basic standards shall also be indicated.

The uncertainties associated with measurements shall also be taken into account when deciding on the declared noise emission values.

NOTE The methodology for taking uncertainties into account should be based on the use of measured values and uncertainties. The latter are the uncertainties associated with the measurement procedure (which is determined by the grade of accuracy of the measurement method used) and the production uncertainties (variation of the noise emission from one machine to another of the same type made by the same manufacturer). One method for the calculation of uncertainty is given in EN ISO 4871.

Annex B
(normative)

Measurement of vibration values at the handles

B.1 General

The specifications given in Clauses 3 to 10 of EN ISO 22867:2008 apply together with this annex.

B.2 Measurement direction and location

The accelerometer orientation and locations shall be as defined in Figures B.1 and B.2, depending on handle design.

The position of the accelerometer shall be as near as possible to the hand and without obstructing the normal grip.

For the handle with the throttle control fitted, the accelerometer shall, if possible, be (20 ± 2) mm in front of the throttle trigger (Figures B.1 and B.2). If (20 ± 2) mm cannot be obtained, the accelerometer shall be placed at the front end of the handle.

For any other handle, the accelerometer shall be (20 ± 2) mm from the front end of the handle or for bail handles at a point (40 ± 2) mm from the centre of the handle.

B.3 Adjustment of the machine before test

Measurements shall be carried out on a machine in all its operating configurations for normal use.

If needed, the machine to be tested shall have the engine run-in prior to the test. Instruction for such run-in of the engine shall be given in the instruction manual.

The machine shall be warmed up until stable conditions are reached before the test is commenced.

The carburettor shall be set according to the user instruction manual.

No alterations to the initial settings are permitted once measurements have commenced.

The machine shall be operated upright, connected to the harness, if any, and held by the operator so that the middle of the handle to which the throttle trigger is fitted is (775 ± 10) mm above the ground.

For backpack machines the backpack unit shall be carried in the harness on the operator's back.

The lowest point of the air nozzle shall be (50 ± 25) mm above the ground.

During measurement the operator shall apply a gripping force around the handle(s) corresponding to normal working conditions.

NOTE Gripping forces on the handles will influence the vibration measurements.

B.4 Test procedure

B.4.1 General

The operating conditions are idling and racing. The tests to obtain the required data for a given operating condition shall consist of:

— a minimum of four measurements with a short break with a significant change of speed between the measurements in order to allow stable conditions; each measurement at idle shall be separated by a short period of racing and vice versa;

— at least four separate periods of vibration data shall be obtained totalling at least 20 s.

Each period of vibration data shall be at least 2,0 s, over which the engine speed for racing mode is within ± 2,0 $r.s^{-1}$, and for idling mode within ± 3,5 $r.s^{-1}$.The collection of data for idling and racing does not need to be carried out in any fixed sequence.

B.4.2 Idling

Measurements shall be made at the engine idling speed achieved when the throttle trigger is released.

B.4.3 Racing

Measurements shall be made with the fully open throttle. If the engine has a speed limiter the measurement shall be made at the maximum speed achievable.

If the engine does not run with a stable speed the test shall be carried out at the maximum possible stable speed. In this case the speed shall be kept at least 8 $r.s^{-1}$ below the governed speed. The throttle trigger shall control the speed of the engine.

NOTE The operating modes given in B.4.2 and B.4.3 may of interest for assessment of user vibration exposure values, for example over a typical working day.

B.5 Information to be reported

B.5.1 General

The following information, when applicable, shall be compiled and recorded for all measurements made in accordance with the requirements of this European Standard.

B.5.2 Machine under test

a) Description of the machine, including its engine displacement, type and serial number, and blower or vacuum equipment used;

b) Operating conditions, as listed in Table B.1.

B.5.3 Instrumentation

a) Instrumentation used for the measurements, including name, type, serial number and brand/manufacturer;

b) Methods used to fasten the accelerometers;

c) Method used to calibrate the instrumentation system;

d) Date and place of the most recent calibration of the accelerometer calibrator.

B.5.4 Vibration and other data

a) Location of the accelerometer positions (a sketch may be included, if necessary);

b) Measurement values and arithmetic mean values in accordance with Table B.1;

c) Declared vibration emission values;

d) Remarks if any;

e) Air temperature;

f) Date and place of the measurements.

Table B.1 — Table for recording vibration measurements and calculation of the arithmetic means of the vibration total values

Operation	Measured data and validity	Nominal engine speed $r.s^{-1}$	Test nr.						
			1	2	3	4	5	6	*n*
Idling (Id)	$a_{hv,Id}$ ($m.s^{-2}$)								
	$\overline{a_{hv,Id}}$ ($m.s^{2}$)		---	---	---				
	s_{n-1} ($m.s^{-2}$)		---	---	---				
	C_v (-)		---	---	---				
Racing (Ra)	$a_{hv,Ra}$ ($m.s^{-2}$)								
	$\overline{a_{hv,Ra}}$ ($m.s^{-2}$)		---	---	---				
	s_{n-1} ($m.s^{-2}$)		---	---	---				
	C_v (-)		---	---	---				

NOTE 1 The vibration total value (a_{hv}) is measured and recorded and the arithmetic mean ($\overline{a_{hv}}$) is calculated until the coefficient of variation (C_v) or the standard deviation (s_{n-1}) is less than 0,4.

NOTE 2 The calculation of arithmetic mean ($\overline{a_{hv}}$) is based on at least four measurements of vibration total value (a_{hv}).

NOTE 3 The values for the arithmetic mean ($\overline{a_{hv,Id}}$, $\overline{a_{hv,Ra}}$) are used to calculate the equivalent vibration total value ($a_{hv,eq}$).

B.5.5 Calculation of equivalent vibration total values

The equivalent vibration total values, $a_{\mathrm{hv,eq}}$, are based on a work cycle composed of idling and racing with a duration of 1/7 for idling and 6/7 for racing.

The equivalent vibration value $a_{\mathrm{hv,eq}}$ shall be determined as follows:

$$a_{hv,eq} = \left(\frac{1}{7} a_{hv,Id}^{-2} + \frac{6}{7} a_{hv,Ra}^{-2} \right)^{1/2}$$

B.6 Declaration and verification of vibration values

Vibration declaration is the responsibility of the manufacturer. If undertaken, it shall be done so that it is possible to verify the declared values.

The declaration shall include a reference to this European Standard. Deviations, if any, shall be indicated.

Calculated equivalent vibration total values shall be used for the declaration of the vibration emission values. Information shall also be given on the uncertainty (K).

The average vibration value for applicable operating modes (idling and racing) shall be made available.

The uncertainty (K) to be associated with the declared vibration emission value(s) is based on total standard deviation σ_t which is composed of the standard deviation of reproducibility σ_R and the standard deviation of production σ_p. Guidelines for σ_R are given in this Annex. The determination of σ_p shall be done by the manufacturer, based on his experience of the production variation.

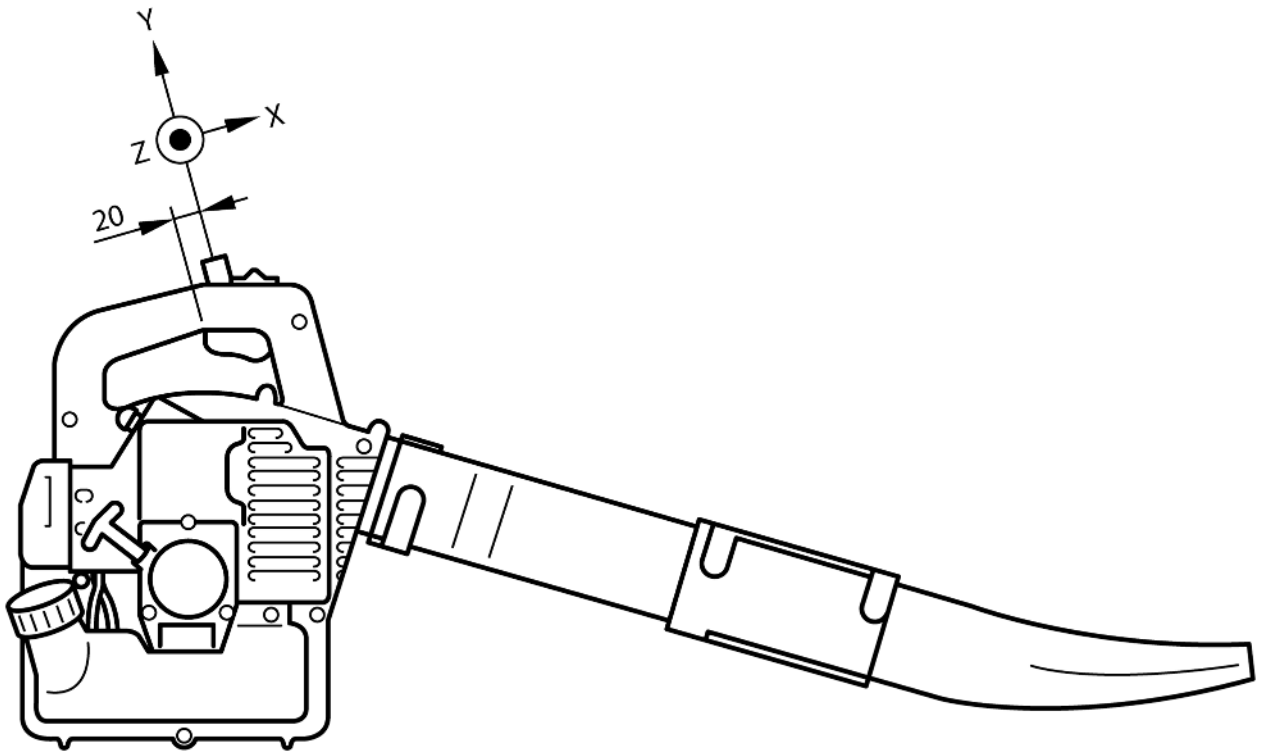


Figure B.1 — Accelerometer mounting position for handheld blower/vacuum

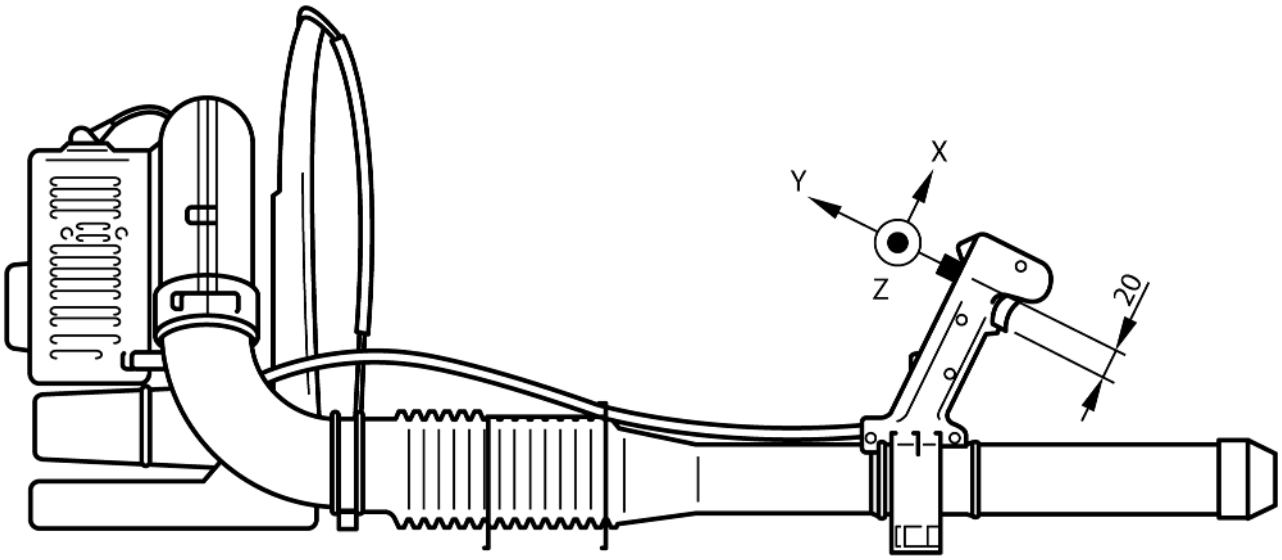


Figure B.2 — Accelerometer mounting position for backpack blower / vacuum

Annex C
(informative)

Examples of safety signs
General

The safety symbols and safety signs, which may be used on machines, as defined in this European Standard are presented in this Annex.

For symbols it is recommended to follow the conventions laid down in ISO 3767-1 [8], ISO 3767-3 [9], ISO 3767-4 [10], ISO 3767-5 [11] and ISO 3864-1 [12] and for safety signs the conventions presented in ISO 11684 [13]. The symbol or safety sign size may be modified to fit a specific machine design.

NOTE Symbol 1641 of ISO 7000:2004 [14] may be used as an alternative in the lower panel of the safety sign above.

Figure C.1 — Read operator's manual

Figure C.2 — Keep bystanders away

Figure C.3 — Wear eye protection.

Figure C.4 — Wear ear protection

〚A1〉 *deleted text* 〈A1〛

A2

Annex D
(normative)

Tortuous path test

D.1 Requirements

The path of access from any point of the opening to hazardous moving parts shall be designed in such a way to prevent moving parts being reached by the fingers.

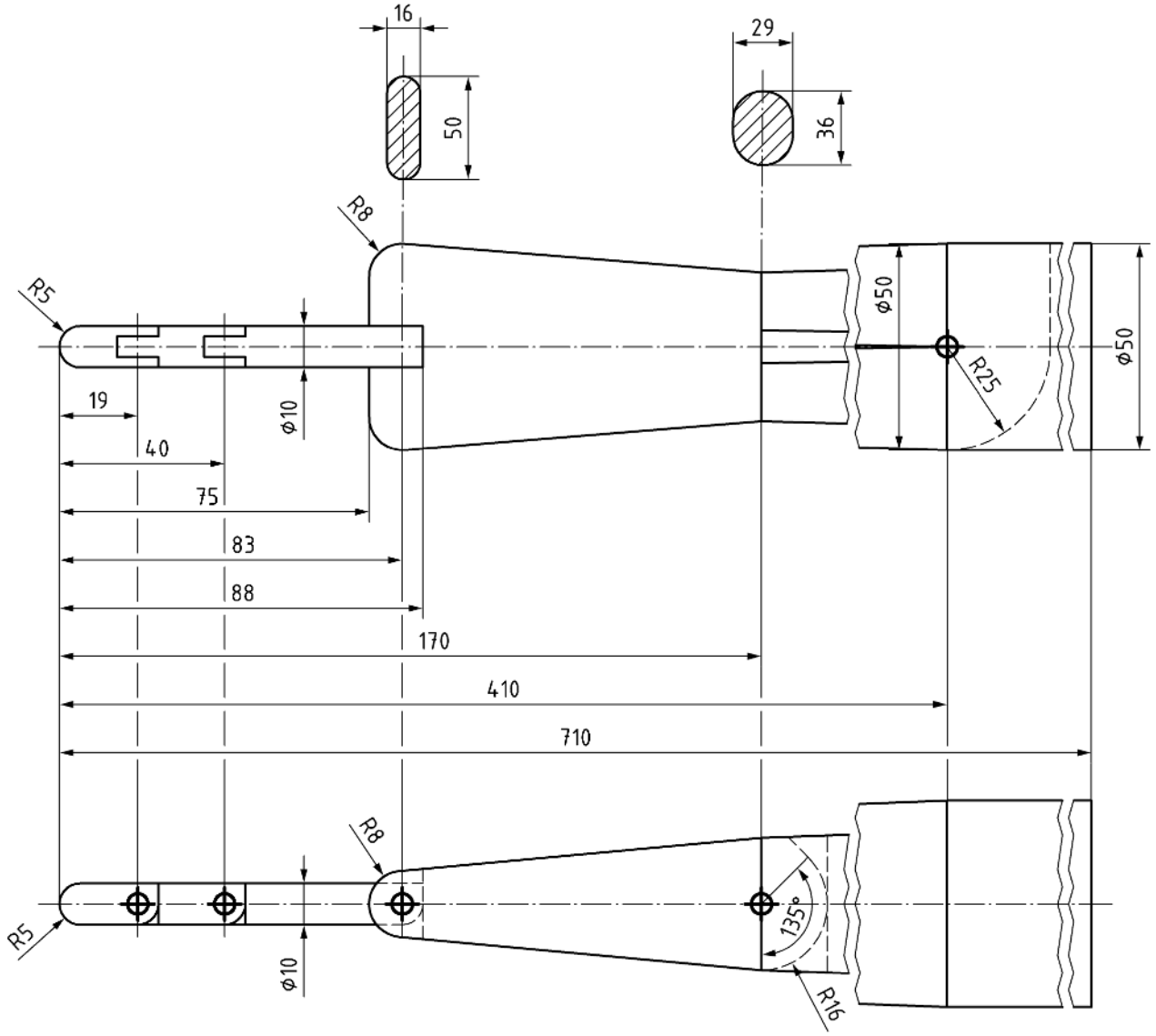
D.2 Test procedure

The two arm probes shown in Figure D.1 shall not be able to make contact with the hazardous moving parts when they are inserted into the in-feed and discharge opening up to the maximum distance permitted by their shape and articulation under the following conditions. All probe tests shall begin from the straight position, for the fingers and the elbow the articulation of the probes shall enable a rotation of 90° and for the wrist it shall be +90° and -45°.The movements of the joints of the probes shall be free enough to allow easy articulation as the probes are inserted into the opening. The probes shall be applied with a force not exceeding 20 N.

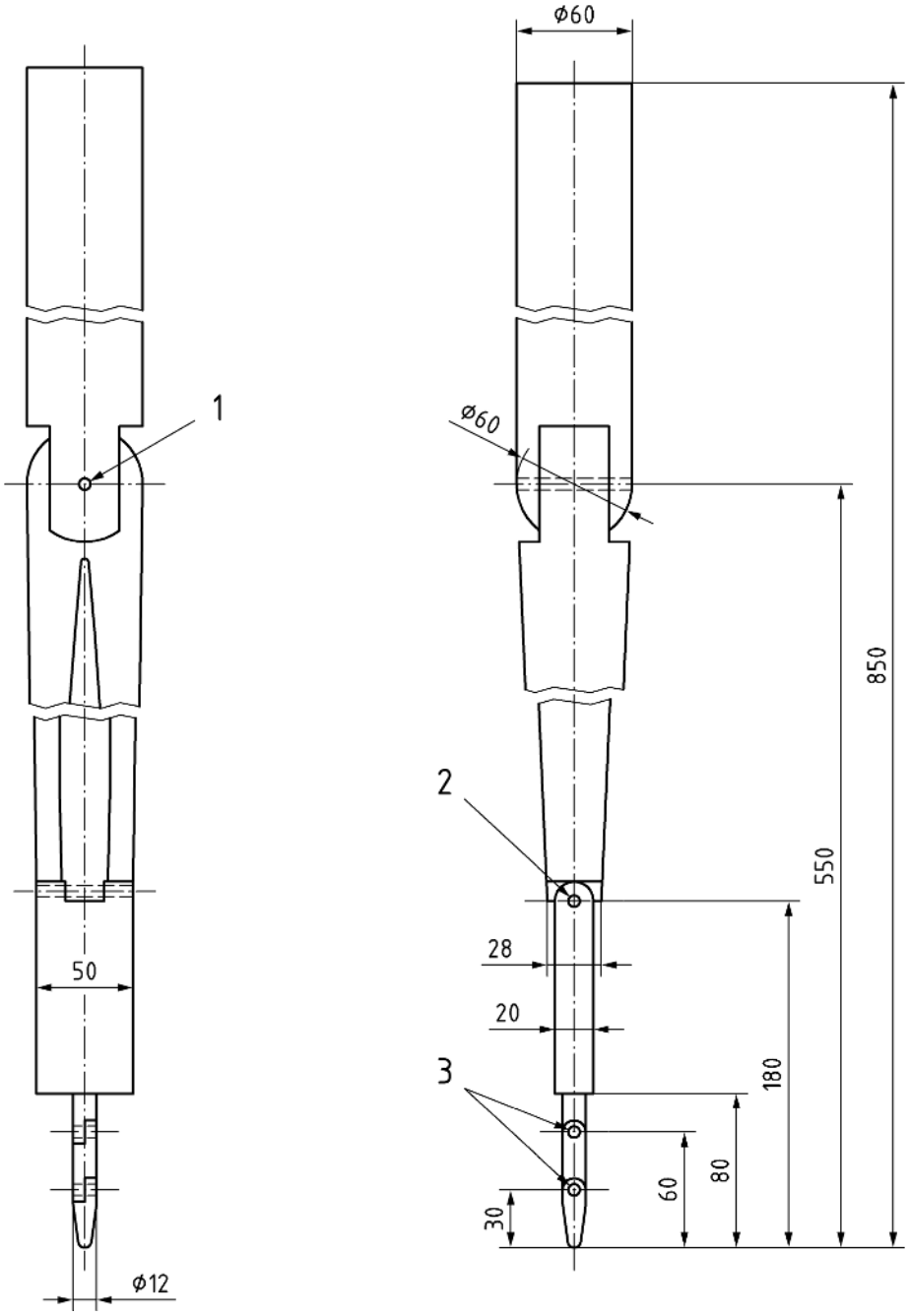
The arm probes shall be twisted and moved in any direction allowed by the joints when approaching the hazardous moving parts. If necessary, one or more sections of the machine may be cut away to allow the probe to be configured such that it penetrates as far as possible towards the hazardous moving parts. If a section is removed this shall not allow the probe to penetrate further than it would have done before the removal of the section(s).

The test shall be carried out both with and without the debris collector in place. If by design (e.g. interlocking)the removal of the debris collector causes the power to the fan and/or shredding means to be stopped, then the test shall only be done with the debris collector in place.

Dimensions in mm



a) young adult arm probe



Key

1 axis of rotation of "elbow" joint

2 axis of rotation of "wrist" joint

3 axes of rotation of "finger" joints

b) adult arm probe

NOTE This figure is not to scale.

Figure D.1 — Arm probes for testing guarding by tortuous path

D.3 Test acceptance

Neither arm probe shall contact the hazardous moving parts. When the test is conducted with the debris collector in place it shall not be possible to push any part of the debris collector into moving parts. A2

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42/EC

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide one means to conform to Essential Requirements of the New Approach Machinery Directive 2006/42/EC.

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this standard confers, within the limits of the scope of this standard, a presumption of conformity with the relevant Essential Requirements, *except Essential Requirement(s) 1.2.1, 3rd paragraph, 2nd indent for blowers and vacuum blowers,1.3.2 for harness and back-pack support and 1.5.9 with regard to backpack power units* of that Directive and associated EFTA regulations.

WARNING - Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this European Standard.

Bibliography

[1] EN 60335-1:2002, *Household and similar electrical appliances — Safety — Part 1: General requirements (IEC 60335-1:2001, modified)*

[2] IEC 60355-2-100:2002, *Household and similar electrical appliances — Safety — Part 2-100: Particular requirements for hand-held mains-operated garden blowers, vacuums and blower vacuums*

[3] EN 60073:2002, *Basic and safety principles for man-machine interface, marking and identification — Coding principles for indicators and actuators (IEC 60073:2002)*

[4] EN 894-1:1997, *Safety of machinery — Ergonomics requirements for the design of displays and control actuators — Part 1: General principles for human interactions with displays and control actuators*

[5] EN ISO 11688-1:2009, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 1: Planning (ISO/TR 11688-1:1995)*

[6] CR 1030-1, *Hand-arm vibration — Guidelines for vibration hazards reduction — Part 1: Engineering methods by design of machinery*

[7] European Directive 2000/14/EC of the European Parliament and of the Council of 8 May 2000 on the approximation of the laws of the Member States relating to the noise emission in the environment by equipment for use outdoors

[8] ISO 3767-1:1998, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Symbols for operator controls and other displays — Part 1: Common symbols*

[9] ISO 3767-3:1995, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Symbols for operator controls and other displays — Part 3: Symbols for powered lawn and garden equipment*

[10] ISO 3767-4:1993, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Symbols for operator controls and other displays — Part 4: Symbols for forestry machinery*

[11] ISO 3767-5:1992, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Symbols for operator controls and other displays — Part 5: Symbols for manual portable forestry machinery*

[12] ISO 3864-1:2002, *Graphical symbols — Safety colours and safety signs — Part 1: Design principles for safety signs in workplaces and public areas*

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[14] ISO 7000:2004, *Graphical symbols for use on equipment — Index and synopsis*

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