
Machinery for forestry — Noise test code

Matériel forestier — Code d'essai acoustique

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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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](http://standards.iteh.ai/Foreword-Supplementary-information)

The committee responsible for this document is ISO/TC 23, *Tractors and machinery for agricultural and forestry*, Subcommittee, SC 15, *Machinery for forestry*.

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Introduction

This International Standard is a specific noise test code for forestry machinery mentioned in the scope of this International Standard and as defined in ISO 6814.

A simulated dynamic test condition, rather than an actual work cycle, is used. Simulated dynamic test conditions provide noise emission data which are repeatable and representative. Actual work cycle tests are complex and repeatability can be a problem.

This International Standard may also be used to determine noise emission for each part of the simulated work cycle.

Specific procedures are described in this International Standard to enable the sound power level and the emission sound pressure level in dynamic test conditions to be determined in a manner which is repeatable. This International Standard enables compliance with noise limits to be determined, if applicable. It can also be used for evaluation purposes in noise reduction investigations.

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Machinery for forestry — Noise test code

CAUTION — The test method specified in this International Standard may lead to a hazardous situation due to moving and rotating machine parts. Test personnel shall stay in safe zones when measuring and observing the tests.

1 Scope

This noise test code specifies all the information necessary for carrying out efficiently and under standardised conditions the noise emission values of self-propelled forestry machinery. It is applicable to fellers, bunchers, delimbers, forwarders, log loaders, skidders, processors, harvesters, mulchers and multi-function versions of these machine types, as defined in ISO 6814.

Noise emission characteristics include A-weighted emission sound pressure values at the operator's station and the A-weighted sound power value. The determination of these quantities is necessary for the following:

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

NOTE For low-noise design, noise emission values in frequency bands are useful and the basic International Standards ISO 3744 and ISO 11201 can be used for determining noise emission quantities in frequency bands.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies..

ISO 3744:2010, *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Engineering methods for an essentially free field over a reflecting plane*

ISO 4871, *Acoustics — Declaration and verification of noise emission values of machinery and equipment*

ISO 5353, *Earth-moving machinery, and tractors and machinery for agriculture and forestry — Seat index point*

ISO 6395:2008, *Earth-moving machinery — Determination of sound power level — Dynamic test conditions*

ISO 6396:2008, *Earth-moving machinery — Determination of emission sound pressure level at operator's position — Dynamic test conditions*

ISO 11201, *Acoustics — Noise emitted by machinery and equipment — Determination of emission sound pressure levels at a work station and at other specified positions in an essentially free field over a reflecting plane with negligible environmental corrections*

3 Emission sound pressure level determination at the operator's station

3.1 For the measurement of the A-weighted emission sound pressure levels, ISO 11201 shall be used.

3.2 The following emission sound pressure levels shall be determined at the operator's station:

— A-weighted time-averaged sound pressure level.

3.2.1 For operators, the microphone shall be mounted on an open-frame helmet worn on the operator's head or on a shoulder harness in such a way that the microphone axis is horizontal and its diaphragm is $200\text{ mm} \pm 20\text{ mm}$ to the side of the centre plane of the operator's head, in the same vertical plane as his eyebrows and facing forwards.

For seated operators, the centre of the microphone shall be $700\text{ mm} \pm 50\text{ mm}$ above the seat index point. The seat index point shall be determined in accordance with ISO 5353.

The standing operator shall be $1,75\text{ m} \pm 0,1\text{ m}$ tall including shoes or as defined in ISO 6396:2008, 6.2 for ride-on machines and standing operator.

The side of the head chosen for the microphone shall be that for which the higher sound pressure level occurs.

3.2.2 The operator shall be positioned in the operator's position for normal operation of the machine. The actual position shall be recorded and reported. If the machine is processing during the measurement, the operator's position is facing the process. For forwarding machines, the operator shall be facing the forwarding direction. The operator shall continue to face in the prescribed direction during the noise measurement.

The operator can use a head-mounted open helmet or hearing protector or both if needed during the measurements. Their use shall be reported.

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4 A-weighted sound power level determination

4.1 For the determination of the A-weighted sound power level, ISO 3744 shall be used. Background noise criteria shall be according to ISO 3744:2010, 4.2.

4.2 Six measurement positions shall be used on a hemispherical surface according to [Figure 1](#) and [Table 1](#).

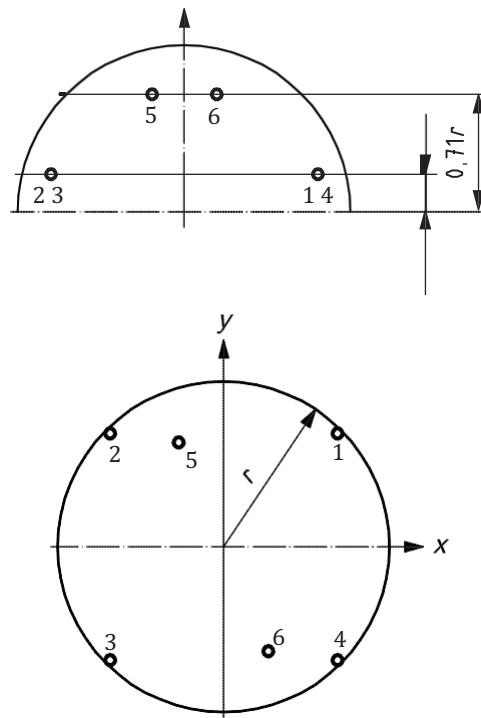


Figure 1 — Microphone array on the hemisphere

Table 1 — Coordinates of microphone positions

Microphone position	x/r	y/r	z
1	0,7	0,7	1,5 m
2	-0,7	0,7	1,5 m
3	-0,7	-0,7	1,5 m
4	0,7	-0,7	1,5 m
5	-0,27	0,65	0,71 r
6	0,27	-0,65	0,71 r

4.3 The hemisphere radius shall be 4 m or 10 m or 16 m. The radius shall be

- 4 m when the basic length, l , of the machine to be tested is less than 1,5 m, or
- 10 m when the basic length, l , of the machine to be tested is greater than or equal to 1,5 m but less than 4 m, or
- 16 m when the basic length, l , of the machine to be tested is greater than or equal to 4 m,

where the basic length, l , is total frame length, horizontal distance between the vertical planes perpendicular to the longitudinal axis passing through the farthest points on the front and rear frame of the machine, blade and loader excluded.

4.4 For machines equipped with a crane, the hemisphere radius may be the maximum reach of the crane boom plus 3 m rounded to the nearest even number.

4.5 The value to be determined is the A-weighted sound power level over a specified work cycle of the machine as stated in [Clause 7](#).

5 Installation and mounting conditions

5.1 The machine installation and mounting conditions as specified by the manufacturer in the instruction handbook shall be applied.

5.2 For the purposes of this International Standard, the test environment specified in ISO 3744:2010, Clause 4 and Annex A, apply. Additional requirements are given in 5.3 to 5.6.

Humidity, air temperature, barometric pressure, vibration and stray magnetic fields shall be within the limits specified by the manufacturer of the instrumentation.

5.3 The test area shall be a hard reflective surface defined as an area bordered by the vertical projection of the microphones to the ground consisting of concrete or non-porous asphalt.

5.4 The requirements for background noise, as specified in ISO 3744, shall be fulfilled. Corrections for background noise shall be made as specified in ISO 3744:2010, 8.3.2.

5.5 Measurements shall not be carried out under the following conditions:

- a) when there is precipitation, i.e. rain, snow or hail;
- b) when the ground surface is covered with snow;
- c) when the temperature is below -10°C or above $+35^{\circ}\text{C}$;
- d) when the wind speed exceeds 8 m/s; for wind speeds in excess of 1 m/s, a microphone windscreen shall be used and appropriate compensation for the effect of its use allowed for when calibrating.

5.6 For test-site measurement ground surfaces consisting of a hard reflecting plane, such as concrete or nonporous asphalt (5.3), and having negligible sound-reflecting obstacles within a distance from the source equal to three times the measurement hemisphere radius, it may be assumed that the absolute value of environmental correction, K_{2A} , is less than or equal to 0,5 dB, and can therefore be disregarded. In this case, K_{2A} shall be equal to 0 dB.

6 Operating conditions

6.1 The operating conditions shall be the same for the determination of both A-weighted emission sound pressure values at the operator's station and the exterior A-weighted sound power value at specified conditions unless otherwise stated below.

Unless otherwise specified, all machines shall be stationary with the tools operating, unloaded, idling at the 75 ± 5 % of manufacturer's rated maximum efficiency engine speed. The machine shall be properly warmed up and stabilized at the normal operating temperature before testing starts.

Adjustments shall be made to ensure that no tools cause additional noise through an unintentional mechanical contact.

If a cab is fitted, the sound pressure level shall be measured with all openings, doors, windows, hatches and windscreen closed.

Measurements shall be taken with the air-conditioning and/or ventilation system(s) in operation. If there is more than one operating speed available, the air conditioning and/or the pressurized ventilation system(s) shall be operated at the second speed for systems with up to four speeds.

For systems with more than four speeds, the third speed shall be used and, for systems with infinitely variable speeds, the mid-range speed.

If the air-conditioning and/or ventilation systems have a recirculate and outside air position control, the control shall be set for outside air.

Windscreen wipers and power take-off shall not be functioning.

6.2 If the engine of the machine or its hydraulic system is fitted with fan(s), they shall operate during the test. The fan speed shall be in accordance with one of the following three conditions, as ISO 6395:2008, 7.3 stated and set by the manufacturer of the machine.

- a) If the fan drive is directly connected to the engine and/or hydraulic equipment (e.g. by belt drive), it shall operate during the test.
- b) If the fan can work at several distinct speeds, the test shall be carried out
 - either at the maximum working speed of the fan, which is fan speed at which the fan provides maximum cooling performance for the machine under the most severe operating conditions or
 - in a first test with the fan set at zero speed and in a second test with the fan set at the maximum working speed; the resulting time-averaged A-weighted sound pressure level, $L_{pA,T}$, shall then be calculated by combining both test results using Formula (1):

$$L_{pA,T} = 10 \lg (0,3 \times 10^{0,1 L_{pA,0\%}} + 0,7 \times 10^{0,1 L_{pA,100\%}}) \text{ dB} \quad (1)$$

where

$L_{pA,0\%}$ is the time averaged A-weighted sound pressure level determined with the fan set at zero speed;

$L_{pA,100\%}$ is the time averaged A-weighted sound pressure level determined with the fan set at maximum speed.

- c) If the fan can work at continuous variable speed, which is fan drive that varies the fan speed continuously throughout a variable range to minimize its speed for the needed cooling performance in relation to the heat load, the test shall be carried out either with accordance with b) or with the fan speed set by the manufacturer at no less than 70 % of the maximum working speed.

If machine is equipped with more than one fan, all fans shall run at the conditions specified in a), b) or c).

6.3 In the case of harvesters, tracked and drive to tree feller bunchers, processors, delimbers, mulchers, skidders and log loaders, the noise emission values shall be determined on a complete working cycle as stated in [Clause 7](#). The work cycle shall be described in the test report and referenced in the noise declaration.

7 Working cycles

7.1 Measurement requirements

When measuring the sound power level and the emission noise pressure level, machine work cycles shall be as follows:

During the measurements, the centre line of the machine body shall be straight; tyres of the machine shall be directed onto straight line forward. The operator position shall be the same.

When defining the working positions operator is facing to 0° and the angle is increasing to the right hand side of the operator.

Special care must be taken concerning movements of the boom or other equipment not to interfere with microphones.