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МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ

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

*Acoustique — Mesurage au niveau de l'oreille de l'opérateur du bruit émis par les
débroussailleuses*

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Reference number
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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 7917 was prepared jointly by Technical Committees ISO/TC 43, *Acoustics* and ISO/TC 23, *Tractors and machinery for agriculture and forestry*.

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Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

Acoustics — Measurement at the operator's position of airborne noise emitted by brush 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 brush saws for use primarily in forestry which are powered by internal combustion engines.

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

NOTE — This International Standard is based on the general guidelines of ISO 6081¹⁾; however, to simulate a normal operating situation of a brush saw, an absorbing ground is specified instead of a reflecting plane.

2 References

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

ISO 8893, *Forestry machinery — Portable brush saws — Engine performance and fuel consumption.*²⁾

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 characteristic A and the time-weighting characteristic S as defined in IEC Publication 651.

3.2 Spectral analysis is optional. When required, octave-band sound pressure levels, in decibels, shall be 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 ice.

4.2 Enclosed space

Measurements may also be carried out in a large building, provided that 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 from 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 brush saw under test.

1) 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.*

2) At present at the stage of draft.

The ambient air temperature shall be in the range from -10 to $+30$ °C; 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 accuracy levels specified in 4.2 and 8.1 from being attained.

5 Saw conditions and testing material

5.1 General conditions

Measurements shall be carried out on a normal production brush saw having a standard configuration with the cutting equipment provided by the manufacturer. The engine shall be run in and warmed up before the test is commenced, the carburettor and ignition timed in accordance with the instructions of the manufacturer, and the cutting equipment sharpened for best cutting performance in accordance with the manufacturer's recommendations.

5.2 Harness adjustment and attachment (see the figure)

Working on the assumption that a man is $1\,750 \pm 20$ mm tall, the following adjustments shall be made before the test:

- the harness shall be adjusted to the size of the operator so that the point where the centreline of the shaft meets the vertical line from the attachment point, when the brush saw is in balance, is 775 ± 10 mm above the ground;
- the handles shall be adjusted to a comfortable working position;
- the distance between the centre of the cutting blade and the ground shall be 300 mm.

5.3 Wood specification

For the cutting test, green, well-grown soft wood or the equivalent shall be used. It shall be firmly attached to the ground and arranged as a continuous plank so that a stable cutting speed can be attained. The grain shall be vertical. The thickness of the plank shall be approximately two-thirds of the difference in radius between the saw blade and washer. The width of the plank in the cutting direction shall be such that a stable cutting speed can be attained.

6 Instrumentation

6.1 Measuring equipment

A suitable measuring device is a sound level meter meeting 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. Use a wind-screening attachment to the microphone, provided that this is allowed for in the calibration and does not, in any case, 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 from 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 insulate the microphone from vibrations which could affect the measurements. Care should also be exercised to avoid introducing acoustical noise (e.g. noise due to the microphone rubbing against the operator's clothing) or electrical noise (e.g. 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 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 on the side of the head where the higher 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 maximum flat response (as specified by the manufacturer) pointing vertically downwards. The operator shall wear a helmet on which the microphone may be attached. The helmet shall be of

a shape that its outer edge is at least 30 mm closer to the head than the microphone.

The location of the microphone above the ground shall be $1\ 650 \pm 10$ mm (see the figure).

8 Test procedure

8.1 General

Perform a complete testing cycle as described below in 8.2 to 8.4 and repeat the cycle three times, i.e. perform four cycles in all.

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

For all conditions as specified below, carry out the following procedure both when measuring A-weighted sound pressure levels and, if required, octave-band sound pressure levels.

The brush saw shall be operated in an upright position in accordance with the figure. The saw shall be connected to the harness and held with both hands in a manner consistent with day-long use of the saw.

The height of the operator shall be $1\ 750 \pm 20$ mm.

Carry out measurements of sound pressure levels under operating conditions as described in 8.2 to 8.4.

During the measurements, keep the engine speed to within $\pm 3,5$ r/s of the speed at maximum power as determined in accordance with ISO 8893.

8.2 Idling

Take measurements at the engine idling speed stated by the manufacturer, ensuring that the cutting element does 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

Ensure that full load is obtained with the throttle fully open at the speed at maximum power as determined in accordance with ISO 8893.

Ensure that the saw is cutting wood and that the speed of the engine is controlled by the cutting force. Cut the plank across the grain.

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Dimensions in millimetres

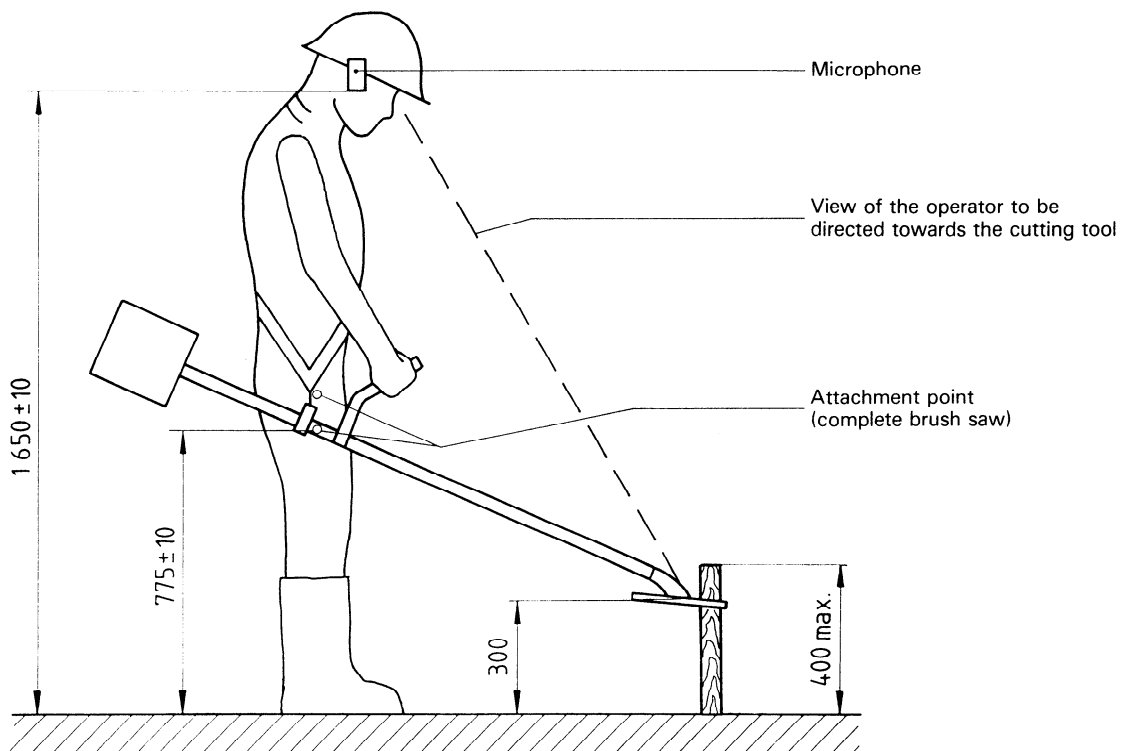


Figure — Brush saw position for cutting test

8.4 Racing

Take measurements at an engine speed which is 133 % of the speed at maximum engine power, as determined in accordance with ISO 8893, or at maximum speed, whichever is less.

The speed shall be controlled by operation of the throttle, if the maximum possible speed exceeds 133 % of the speed at maximum power.

9 Information to be recorded

The information specified in 9.1 to 9.4, 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

The following information shall be recorded :

- a) description of the saw (including its engine displacement, manufacturer, type and serial number, and cutting equipment);
- b) operating conditions, as listed in the table, during acoustical evaluation;
- c) dimensions and type of wood.

9.2 Acoustical environment

The following information shall be recorded :

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

9.3 Instrumentation

The following information shall be recorded :

- 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

The following information shall be recorded :

- 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 the table;
- 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 — Table for reporting measurement results

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

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