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**Manually portable chain-saws with internal
combustion engine — Determination of
sound power levels — Engineering
method (grade 2)**

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*Scies à chaîne portatives avec moteur thermique — Détermination des
niveaux de puissance acoustique — Méthode d'expertise (classe 2)*

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Reference number
ISO 9207:1995(E)

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.

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

International Standard ISO 9207 was prepared jointly by Technical Committees ISO/TC 43, *Acoustics*, Subcommittee SC 1, *Noise* and ISO/TC 23, *Tractors and machinery for agriculture and forestry*.

Annex A of this International Standard is for information only.

Introduction

The sound power level is one of the two major descriptors of the noise emitted by machinery. The other one is the emission sound pressure level at a work station, which can be determined using ISO 7182. This International Standard, together with ISO 7182, constitutes the noise test code for manually portable chain-saws with an internal combustion engine. The determination of sound power levels and emission sound pressure levels at work stations is necessary for:

- manufacturers, to declare the noise emitted;
- comparing the noise emitted by machines in the group concerned;
- purposes of noise control at source at the design stage.

This International Standard has been prepared according to the rules for the drafting of noise test codes given in ISO 12001. However, ISO 7182 and ISO 9207 together do not constitute a noise test code that meets the requirements of ISO 12001 because ISO 7182 specifies an absorbing floor so does not meet any of the basic noise standards for the determination of emission sound pressure levels at a work station.

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Manually portable chain-saws with internal combustion engine — Determination of sound power levels — Engineering method (grade 2)

1 Scope

This International Standard specifies a method for determining the sound power level of manually portable chain-saws.

It provides all the information necessary to carry out efficiently and under standardized conditions the determination, declaration and verification of sound power levels of manually portable hand-held chain-saws with an internal combustion engine, as primarily used in forestry.

The use of this International Standard ensures the reproducibility of the determination of sound power levels within specified limits determined by the grade of accuracy of the basic noise standard used for the determination of sound power levels. Preferred methods for the determination of sound power levels according to this International Standard are engineering methods (grade 2).

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

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:—¹⁾, *Acoustics — Declaration and verification of noise emission values of machinery and equipment.*

ISO 6531:1982, *Machinery for forestry — Portable chain saws — Vocabulary.*

ISO 6532:1993, *Portable chain-saws — Technical data.*

ISO 7293:1983, *Forestry machinery — Portable chain saws — Engine performance and fuel consumption.*

3 Definitions

For the purposes of this International Standard, the definitions given in ISO 3744 apply.

4 Description of machinery family

This International Standard applies to portable hand-held chain-saws with combustion engines as described in ISO 6531 and ISO 6532.

5 Sound power level determination

5.1 Basic International Standards to be used

The preferred method for determining the sound power levels of chain-saws is that given in ISO 3744. This basic standard for the determination of sound

1) To be published. (Revision of ISO 4871:1984)

power levels is based on sound pressure measurements at positions specified on a surface enveloping the sound source. It gives all specifications necessary (qualification of the test environment, basic measurement and calculation procedures, instrumentation, determination of background noise and environmental corrections, etc.) for the determination of sound power levels. ISO 3744 also offers some options; those retained for this International Standard are specified in 5.2.

NOTE 1 Other basic measurement methods yielding the same or a higher grade of accuracy may be used (see annex A).

5.2 Options retained in the basic standard

When using ISO 3744:

- the measurement surface shall be a hemisphere with a radius r equal to 4 m;
- an array of 6 microphones, as shown in figure 1 and with the coordinates given in table 1, shall be used.

NOTE 2 This 6-microphone array is permitted because experimental data on chain-saws or similar machinery show that use of this array does not yield results that differ sig-

nificantly from those obtained with the 10-microphone array specified in ISO 3744.

Table 1 — Six-microphone array: Coordinates of the microphone positions

Values in metres

No.	x	y	z
1	2,60	2,60	1,50
2	-2,60	2,60	1,50
3	-2,60	-2,60	1,50
4	2,60	-2,60	1,50
5	-1,10	2,60	2,80
6	1,10	-2,60	2,80

The chain-saw shall be oriented in such a way that the operator faces point A as shown in figure 1.

The quantity to be determined, especially for noise declaration purposes, is primarily the A-weighted sound power level. This quantity is determined from measured A-weighted time-averaged sound pressure levels as defined in ISO 3744.

NOTE 3 Depending on the purpose of the measurement, sound power levels with other frequency weightings, time-weighted or in frequency bands (octave or one-third-octave bands) may also be determined.

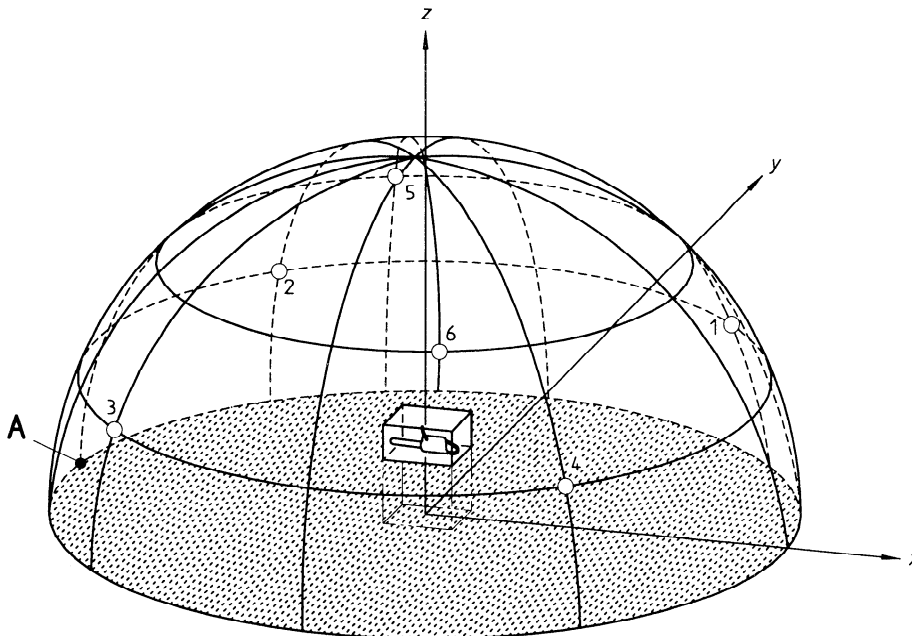


Figure 1 — Six-microphone array: Location of the microphone positions on the hemisphere of radius r equal to 4 m

5.3 Test environment

In addition to the requirements and procedures for the qualification of the test site given in annex A of ISO 3744:1994, the following applies for outdoor measurements. An open space of at least 10 m shall be completely free from obstructions that might influence the results. Significant reflecting surfaces, such as a wall or a fence more than 1 m high, shall not be closer than a radius of 20 m. The ground throughout the test site to a radius of 10 m shall be relatively plane. Suitable ground surfaces are hard-packed soil, asphalt or, preferably, concrete. If the above requirements for outdoor tests are met, the environmental correction factor K_2 defined in ISO 3744 can be considered as negligible.

5.4 Measurement uncertainty

The measurement uncertainty is expressed in terms of standard deviation of reproducibility. For chain-saws and grade 2 accuracy, the standard deviations of reproducibility for sound power levels are those specified in ISO 3744. For A-weighted sound power levels, it is equal to 1,5 dB.

5.5 Test procedure

5.5.1 General

Measurements on a chain-saw shall be carried out on four successive occasions. The engine shall be shut off and the saw left for a minimum of 5 min between measurements. A complete set of the three operating conditions described in 6.2 to 6.4 shall be performed at each occasion. For each operating condition, time-averaged sound pressure levels shall be measured at each microphone position and, if necessary, corrected for background noise. Corrected values shall then be averaged on an energy basis to obtain the surface sound pressure level defined in ISO 3744.

For a given operating condition, the four surface sound pressure levels obtained shall not differ by more than 3 dB. If this value is exceeded, then tests shall be repeated for this operating condition until four consecutive values of the surface sound pressure level are within 3 dB. The final value to be retained as the surface sound pressure level from which the sound power level shall be determined is the arithmetical mean of the four successive values satisfying the above criterion.

The sound power level shall be determined for the installation and operating conditions specified in clause 6.

5.5.2 Revolution indicator

An easy-to-read revolution indicator is needed to check the engine speed. It shall have an accuracy of $\pm 2,5\%$. The counter shall not affect the sawing work during the test. The revolution indicator shall be connected to the chain-saw in such a manner that the operator can conveniently check engine speed without interfering with the sawing.

5.5.3 Ambient conditions

Ambient air temperature shall be in the range $-10\text{ }^{\circ}\text{C}$ to $30\text{ }^{\circ}\text{C}$. Measurements at ambient temperatures below $0\text{ }^{\circ}\text{C}$ are allowed provided that appropriate measuring instruments are used. The wind speed shall not exceed 5 m/s. A windscreen shall be used each time the wind speed exceeds 1 m/s.

5.5.4 Operator and observer

The operator shall wear usual working clothes with no pronounced acoustically absorbent or reflective effects. A safety helmet and appropriate ear and eye protection are permissible.

NOTE 4 It is strongly recommended that the operator wear a safety helmet and appropriate ear and eye protection.

NOTE 4 The operator, excepted, no person, including the observer who records the results, shall stand inside the hemisphere or close to a microphone.

6 Installation and operating conditions

6.1 General

Measurements shall be carried out on a normal production chain-saw with standard equipment and with a chain provided by the manufacturer. The engine shall be run-in and warmed-up before the test is commenced with the carburettor and ignition timed in accordance with the manufacturer's instructions. The chain shall be sharpened.

The chain-saw shall be maintained by the operator in the position indicated in figure 2. The spiked bar on the front face of the engine housing shall not touch the beam of timber during the test.

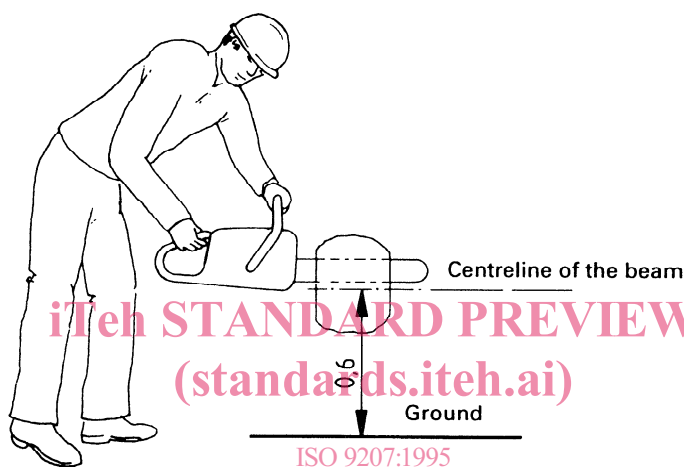
6.2 Idling operating condition

Measurements shall be made at the engine idling speed stated by the manufacturer and the chain shall not move.

Table 2 — Corresponding values of engine displacement, length of guide bar and width of log during the test

Engine displacement cm ³	Effective length L of guide bar m	Width of test beam m
0 to 44	0,25 to 0,35	$(75 \pm 5) \%$ of L
45 to 69	0,30 to 0,40	$(75 \pm 5) \%$ of L
70 to 89	0,40 to 0,50	$(75 \pm 5) \%$ of L
90 and above	0,50 and above	$L - 0,1$

Dimensions in metres

**Figure 2 — Position of the chain-saw during the test**

Time-averaged sound pressure levels shall be measured over a period of at least 10 s and preferentially 15 s.

6.3 Full-load operating condition

A rectangular beam of non-dried timber shall be placed on a saw-horse so that its centre is 0,6 m above the ground (see figure 2) and so that slices can be cut from it. Slices shall be cut from the side that gives the highest sound pressure level. Measurements shall be made during cross-cutting with the throttle fully open.

The guide bar of the chain-saw shall be fed into the log so that the engine speed for maximum engine power $\pm 3,5$ r/s is kept constant. For guide bars longer than 0,5 m, the width of the timber shall be 0,1 m less than the guide bar length.

Only one measurement value shall be recorded for each cross-cut and the measurement shall be per-

formed when the guide bar is in the inner third of the log height, and horizontal.

The ratio between the width of the beam, the engine power and the length of the guide bar of the chain-saw to be tested shall be as given in table 2.

The maximum engine power shall be measured in accordance with ISO 7293.

6.4 Racing operating condition

NOTE 5 This measurement does not normally apply to chain-saws with an engine displacement of over 80 cm³.

Measurements shall be made at an engine speed which is 133 % of the speed at maximum engine power. If the engine has a revolution limit which is below that speed, the measurement shall be made at the stipulated maximum revolution speed.

Time-averaged sound pressure levels shall be measured over a period of at least 10 s and preferentially 15 s.

7 Information to be recorded

The information to be recorded is the same as that specified in the basic standard used for the determination of sound power levels. This includes a description of the test environment:

- if outdoors, a sketch showing the location of the engine with respect to the surrounding terrain, including a physical description of the test environment (the nature of the ground shall be described);
- if indoors, a description of any physical treatment of walls, ceiling and floor and a sketch showing the location of the engine and the room contents.

For each of the operating conditions specified in clause 6 and for each microphone position, the measured time-averaged sound pressure levels (corrected for background noise and the influence of the environment), if available, and the surface sound pressure level \bar{L}_{pf} shall be recorded. For this, table 3 may be used.

The sound power level obtained for each operating conditions (see clause 8) shall be recorded.

Any deviations from this International Standard and/or from the basic standard used for the determination of sound power levels shall be recorded and technical justification for them shall be given.

Table 3 — Acoustical measurement results to be recorded

Test	Operating condition	L_{p1}	L_{p2}	L_{p3}	L_{p4}	L_{p5}	L_{p6}	\bar{L}_{pf}
1	Idling							
	Full-load							
	Racing							
2	Idling							
	Full-load							
	Racing							
3	Idling							
	Full-load							
	Racing							
4	Idling							
	Full-load							
	Racing							

NOTES

- 1 L_{p1} to L_{p6} are the measured time-averaged sound pressure levels at the corresponding microphone positions corrected for background noise and for the influence of the environment. \bar{L}_{pf} is the surface sound pressure level.
- 2 Table 3 shall be filled in for A-weighted levels and for frequency band levels if such levels have been measured.
- 3 Individual values of L_p shall only be recorded if available. Indeed, the test procedure may include the automatic calculation of \bar{L}_{pf} .