SLOVENSKI STANDARD
SIST ISO 11094:2002

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Akustika ï Preskusni postopek za merjenje hrupa v zraku, ki ga sevajo gnane kosilnice za trato, traktorji za trato, traktorji za trato in vrt, profesionalne kosilnice in traktorji za trato in vrt s premiļ nim priklopom

Acoustics -- Test code for the measurement of airborne noise emitted by power lawn mowers, lawn tractors, lawn and garden tractors, professional mowers, and lawn and garden tractors with mowing attachments

Acoustique -- Code d'essai pour le mesurage du bruit aérien émis par les tondeuses à gazon à moteur, les tracteurs de pelouse, les tracteurs de jardin et de pelouse, les tondeuses à usage professionnel, et les tracteurs de jardin et de pelouse avec équipements de tonte adaptables

Ta slovenski standard je istoveten z: **ISO 11094:1991**

ICS:

17.140.20	Emisija hrupa naprav in opreme	Noise emitted by machines and equipment
65.060.70	Vrtnarska oprema	Horticultural equipment

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INTERNATIONAL STANDARD

ISO 11094

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Acoustics — Test code for the measurement of airborne noise emitted by power lawn mowers, lawn tractors, lawn and garden tractors, professional mowers, and lawn and garden tractors with mowing attachments

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Reference number
ISO 11094:1991(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 11094 was prepared jointly by Technical Committees ISO/TC 43, *Acoustics*, Sub-Committee SC 1, *Noise* and ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Sub-Committee SC 13, *Powered lawn and garden equipment*.

Annex A of this International Standard is for information only.

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Introduction

This International Standard describes a method for measuring the airborne noise emitted by powered grass-cutting machines essentially in accordance with ISO 4872. The method specifies the determination of the acoustical characteristics of a machine in terms of the A-weighted sound power level. The values obtained are the fundamental quantities for characterizing the sound output of the machine under test. The A-weighted sound power level of the machine is calculated from measured values of the A-weighted sound pressure level at several microphone positions located on a hypothetical hemispherical surface which envelops the machine. It has, however, been considered appropriate to specify fewer microphone positions than those in ISO 4872.

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Acoustics — Test code for the measurement of airborne noise emitted by power lawn mowers, lawn tractors, lawn and garden tractors, professional mowers, and lawn and garden tractors with mowing attachments

1 Scope

This International Standard specifies methods for measuring the A-weighted sound pressure levels at prescribed microphone positions in the proximity of the machine under test while the machine is stationary or in motion. From these values the A-weighted sound power level of the machine may be calculated.

It defines acoustical requirements for measurements in an essentially free field over a partially reflecting plane, covered with a specified official absorbing material or natural grass (see 4.1). The operating and mounting conditions of the machine under test are described in detail.

NOTE 1 For noise control purposes, for example in the development of quieter machines, other methods employing frequency analysis are usually applied.

This International Standard applies to the following types of mower designed for private or professional (commercial) use in recreational, decorative and domestic areas:

— powered lawn mowers: walk-behind mowers, self-propelled mowers and riding mowers with, for example, rotary- and reel-mowing systems, and with reference to the power source such as mains-powered electric mowers, battery-powered electric mowers and internal combustion engine-powered mowers;

— lawn and garden tractors or other multi-purpose gardening machines with attachments for mowing, with mowing systems as for powered lawn mowers being powered by electric batteries and/or internal combustion engines;

— professional (commercial) mowers and turf-care equipment.

It does not apply to the following:

— towed machines with mowing systems which are not powered by the machine but powered by a gearing mechanism from the wheels of the machine;

— agricultural and forestry machines for grass-cutting or grass-harvesting.

This International Standard does not describe the following:

— measurement of sound pressure levels at the operator's position (i.e. at the ears of the operator);

— determination of the directivity characteristics of the emitted noise and of the content of impulsive noise since these quantities are irrelevant;

— determination of frequency characteristics, for example, for noise control purposes in the development of quieter machines, where frequency analysis in octave bands or one-third octave bands is usually applied.

NOTES

2 A-weighted sound power levels determined in accordance with this International Standard tend to result in repeatability standard deviations of approximately 1 dB, provided that the noise spectrum does not contain pronounced discrete frequencies. If it does, the magnitude of the repeatability standard deviations may be larger than 1 dB. The repeatability standard deviation of 1 dB reflects the cumulative effects of all causes of measurement uncertainty, excluding variations in the noise emission from machine to machine in mass or quantity production and from test site to test site.

3 For different test sites, the reproducibility standard deviation may be 2 dB. Artificial test site surfaces will

probably give the smallest reproducibility standard deviations.

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 354:1985, *Acoustics — Measurement of sound absorption in a reverberation room.*

ISO 4046:1978, *Paper, board, pulp and related terms — Vocabulary.*

ISO 4872:1978, *Acoustics — Measurement of airborne noise emitted by construction equipment intended for outdoor use — Method for determining compliance with noise limits.*

ISO 5395:1990, *Power lawn-mowers, lawn tractors, lawn and garden tractors, professional mowers, and lawn and garden tractors with mowing attachments — Definitions, safety requirements and test procedures.*

IEC 651:1979, *Sound level meters.*

IEC 804:1985, *Integrating-averaging sound level meters.*

IEC 942:1988, *Sound calibrators.*

3 Definitions

For the purposes of this International Standard, the definitions given in ISO 5395 and the following definitions apply. For the convenience of users, some definitions from ISO 5395 are repeated.

3.1 sound pressure level, L_p: Ten times the logarithm to the base 10 of the ratio of the square of the sound pressure to the square of the reference sound pressure. It is expressed in decibels. The reference sound pressure is 20 µPa $(2 \times 10^{-5}$ Pa). The symbol for the A-weighted sound pressure level is L_{pA}.

3.2 A-weighted surface sound pressure level, $\overline{L_{pA}}$: Mean sound pressure level weighted over the measurement surface. (See clause 8.) It is expressed in decibels.

3.3 sound power level, L_W: Ten times the logarithm to the base 10 of the ratio of a given sound power to the reference sound power. It is expressed in decibels. The reference sound power is 1 pW$(10^{-12}$ W). The symbol for the A-weighted sound power level is L_{WA}.

3.4 measurement surface: A hypothetical surface of area S which envelops the machine under test and on which the microphone positions are located.

3.5 background noise: At the microphone positions on the measurement surface, the A-weighted sound pressure levels of any noise which is not generated by the machine under test.

3.6 maximum operating engine [motor] speed: Highest engine/motor speed obtainable when adjusted in accordance with mower manufacturer's specifications and/or instructions with the cutting means engaged, taking into account all tolerances.

[ISO 5395:1990, 1.3.23]

3.7 grass catcher: Part or combination of parts which provides a means for collecting grass clippings or debris.

[ISO 5395:1990, 1.3.17]

3.8 cutting width: Width of cut measured across the cutting means at right-angles to the direction of travel and calculated from the dimensions of the cutting means or the diameter(s) of the blade tip circle(s).

[ISO 5395:1990, 1.3.9]

3.9 directional designation: Those designations, such as front, forward, rear, right, right-hand, left-hand, which refer to the direction of travel or orientation of the vehicle, mower or parts thereof when the operator is in the normal operating position.

3.10 machine: Term used for any kind of grass-cutting machinery, e.g. lawn mower tractor with attachments for mowing.

4 Acoustic environment

4.1 Criteria for adequacy of the test environment

4.1.1 General

The test environment shall be a flat open space (a slope, if any, not exceeding 5/100), visibly free of sound-reflecting objects (building, trees, poles, sign boards, etc.) within a circular area with a radius equal to approximately three times the radius of the hemispherical measurement surface used. Two alternatives for the surface of the test environment are given in 4.1.2 and 4.1.3.

For measurements indoors, the sound field inside the measurement room shall be similar to that of an acoustical free field and the values obtained shall be the same as those obtained when measurements are undertaken outdoors in the open air using an artificial surface.

4.1.2 Artificial surface

The artificial surface shall have absorption coefficients as given in table 1, measured in accordance with ISO 354.

Table 1 — Absorption coefficients

Frequency Hz	Absorption coefficient	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 absorptive material 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 the acoustical properties are also met with the absorptive material in place. The structure shall support the mower to avoid compression of the absorbing material.

NOTE 4 See annex A for an example of a material and construction which can be expected to fulfil these requirements.

4.1.3 Natural grass

The test environment shall be covered, at least for the horizontal projection of the measurement surface used, with high-quality natural grass, cut before the measurements are taken to a height of cut in accordance with 6.1. The surface shall be clean of grass clippings and debris and shall be visibly free of moisture, frost or snow.

4.2 Criterion for background noise

At the microphone positions, the A-weighted sound pressure level due to any background noise shall be at least 6 dB, and preferably more than 10 dB, below the A-weighted sound pressure level when the machine under test is operating (see 7.3).

4.3 Climatic conditions

At the open test site, the wind speed shall be less than 8 m/s, and preferably not greater than 5 m/s. For wind speeds in excess of 1 m/s, the microphone(s) shall be equipped with a suitable wind-screening attachment and appropriate corrections for the effects of its use shall be applied in accordance with the manufacturer's instructions.

The air temperature of the test environment shall not be below 5 °C

5 Instrumentation

5.1 Instrumentation for measuring acoustical data

The instrumentation shall be designed to permit the determination of A-weighted sound pressure levels averaged over time on an energy basis. Tolerances of the measuring chain shall not exceed the tolerances specified in the relevant clauses of IEC 651 for instruments of Type 1. If used, integrating-averaging sound level meters shall be in accordance with IEC 804 for instruments of Type 1.

To minimize the influence of the observer on the measurements, the microphone(s) should preferably be connected by cables to the measuring instruments. The observer shall not stand between any microphone and the machine whose sound power is being determined, nor in close proximity to any microphone.

To ensure compliance with the requirements of IEC 651, the measuring instrumentation shall be calibrated at intervals of not more than 2 years in a suitable laboratory with a sound calibrator fulfilling at least the requirements for a Class 1 calibrator in accordance with IEC 942.

At least before and after each series of measurements, an acoustical calibrator with an accuracy of ± 0,3 dB shall be applied to the microphone(s) to verify the calibration of the entire measuring system, including microphone cable(s), if used, at one or more frequencies. One calibration frequency should be in the nominal range from 250 Hz to 1 000 Hz. The calibrator shall be checked annually to verify that its output is within the specification.

NOTES

5 An example of an appropriate instrument for these measurements is a Type 1 sound level meter that meets the requirements of IEC 651 for measurements of steady noise.

6 Another example of an appropriate instrumentation system is an integrator which performs an analog or digital integration of the squared signal over a specified time interval.