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Forestry machinery — Noise test code for portable hand-held machines with internal combustion engine — Engineering method (Grade 2 accuracy)

Machines forestières — Code d'essai acoustique pour machines portatives tenues à la main à moteur à combustion interne — Méthode d'expertise (classe de précision 2)

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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 22868 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 17, *Manually portable forest machinery*.

This first edition of ISO 22868 cancels and replaces ISO 7182:1984, ISO 7917:1987, ISO 9207:1995 and ISO 10884:1995, of which it constitutes a technical revision.

This corrected version of ISO 22868:2005 incorporates the following corrections:

— Page 7, A.2.3, Figure A.1, the dimension (700 ± 10) mm has been altered for conformity with the text.

Introduction

During the first steps in the revision of this International Standard, it became obvious that the repeatability of the test results could become better if the operator were to be replaced by a simulation process, representing the normal operating modes with chain-saws and trimmers/brush-cutters. Furthermore, it was found that the cutting process performed with chain-saws causes considerable deviations, which are not related to the measured object but to the test procedure itself.

Based on these observations, it was concluded that the operators in both test procedures, i.e. for chain-saws and trimmers/brush-cutters, ought to be replaced by a defined fixture and the cutting process with chain-saws by a brake simulating the load. In this manner, the operating conditions during measurement would simulate normal operating conditions.

The determination of noise emission characteristics is primarily used for

— manufacturers' declarations of noise emitted,

— comparing the noise emitted by machines in the family concerned, and

— purposes of noise control at source at the design stage.

The use of this noise test code will ensure reproducibility of the determination of the noise emission characteristics within specified limits determined by the grade of accuracy of the basic noise measurement method used. Noise measurement methods allowed by this International Standard give results with Grade 2 accuracy.

The operating modes are of interest for assessment of the exposure sound pressure levels, for example, over a typical working day.

The work cycles chosen for this test code are based on the following considerations of application:

a) chain-saws with an engine of $< 80\ cm^3$ are used for various operations, including felling, bucking and delimbing;

b) chain-saws with an engine of $\geqslant 80\ cm^3$ are normally used for felling and bucking.

Delimbing will cause the saw to run at racing speed; therefore, racing is included only for saws with a $< 80\ cm^3$ engine.

For brush-cutters and grass-trimmers, the cutting mode (full load) is estimated to be valid only for short periods, while racing and idling are the two dominant modes. Moreover, it has been found to be diverse and not able to be performed under repeatable conditions.

For trimmers, the full load and the racing modes are integrated in one single mode due to the loading effect of the flexible line.

For brush-cutters, it is not possible to simulate the full load mode in a feasible way since there are no constant load conditions comparable to chain-saws. Since the operating mode “racing” is anyhow the worst case, it is used as representative.

In either case, transport and other tasks between operations will cause the machine to run at idling. Experience has lead to the conclusion that equal duration for the different working modes is a good estimation of daily exposure.

Forestry machinery — Noise test code for portable hand-held machines with internal combustion engine — Engineering method (Grade 2 accuracy)

1 Scope

This International Standard specifies a noise test code for determining, efficiently and under standardized conditions, the noise emission characteristics of portable, hand-held, internal combustion-engine-powered forest machines such as chain-saws, brush-cutters and grass-trimmers. Noise emission characteristics include the A-weighted emission sound pressure level at the operator position and the A-weighted sound power level. The code is applicable for manufacturers' product controls as well as type tests. It is intended that the results obtained will be able to be used to compare different machines or different models of the same type of machine. Although the noise emission values determined are obtained in an artificial operation, they are representative of noise emission in a real work situation.

2 Normative references

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

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

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

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

ISO 6531, *Machinery for forestry — Portable hand-held chain-saws — Vocabulary*

ISO 7112, *Machinery for forestry — Portable hand-held brush-cutters and grass-trimmers — Vocabulary*

ISO 7293, *Forest machinery — Portable chain saws — Engine performance and fuel consumption*

ISO 8893, *Forestry machinery — Portable brush-cutters and grass-trimmers — Engine performance and fuel consumption*

ISO 11201:1995, *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*

IEC 60651:1979, *Sound level meters*

IEC 60804:2000, *Integrating-averaging sound level meters*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 6531 and ISO 7112 apply.

4 Quantities to be measured and quantities to be determined

Quantities to be measured are time-averaged sound pressure levels defined in the relevant basic noise measurement standards (ISO 3744, ISO 11201): A-weighted and — if required — in frequency bands.

Quantities to be determined are sound power levels and emission sound pressure levels: A-weighted and — if required — in frequency bands.

5 A-weighted sound power level determination

For the determination of the A-weighted sound power level, ISO 3744:1994 shall be used, subject to the following modifications or additions.

a) The microphone array shall be six microphone positions, in accordance with Figure 1 and Table 1.

NOTE 1 The six-microphone array is permitted because experimental data have shown that use of this array does not yield results that differ significantly from those obtained with the 10-microphone array specified in ISO 3744.

b) The measurement surface shall be a hemisphere with a radius, r, of 4 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 $r = 4$ m. If a smaller radius, r, is used, it shall not be less than $2\,d_0$, where d_0 is defined by the reference box enclosing the machine.

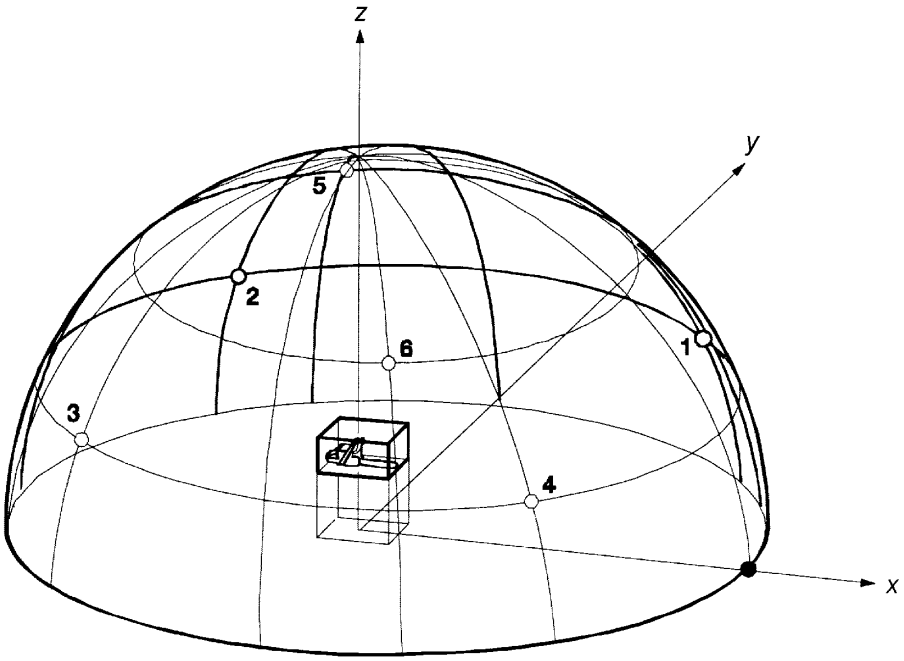
NOTE 2 The smaller radius could be necessary in an anechoic room where a radius of 4 m cannot be provided.

c) The conditions for the particular type of machine to be tested and its mounting and orientation shall be according to Annexes A and B.

d) Environmental conditions shall be within the limits specified by the manufacturers of the measuring equipment. The ambient air temperature shall be in the range −10 °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.

e) Measurements shall be made using instruments with the time-weighting characteristics “slow”, as defined in IEC 60651, or, preferably, using an integrating-averaging sound level meter as defined in IEC 60804.

f) The value of K_{2A}, determined in accordance with ISO 3744:1994, Annex A, shall at maximum be 2 dB, in which case K_{2A} shall be taken as zero.



NOTE The microphone positions differ when determining the sound power level according to European Directive 2000/14/EC (see Annex D).

Figure 1 — Microphone positions on hemisphere

Table 1 — Coordinates of microphone positions

Position No.	Coordinate		
	x	y	z
1	+ 0,65 r	+ 0,65 r	0,38 r
2	− 0,65 r	+ 0,65 r	0,38 r
3	− 0,65 r	− 0,65 r	0,38 r
4	+ 0,65 r	− 0,65 r	0,38 r
5	− 0,28 r	+ 0,65 r	0,71 r
6	+ 0,28 r	− 0,65 r	0,71 r

6 A-weighted emission sound pressure level measurement at the operator position

6.1 General

For the measurement of the A-weighted emission sound pressure level, ISO 11201:1995 shall be used, subject to the following modifications and additions.

a) The conditions for the particular type of machine to be tested and its mounting shall be in accordance with Annexes A and B.

b) The surface shall comply with the provisions of either 6.2, 6.3 or 6.4. 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 (see 6.2).

c) Environmental conditions shall be within the limits specified by the manufacturers of the measuring equipment. The ambient air temperature shall be in the range −10 °C to 30 °C, and the wind speed shall be less than 5 m/s. A wind screen shall be used each time the wind speed exceeds 1 m/s.

d) Measurements shall be made using instruments with the time-weighting characteristics “slow”, as defined in IEC 60651, or, preferably, using integrating-averaging sound level meters as defined in IEC 60804.

e) The location of a particular type of machinery respective to the microphone array shall be in accordance with Annex A or B.

6.2 Requirements for artificial surface

The artificial surface shall have absorption coefficients in accordance with Table 2, measured according to ISO 354.

Table 2 — Absorption coefficient

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 acoustic properties are met with the absorptive material in place. The structure shall support the test set-up such that compression of the absorbing material is avoided.

NOTE See ISO 5395:1990[1] for an example of a material and construction that can be expected to fulfil these requirements.

6.3 Requirements for ground

The ground at the centre of the test site shall be flat and have good sound-absorbing properties. The surface shall be either forest ground or grass, with the grass or other organic material having a height of (50 ± 20) mm.

6.4 Requirements for concrete floor covered with sawdust

The ground at the centre of the test site shall be flat and have good sound-absorbing properties. The surface shall be of concrete covered with saw dust, having a height of (25 ± 10) mm.

7 Installation, mounting and operating conditions

Measurements shall be carried out on a new, normal production machine fitted with standard equipment as provided by the manufacturer.

An engine speed indicator shall be used to check the speed of the engine. It shall have a measurement uncertainty of ± 1,0 % of the reading. The indicator and its engagement with the machine shall not affect the operation during testing.

NOTE The specific conditions for the applicable machines are given in Annexes A and B.

8 Information to be recorded and reported

See Annexes A and B for details.

9 Declaration of noise emission values

Noise declaration is the responsibility of the manufacturer. Calculated equivalent sound levels for the work cycles (see A.4.1. and B.4.1) shall be declared, preferably by a single-number declaration (see ISO 4871:1996:Annex A). Noise emission values (A-weighted sound power level and A-weighted emission sound pressure level at operator's position) for idling, full load and racing — if applicable — shall be provided by the manufacturer on request, for example to potential buyers.

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

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

NOTE 1 The methodology used for taking uncertainty into account should be based on the use of measured values and uncertainties. The latter are the uncertainty associated with the measurement procedure (which is determined by the grade of accuracy of the measurement method used) and the production uncertainty (variation of 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 ISO 4871.

NOTE 2 For the declaration of A-weighted sound power levels according to the European Noise Directive 2000/14/EC, see Annex D concerning work cycles and microphone positions and use of single number value.

If undertaken, verification of the declared values shall be carried out according to methods given in ISO 4871.

Annex A
(normative)

Specific conditions for chain-saws

A.1 Chain-saw conditions and test timber

Measurements shall be carried out on a saw with the bar and chain recommended by the manufacturer. The minimum length of the guide bar shall be such that the dimensions are in accordance with Figure A.1. The engine and the saw chain shall be run-in prior to the test according to the manufacturer's recommendations. The chain-saw engine shall be at operating temperature before the test is started.

The carburettor shall be set according to the manufacturer's instructions.

The cutting devices shall be lubricated according to the manufacturer's recommendation. The engine speed for all test modes shall be kept constant to within $\pm$ 3,5 s^{-1}. No alterations to the initial settings are permitted once measurements have commenced.

A test timber in the form of a rectangular log shall be placed on a sawhorse so that its centreline is (600 $\pm$ 10) mm above the ground (see Figure A.1).

The lateral width of the test timber in the direction of the guide bar shall be (200 $\pm$ 10) mm and the vertical height (400 $\pm$ 50) mm. The test timber shall have a slot with a width of (40 $\pm$ 2) mm and a depth of 260 mm $\pm$ 10 mm.

A.2 Mounting and orientation of chain-saw

A.2.1 General

The chain-saw shall be mounted on a test stand with the bar centreline horizontal, as indicated in Figure A.1.

The chain-saw and the bar with the saw chain shall not touch the log during the measurements. The saw chain shall be kept (15 $\pm$ 5) mm from the bottom of the slot. There shall be a distance of (10 $\pm$ 5) mm between the tip of the spiked bumper and the rear surface of the log.

The bar shall be provided with a water brake (or equivalent) at the tip of the bar, capable of absorbing the energy of the saw. If a water brake is used, the speed of the engine shall be controlled by the water flow inside the water brake. The weight, shape or design of the loading device shall be such that there is no influence on the noise readings. See Annex C for an example of a water brake.

A.2.2 A-weighted sound power level measurement

During the measurements, the tip of the bar shall be directed above and in the direction of the positive x-axis and with the front handle vertically above the centre point of the hemisphere.

The saw shall be mounted in the test fixture as described by Figure A.1. A fixture which holds the saw in the intended position and which does not cause any reflections shall be used. A flexible mount is recommended for avoiding any structural resonance.