
International Standard



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Acoustics — Measurement at the operator's position of airborne noise emitted by chain saws

Acoustique — Mesurage au niveau de l'oreille de l'opérateur du bruit émis par les scies à chaîne

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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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 7182 was prepared jointly by Technical Committees ISO/TC 23, *Tractors and machinery for agriculture and forestry*, and ISO/TC 43, *Acoustics*.

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Acoustics — Measurement at the operator's position of airborne noise emitted by chain saws

1 Scope and field of application

This International Standard specifies a method for measuring the A-weighted and octave band sound pressure levels, at the operator's position, of noise emitted by portable, hand-held, combustion engine chain saws for use primarily in forestry.

The operating conditions during measurement simulate normal operating conditions in the forest.

NOTE — This International Standard is based on the general guidelines of ISO 6081; however, to simulate a normal operating situation of a chain saw an absorbing ground is specified instead of a reflecting plane.

2 References

ISO 266, *Acoustics — Preferred frequencies for measurements.*

ISO 6081, *Acoustics — Noise emitted by machinery and equipment — Guidelines for the preparation of test codes of engineering grade requiring noise measurements at the operator's position.*¹⁾

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

IEC Publication 225, *Octave, half-octave and third-octave band filters intended for the analysis of sounds and vibrations.*

IEC Publication 651, *Sound level meters.*

3 Measured quantities

3.1 The values measured shall be A-weighted sound pressure levels, in decibels, determined with the frequency weighting "A" and the time weighting "S" as defined in IEC Publication 651.

3.2 Spectral analysis is optional. When it is required, the values measured shall be octave band sound pressure levels in decibels, measured in the eight bands having centre frequencies from 63 to 8 000 Hz.

4 Acoustic environment

4.1 Open space

The test site shall be an open space having a radius of at least 10 m which shall be completely free from obstructions which might influence the measurement. However, large reflecting surfaces, such as a fence or a wall, shall not be closer than a radius of 20 m. No person, including the observer, shall approach closer than 2 m to the operator. The operator's clothing shall not be of particularly absorbing or reflecting material. The ground at the centre of the test site shall have good sound absorbent properties and may comprise forest ground, grass or an equivalent surface. It should be approximately flat. The ground may be covered in snow, but not frozen over.

4.2 Enclosed space

Measurements may also be carried out in a large building provided it can be proved that they are in accordance, to within ± 1 dB, with the levels measured under the conditions given in 4.1 for one-third octave bands of noise in the frequency range 50 to 10 000 Hz.

4.3 Background noise

At the microphone position, the background noise (including wind noise) measured as the A-weighted sound pressure level and in each octave band, as appropriate, shall be at least 10 dB below the sound pressure levels measured during the test.

4.4 Ambient conditions

Environmental conditions (humidity, temperature, vibration, stray fields, etc.) shall be within the limits specified by the manufacturers of the measuring equipment and of the engine under test.

The ambient air temperature shall be in the range from -10 °C to $+30$ °C, and the wind speed shall be less than 5 m/s.

NOTE — This requirement is intended to ensure that the meteorological conditions do not prevent the attainment of the accuracy levels specified in 4.2 and 8.1.

¹⁾ At present at the stage of draft.

5 Saw conditions and testing material

Measurements shall be carried out on a normal production saw featuring standard equipment with the chain provided by the manufacturer. The engine shall be run in and warmed up before the test is commenced, the carburettor and ignition timed according to the instructions of the manufacturer, and the chain sharpened.

A log or rectangular baulk of non-dried timber shall be placed on a saw horse so that its centre is 0,6 m above the ground and so that slices can be cut from it.

The ratio between the width of the log, the engine power and the length of guide bar of the saw to be tested shall be as given in table 1.

For guide bars longer than 0,5 m, the width of the log shall be 0,1 m less than the guide bar length.

Table 1 — Corresponding values of engine displacement and length of guide bar and width of log during test

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

6 Instrumentation

6.1 Measuring equipment

A suitable measuring device is a sound level meter meeting or exceeding the requirements of a Type 1 instrument in accordance with IEC Publication 651. It is recommended that a microphone with a diameter not greater than 13 mm be used for the measurements. A wind screening attachment to the microphone may be used, provided that this is allowed for, if necessary, in the calibration and does not alter the measured sound pressure level by more than $\pm 0,5$ dB as a consequence of its effect on the omnidirectional characteristics of the microphone.

If alternative measuring equipment, including, for example, a tape recorder, is used, the tolerances of the whole measuring system shall not exceed the tolerances of the relevant clauses of IEC Publication 651 for a Type 1 instrument in the frequency range 50 to 10 000 Hz.

NOTES

1 If a tape recorder is used as part of the measuring equipment, it may be necessary to include suitable weighting networks for recording and reproduction to provide an adequate signal-to-noise ratio over the whole frequency range of interest.

2 Care should be taken, particularly when a microphone with a diameter of more than 13 mm is used, to ensure that the directional characteristics of the microphone do not lead to errors (see clause 7). It is recommended that, when necessary, a random incidence adaptor be used to ensure that the omnidirectionality is not worse than that of a Type 1 sound level meter as specified in IEC Publication 651.

3 Care should be taken to isolate the microphone from vibrations which could affect the measurements. Care should also be exercised to avoid introducing acoustical noise (for example, noise due to the microphone rubbing against the operator's clothing) or electrical noise (for example, due to a flexing cable) that could interfere with the measurements.

6.2 Frequency analysis

Measurement of the sound frequency spectrum, if required, shall be carried out using a frequency analyser fitted with octave filters in accordance with IEC Publication 225. The centre frequencies of the frequency bands shall be in accordance with ISO 266.

6.3 Calibration

At least before and after each series of measurements an acoustical calibrator with an accuracy of at least $\pm 0,5$ dB shall be applied to the microphone to check the calibration of the entire measuring system at one or more frequencies in the range from 200 to 1 000 Hz. The calibrator shall be checked at least once every year to verify that its output has not changed. In addition, an acoustical and an electrical calibration of the instrumentation system over the entire frequency range of interest shall be carried out at least every two years.

The measuring equipment shall be allowed to reach the ambient temperature before it is calibrated.

6.4 Engine speed indicator

An engine speed indicator shall be used to check the speed of the engine. It shall have an accuracy of $\pm 2,5$ % of the reading. The indicator and its engagement with the saw shall not affect the sawing work during the test.

7 Microphone position

The microphone shall be located 200 ± 20 mm to the side of the centreplane of the operator's head, straight out from the ear to the side of the head where the highest sound pressure level is observed and at the same level as the eyebrows of the operator. The microphone shall be aimed with its axis of maximally flat response (as specified by the manufacturer) pointing at the front handle of the saw. The operator shall wear a helmet on which the microphone may be attached. The helmet shall be of a shape so that its outer edge is at least 30 mm closer to the head than the microphone.

8 Test procedure

8.1 General

A complete testing cycle as described below in 8.2 to 8.4 shall be performed four times.

The range of four values noted in table 2 for each operating condition shall not be greater than 3 dB. If this range is exceeded, then the tests shall be repeated until four consecutive results fall within a range of 3 dB.

For all conditions as specified below, the following procedure shall be followed both when measuring A-weighted sound pressure levels and for octave band measurements, if required.

The saw shall be held in the natural manner for normal cross-cutting, as defined in clause 5. The shortest distance from an imaginary line drawn through the upper horizontal part of the front handle to the microphone shall be as close to 0,7 m as possible. Measurements under idling and racing conditions shall be made at a distance of at least 0,7 m from the timber.

Only one measurement value shall be recorded for each cross-cut and the measurement shall be performed when the guide bar is in the inner third of the log diameter and horizontal.

Measurements of sound pressure levels shall be carried out under the operating conditions described in 8.2 to 8.4.

8.2 Idling

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

NOTE — Idling measurements are mainly of interest for ultimate determination of equivalent continuous A-weighted sound pressure levels, for example over a typical working day.

8.3 Full load

Slices shall be cut from the log or baulk of timber, from the end that gives the highest sound pressure level. Measurements shall be made during cross-cutting with the throttle fully open. The guide bar of the saw shall be fed into the log so that engine speed for maximum engine power is kept constant to within $\pm 3,5$ r/s.

8.4 Racing

Measurements shall be made at an engine speed which is 133 % of the speed at maximum engine power as determined in accordance with ISO 7293. If the engine has a revolution limit which is below that speed, the measurement shall be made at the maximum revolution speed stipulated by the manufacturer.

9 Information to be recorded

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

9.1 Saw under test

- a) Description of the saw (including its engine displacement, manufacturer, type and serial number, and length of guide bar).

- b) Operating conditions, as listed in table 2, during acoustical evaluation.

- c) Diameter or thickness of sawn log and type of wood.

9.2 Acoustic environment

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

9.3 Instrumentation

- a) Equipment used for the measurements, including name, type, serial number and manufacturer.
- b) Method used to calibrate the instrumentation system.
- c) Date and place of the most recent calibration of the acoustical calibrator.

9.4 Acoustical and other data

- a) The location of the microphone position (a sketch may be included, if necessary).
- b) The sound pressure levels of the background noise.
- c) Measurement values and mean values in accordance with table 2.
- d) Remarks on subjective impression of noise (audible discrete tones, impulse character, spectral content, temporal characteristics, etc.).
- e) Air temperature and wind speed.
- f) The date and place of the measurements.

Table 2 — Table for reporting measurement results

Operating condition	Number of revolutions per second	A-weighted sound pressure level dB				
		Test				Arithmetic mean
		1	2	3	4	
Idling						
Full load						
Racing						

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