

INTERNATIONAL
STANDARD

ISO
10884

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**Manually portable brush-cutters and
grass-trimmers with internal combustion
engine — Determination of sound power
levels — Engineering method (Grade 2)**

*Débroussailleuses et coupe-herbe portatifs à moteur à combustion
interne — Détermination des niveaux de puissance acoustique —
Méthode d'expertise (classe 2)*



Reference number
ISO 10884:1995(E)

Foreword

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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 10884 was prepared jointly by Technical Committees ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 17, *Manually portable forest machinery* and ISO/TC 43, *Acoustics*, Subcommittee SC 1, *Noise*.

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Introduction

The International Standard gives a method for determining the sound power level of manually portable brush-cutters and grass-trimmers since 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 the workstation which can be determined using ISO 7917. This International Standard together with ISO 7917 constitute the noise test code for manually portable brush-cutters and grass-trimmers with internal combustion engines. The determination of sound power levels and emission sound pressure levels at workstations 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 7917 and this International Standard together do not constitute a noise test code that meets the requirements of ISO 12001, because ISO 7917, in prescribing an absorbing floor, does not meet any of the basic noise standards for the determination of emission sound pressure levels at the workplace.

Manually portable brush-cutters and grass-trimmers with internal combustion engine — Determination of sound power levels — Engineering method (Grade 2)

1 Scope

This International Standard specifies a method of carrying out, efficiently and under standardized conditions, the determination, declaration and verification of sound power levels of manually portable hand-held brush-cutters and grass-trimmers, as defined in 3.1 and 3.2 respectively. These units have internal combustion engines and are 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 for the determination of sound power levels used. 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 4871:1984, *Acoustics — Noise labelling of machinery and equipment.*

3 Definitions

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

3.1 brush-cutter: Unit using a rotating blade made of metal or plastics, intended to cut weed, brush, small trees and similar vegetation.

3.2 grass-trimmer: Unit using flexible line(s), string(s) or similar non-metallic flexible cutting elements, such as pivoting cutters, intended to cut weed, grass or similar soft vegetation.

4 Sound power level determination

4.1 Preferred test method

The preferred method for determining the sound power levels of brush-cutters and grass-trimmers is that given in ISO 3744. This basic Standard for the determination of sound power levels is based on sound pressure measurements at positions specified on a surface enveloping the sound source. It gives all specifications necessary (qualities 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.

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

ISO 3744 also offers some options: those chosen for this International Standard are as follows.

When using ISO 3744, the measurement surface shall be a hemisphere with a radius, r , of 4 m.

The microphone array shall be six microphone positions as defined in figure 1 and table 1.

NOTE 2 This six-microphone array is permitted because experimental data on these types of machinery show that the use of this array does not yield results that differ significantly from those obtained with the ten-microphone array specified in ISO 3744:1994, subclause 7.2.1 and figure B 1.

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

The parameter to be determined, especially for noise declaration purposes, is primarily the A-weighted sound power level. This parameter 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 third-octave bands) may also be determined.

4.2 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 radius of 10 m shall be relatively plane. Suitable ground surfaces are hard-packed soil, asphalt or, preferably, concrete. If the above requirements for the outdoor test are met, the environmental correction factor K_2 defined in ISO 3744 can be considered as negligible.

4.3 Measurement uncertainty

The measurement uncertainty is expressed in terms of standard deviation of reproducibility. For these types of machines 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.

4.4 Test procedure

4.4.1 General

Measurements on a machine shall be carried out at four times. The engine shall be shut off and left for a minimum of 5 min between these times. A complete set of the two operating conditions described in 5.2 and 5.3 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 average 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 5.

Measurements of sound pressure levels shall be carried out under no-load conditions (idling and racing speed). Investigations have shown that the noise emitted under no-load conditions is representative for these machines.

4.4.2 Revolution indicator

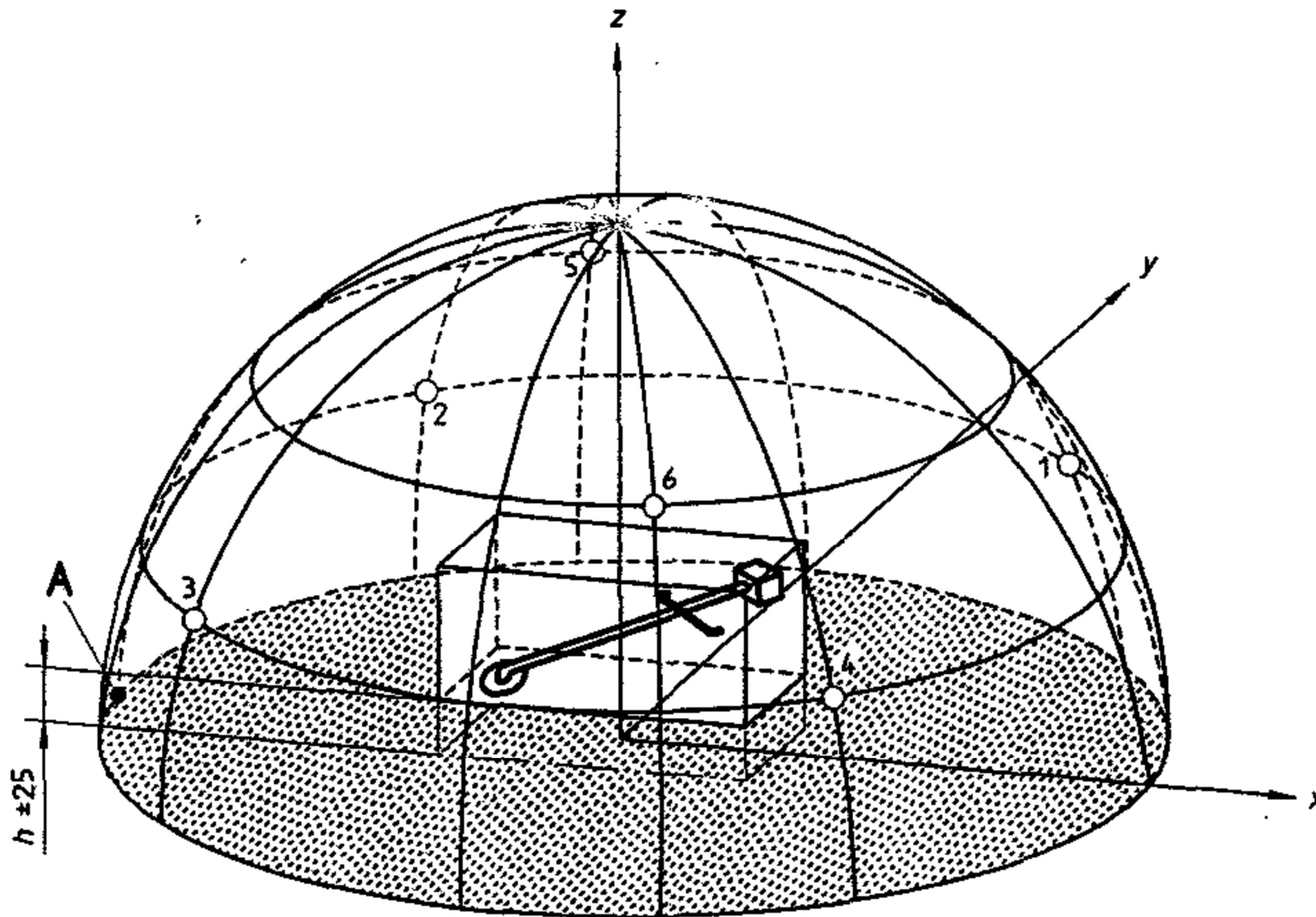
An easy-to-read revolution indicator with an accuracy of $\pm 2,5\%$ shall be connected to the machine such that the operator can conveniently check engine speed without interfering with the running of the cutting means.

4.4.3 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 permissible if appropriate measuring instruments are used.

The wind speed shall not exceed 5 m/s. A wind screen shall be used every time the wind speed exceeds 1 m/s.

Dimensions in millimetres



Hemisphere radius $r = 4$ m

$h = 300$ mm for brush-cutters

50 mm for grass-trimmers

Figure 1 — Six-microphone positions on hemisphere

Table 1 — Six-microphone array: coordinates of microphone positions

Dimensions in metres

Microphone No.	Plane		
	x	y	z
1	2,6	2,6	1,5
2	-2,6	2,6	1,5
3	-2,6	-2,6	1,5
4	2,6	-2,6	1,5
5	-1,1	2,6	2,8
6	1,1	-2,6	2,8

4.4.4 Operator and observer

The operator shall wear normal working clothes with no pronounced acoustically absorbent or reflective effects.

CAUTION — It is strongly recommended that the operator wears a safety helmet, and appropriate ear and eye protection.

The operator excepted, no person, including the observer who carries out the test, shall stand inside the hemisphere or close to a microphone.

5 Installation and operating conditions

5.1 General

Measurements shall be carried out on a normal production machine with standard equipment and with the cutting means provided by the manufacturer. The engine shall be run-in and warmed up before the test is commenced with the carburettor and ignition timed according to the instructions of the manufacturer.

If the cutting means is of a string type, the string length shall be adjusted to its maximum length.

The machine shall be held by the operator in the position indicated in figure 2.

5.2 Idling operating condition

Measurements shall be made at the engine idling speed stated by the manufacturer; the cutting means shall not move.

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

5.3 Racing operating condition

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 preferably 15 s.

6 Information to be recorded

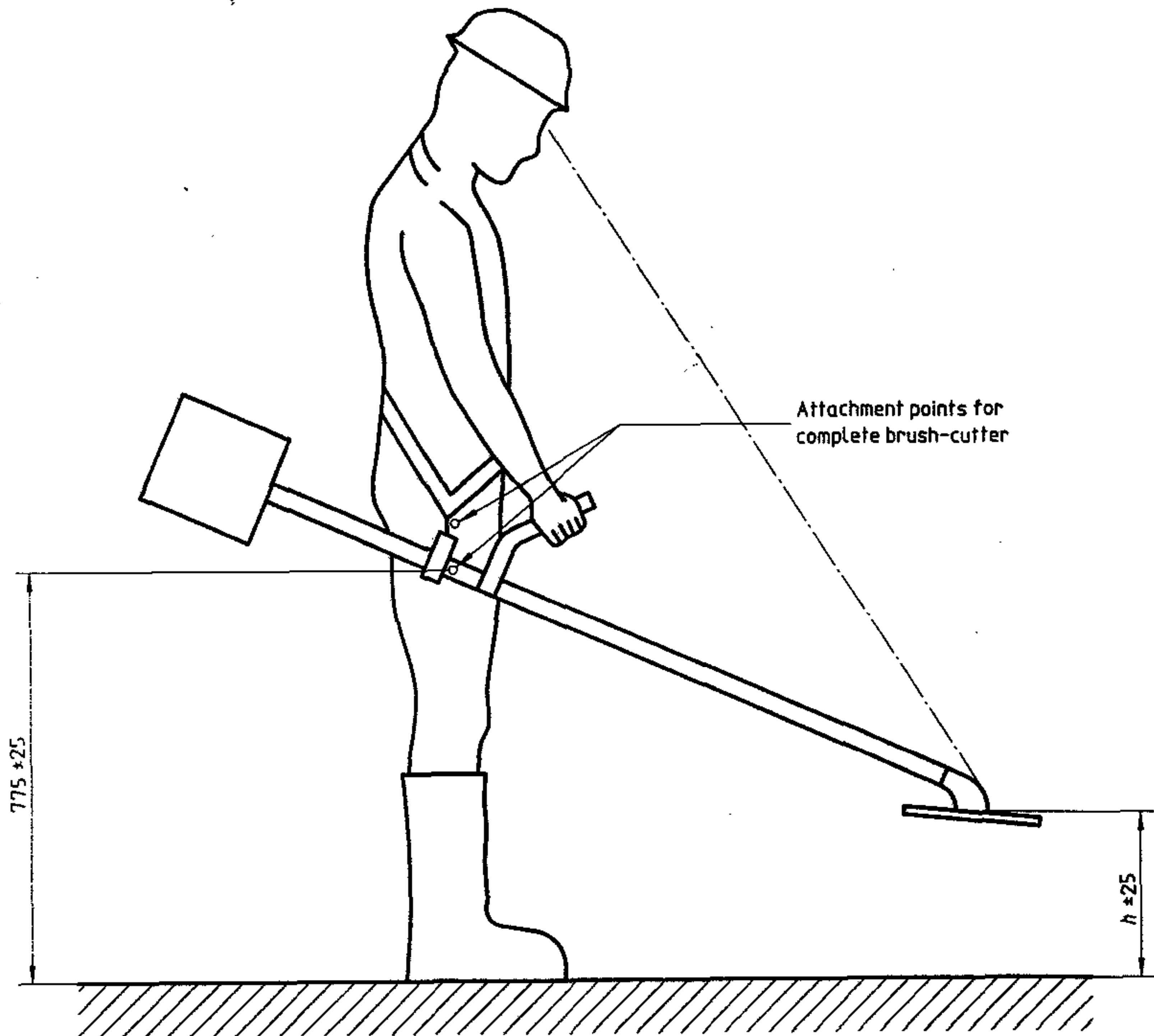
The information to be recorded shall be as specified in the International Standard being applied. This shall include a description of the test environment: if outdoors, a sketch showing the location of the engine with respect to the surrounding terrain, including a physical description of the test environment with the nature of the ground; 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 5 and for each microphone position, measured time-averaged sound pressure levels (corrected for background noise and the influence of the environment), if available, and the surface sound pressure level L_{pf} shall be recorded. For this, table 2 may be used.

The sound power level obtained for each operating condition (see clause 7) shall be recorded.

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

Dimensions in millimetres



$h =$ 300 mm for brush-cutters
 50 mm for grass-trimmers

NOTE — For grass-trimmers without a suspension-point, the distance (775 ± 25) mm is valid to the centre of the handle gripping area, or to the rear handle if located along the shaft-tube.

Figure 2 — Position of machine during test

Table 2 — Acoustical measurement results

Test No.	Operating conditions	L_{p1} dB	L_{p2} dB	L_{p3} dB	L_{p4} dB	L_{p5} dB	L_{p6} dB	\overline{L}_{pt} dB
1	Idling							
	Racing							
2	Idling							
	Racing							
3	Idling							
	Racing							
4	Idling							
	Racing							

NOTES

1 Acoustical measurement results are recorded. 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. \overline{L}_{pt} is the surface sound pressure level. Table 2 shall be filled in for A-weighted levels and for frequency band levels if such levels have been measured.

2 Individual values of L_p shall only be recorded if available: the test procedure may include the automatic calculation of \overline{L}_{pt} .

7 Test report

The information to be reported is that required for the purpose of the measurements. This information includes at least that which the manufacturer requires to prepare a noise declaration or the user requires to verify the declared values. As a minimum, the following information shall be reported:

- reference to this International Standard and to the basic International Standard for the determination of sound power levels used;
- description of the machine, including dimensions of its cutting means, name and address of manufacturer, type and serial number, and year of manufacture;

- description of the installation and operating conditions used;
- the value of the sound power level obtained from those of the surface sound pressure level arithmetically averaged over the four repeated tests, for each of the operating conditions specified: table 3 may be used for reporting these values.

The test report shall confirm that all requirements of this International Standard and of the basic International Standard for the determination of sound power levels used have been fulfilled, or, if this is not the case, the deviations from the requirements shall be reported and technical justification for them shall be given.

Table 3 — Acoustical data

Operating conditions	\overline{L}_{ptm} dB	L_w dB
Idling		
Racing		
NOTE — Acoustical data is reported. \overline{L}_{ptm} is the arithmetical average of the four values of L_{pt} given in table 2 from which the sound power level L_w is calculated. Table 3 shall be filled in for A-weighted levels and for frequency band levels if such levels have been measured.		

8 Declaration and verification of sound power levels

Quantities yielded by this International Standard that shall be declared are A-weighted sound power levels. Declared values of the sound power level shall be

rounded to the nearest whole decibel. The noise declaration shall explicitly state whether or not sound power level values from which declared values have been derived have been obtained using this International Standard. If it is so, the noise declaration shall also indicate which of the basic standards for the determination of sound power levels has been used.

Additional values of the sound power level, for example measured values, values in frequency bands, may also be given in the noise declaration. Such values shall be given in such a format that they cannot be confused with the declared values.

The declaration by a manufacturer of machines of values of the sound power level shall be made in such a fashion that the values can be verified in accordance with ISO 4871:1984, subclause 6.2.

The verification of a declared value of the sound power level shall be conducted by using the same installation and operating conditions as those used for the initial determination of the sound power level.

Annex A (informative)

Bibliography

- [1] ISO 3745:1977, *Acoustics — Determination of sound power levels of noise sources — Precision methods for anechoic and semi-anechoic rooms.*
- [2] ISO 7917:1987, *Acoustics — Measurement at the operator's position of airborne noise emitted by brush saws.*
- [3] ISO 9614-1:1993, *Acoustics — Determination of sound power levels of noise sources using*
sound intensity — Part 1: Measurement at discrete points.
- [4] ISO 9614-2:—¹⁾, *Acoustics — Determination of sound power levels of noise sources using sound intensity — Part 2: Measurement by scanning.*
- [5] ISO 12001:—¹⁾, *Acoustics — Noise emitted by machinery and equipment — Rules for the drafting and presentation of a noise test code.*

1) To be published.

ICS 17.140.20; 65.060.80

Descriptors: agricultural machinery, forest equipment, portable equipment, mechanically-operated devices, grass trimmers, brush cutters, tests, acoustic tests, determination, sound pressure, sound power, rules of calculation, acoustic measurements.

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