

INTERNATIONAL STANDARD

ISO 9533

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Earth-moving machinery — Machine-mounted forward and reverse audible warning alarm — Sound test method

iTeh **STANDARD PREVIEW**

*Engins de terrassement — Avertisseurs sonores de marche avant et de marche
arrière montés sur engins — Méthode d'essai acoustique*
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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. 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 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 9533 was prepared by Technical Committee ISO/TC 127, *Earth-moving machinery*.

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Annex A forms an integral part of this International Standard.

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Earth-moving machinery — Machine-mounted forward and reverse audible warning alarm — Sound test method

1 Scope

This International Standard outlines the procedures and sets the criteria necessary to evaluate the audible performance of alarms mounted on earth-moving machines intended to warn personnel of the potential hazard of the machine moving under its own power, either forward or in reverse. The tests are carried out on a stationary machine.

Alarm performance on the machine is a function of alarm design, conditions, voltage at the alarm, and placement on the machine with respect to machine components. This procedure verifies that the combination of factors produces an audible alarm.

This International Standard applies to earth-moving machinery as defined in ISO 6165.

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

ISO 5353 : 1978, *Earth-moving machinery, and tractors and machinery for agriculture and forestry — Seat index point* (as amended in 1981 and 1984).

ISO 6081 : 1986, *Acoustics — Noise emitted by machinery and equipment — Guidelines for the preparation of test codes of engineering grade requiring noise measurements at the operator's or bystander's position*.

ISO 6165 : 1987, *Earth-moving machinery — Basic types — Vocabulary*.

ISO 6393 : 1985, *Acoustics — Measurement of airborne noise emitted by earth-moving machinery — Method for determining compliance with limits for exterior noise — Stationary test condition*.

ISO 6394 : 1985, *Acoustics — Measurement of airborne noise emitted by earth-moving machinery — Operator's position — Stationary test condition*.

IEC 651 : 1979, *Sound level meters*.

3 Definitions

For the purposes of this International Standard, the definitions given in ISO 4872 and ISO 6081, and the following definitions, apply.

3.1 machine reference box : Imaginary rectangular box that would just fit over the base machine, excluding all equipment and attachment items such as buckets, dozers, backhoes, rippers and booms.

3.2 forward and reverse warning alarm : Machine-mounted alarm intended to warn personnel of the potential hazard of the machine moving under its own power, without undue discomfort or irritation to the machine operator.

4 Apparatus

4.1 Sound level meter with condenser microphone, or its equivalent in accuracy, stability and frequency response. The external diameter of the microphone shall not exceed 13 mm, so as to reduce possible directivity errors. Both the microphone and its cable shall be chosen so that the combined sensitivity does not change significantly over the temperature range encountered during the tests. The instrumentation shall meet the Type 1 requirements of IEC 651.

4.2 Acoustical calibrator, accurate to within $\pm 0,5$ dB.

4.3 Windscreen : this may be required under some test conditions. Otherwise its use is optional providing that it does not affect the A-weighted sound level of the source being measured by more than $\pm 0,5$ dB under zero wind speed conditions.

4.4 Anemometer or other device for measurement of ambient wind speed and direction, accurate to within ± 10 % at the highest recommended wind speed.

4.5 Engine rotational frequency indicator, accurate to within ± 2 % of the indicated rotational frequency.

4.6 Thermometer for measurement of ambient temperature, accurate to within ± 1 °C.

NOTE — Apparatus will also be required to check test environment : see 5.1.

5 Test environment

5.1 Test area

The test area shall consist of a free field above a reflecting plane. No reflective objects or surfaces such as buildings should be located within 30 m of the microphone or the machine being measured. The test area bordered by the microphones shall consist of concrete or sealed asphalt that has not incurred any extensive surface deterioration. For more specific details, refer to ISO 4872 and ISO 6393.

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

5.2 Background noise

The ambient sound level due to sources other than the earth-moving machinery under test, including wind effects, shall be at least 10 dB(A) lower than the lowest measurement of interest.

5.3 Climatic conditions

Measurements shall not be carried out when precipitation, i.e., rain, snow, or sleet, is falling or when the ground is covered with snow.

5.4 Wind

The wind speed at the test site shall be less than 8 m/s. For wind speeds in excess of 1 m/s, a microphone windscreen shall be used and appropriate compensation for the effects of its use shall be allowed for in the calibration.

6 Machine preparation

6.1 Engine

Under prevailing conditions, the machine shall be at a stabilized temperature with the engine operating at maximum governed speed (high idle) under no load, with the transmission in the neutral position during the baseline machine sound test. When conducting the alarm test, it is permissible to have the engine operating at low idle or switched off.

6.2 Attachments

Major attachments should be mounted and in a normal carry position of 300 mm \pm 50 mm above the test site surface.

1) This procedure is the same as a person facing the machine under test, holding his arm out forward in a horizontal plane and rotating the arm along a prescribed radius that will be scribing a vertical plane arc in front of the person moving his arm.

7 Test procedure

7.1 General

Measurements shall be taken and recorded at the specific locations relative to the machine (numbered 1 to 8 in figure A.1, plus point 9) as indicated in table A.1 in annex A.

The measurements shall be made with the microphones moving along circular arcs centred at the nine locations specified in annex A.

7.2 Alarm measurement for exterior locations

7.2.1 For each measurement location, record the maximum reading obtained by moving the microphone with an appropriate manual or automated device (oriented with its long axis perpendicular to the plane of rotation) along the perimeter of a 260 mm \pm 25 mm radius circle with its rotational plane 20° \pm 25° away from the vertical facing plane that is perpendicular to the horizontal axis line from the front or back of the machine through the microphone location points.¹⁾ For simplicity of manual rotation of the microphone, the movement in the vertical plane (0° angle) is the recommended procedure. A rotational rate of 1 r/min \pm 0,25 r/min is preferred. The rotational centre of this circle shall be 1,2 m \pm 0,05 m above the GRP (ground reference plane) at the microphone locations shown in figure A.1.

7.2.2 For the alarm tests at each location in figure A.1, measure and record the maximum sound levels for the following two conditions :

- a) Base machine :
 - 1) sound level meter fast time weighting — A-frequency weighting,
 - 2) engine at maximum governed speed (high idle) — no load,
 - 3) alarm off;
- b) Alarm :
 - 1) sound level meter fast time weighting — A-frequency weighting,
 - 2) engine at low idle speed — no load or off (verify adequate voltage),
 - 3) alarm on;
- c) Calculate the difference in maximum reading of b) minus a).

7.3 Alarm procedures for operator location (reverse alarm only)

Measure and record the maximum sound level for base machine and reverse alarm obtained by moving the micro-

phone with the sound level meter set on fast time weighting — A-frequency weighting (oriented with its long axis perpendicular to the plane of rotation) around the perimeter of a 260 mm ± 25 mm radius circle with its plane horizontal and located 635 mm ± 20 mm above the SIP (seat index point) calculated as shown in ISO 5353. The microphone may be hand-held by the test person in the operator location or swept in a circular path by a mechanical rotator positioned in the operator location. A rotational rate of 1 r/min ± 0,25 r/min is preferred. See ISO 6394.

7.4 Criteria

When tests are conducted in accordance with 7.1 to 7.3, the criteria in 7.4.1 to 7.4.3 shall be met.

7.4.1 Reverse alarm — Exterior test

The A-weighted sound pressure level measured at any given test location (see figure A.1) for the alarm activation test shall

be equal to or greater than the A-weighted sound pressure level measured at the corresponding positions for the base machine at maximum governed speed under no load. [See 7.2.2 a).]

7.4.2 Reverse alarm — Operator test

The A-weighted sound pressure level measured at the operator location during the alarm test shall be no more than 3 dB above the A-weighted sound pressure level of the machine while it is in a stationary position with the engine operating at maximum governed speed under no load and with the alarm not activated.

7.4.3 Forward alarm — Exterior test

As a general rule, the forward alarm A-weighted sound pressure level shall exceed the A-weighted sound pressure level of the machine at maximum engine speed under no load by at least 10 dB at location 8 in figure A.1.

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Annex A
(normative)

Data sheet

1 Alarm

Reverse warning

Forward warning

Alarm manufacturer :
Model No. :
Type :
Location on machine :

2 Earth-moving machine

Type :
Model :
Serial No. :
Maximum engine rotational frequency : r/min
Attachments :

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3 Cab or ROPS¹⁾ : yes/no²⁾ <https://standards.iteh.ai/catalog/standards/sist/0d76770a-37e0-46a8-a3e2-f3db2980e34/iso-9533-1989>

If yes,

OROPS¹⁾ : yes/no²⁾

EROPS¹⁾ or cab : yes/no²⁾

Doors : open/closed²⁾

Windows : open/closed²⁾

4 Test details

Microphone elevation: 1,2 m ± 0,05 m above GRP (see 7.2.1)

Microphone radius 260 mm ± 25 mm at° from vertical plane (see 7.2.1)

1) ROPS : Roll-over protective structure;
OROPS : Open ROPS;
EROPS : Enclosed ROPS.

2) Delete as applicable.

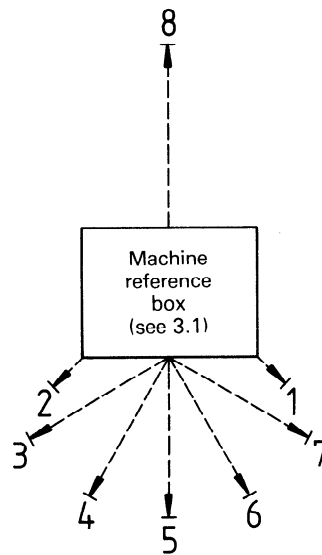


Figure A.1

Table A.1
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Alarm test type	Alarm test position (see figure A.1)	Distance (m) and direction		Measure from :	Sound level, dB(A) :		
					Alarm off, high idle [see 7.2.2a)]	Alarm on, low idle [see 7.2.2b)]	Difference [see 7.2.2c)]
Reverse alarm	1	0,7 right	0,7 rear	right rear corner			
	2	0,7 left	0,7 rear	left rear corner			
	3	4,9 left	4,9 rear	left rear side			
	4	2,7 left	6,5 rear	left rear centre			
	5	0	7 rear	rear centre			
	6	2,7 right	6,5 rear	right rear centre			
	7	4,9 right	4,9 rear	right rear side			
Forward alarm	8	0	7 front	front centre			
Operator, reverse	9, i.e. operator location, 260 mm ± 25 mm radius (see 7.3)			ear height			

5 Test conditions

Description of test area and surface :

Temperature : °C

Ambient wind speed : m/s

Remarks :

Description of instruments :

Date :

Person conducting tests :

6 The alarms met the requirements of ISO 9533 : yes/no¹⁾

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1) Delete as applicable.

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