ASABE/ISO 5007:2003 MAY2006 (R2016ED)
Agricultural wheeled tractors — Operator's seat — Laboratory measurement of transmitted vibration

American Society of Agricultural and Biological Engineers

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Approved May 2006; reaffirmed January 2016 as an American National Standard

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This standard was reviewed for adoption by the ASABE Power and Machinery Agricultural Machinery–Common Tests Technical subcommittee, and has been formally approved by the Technical Committee. The adoption of this standard was made possible by the signing of 2004 SAE-ASABE copyright agreements, which gave ASABE a royalty-free license to publish in whole or in part SAE standard document J1386. Adopted by ASABE May 2006. Approved as an American National Standard May 2006; editorial revision and reaffirmed by ASABE January 2011; reaffirmed by ANSI February 2011, reaffirmed and revised editorially January 2016.

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0 Foreword

0.1 ASABE/ISO 5007:2003, Agricultural wheeled tractors — Operator's seat — Laboratory measurement of transmitted vibration, is an adoption without modification of the identically titled ISO standard ISO 5007:2003, Agricultural wheeled tractors — Operator's seat — Laboratory measurement of transmitted vibration.

This ISO standard is a derivative of SAE J1386, Classification of Agricultural Wheeled Tractors for Vibration Tests of Operator Seats, Recommended Practice.

0.2 This International Standard specifies, in accordance with ISO 10326-1:1992, a laboratory method for measuring and evaluating the effectiveness of the suspension of operator seats on agricultural wheeled tractors. It also specifies acceptance criteria based on the test results, while defining the input spectral classes relating to three classes of agricultural tractor with rubber tyres, unsprung rear axles and no low-frequency cab isolation - those of up to 3 600 kg (class 1), those of from 3 600 kg to 6 500 kg (class 2), and those of over 6 500 kg (class 3) — each of which defines a group of machines having similar vibration characteristics.

The method tests the effectiveness of the seat suspension in reducing the vertical whole-body vibration transmitted to the operator at frequencies of from 1 Hz to 20 Hz. It is not applicable to vibration reaching the operator other than through the seat (e.g. that sensed by the operator's feet on the platform or control pedals or hands on the steering wheel).

NOTE The tests and criteria defined in this International Standard are intended for operator seats used in agricultural tractors of conventional design. Tractors with design features such as isolated front or rear axles or both and low-frequency cab suspensions, which result in significantly different vibration characteristics, can be tested in accordance with ISO 5008 to determine a whole body vibration emission value or using other standards developed for measuring and evaluating the effectiveness of the seat suspension on such vehicles.

0.3 Five normative references are listed in ISO 5007:2003. These references have been reviewed and accepted as part of the adoption of ASABE/ISO 5007:2003.

0.4 This standard has been approved as an American National standard by ANSI (American National Standard Institute).

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Text of ISO 5007:2003, Agricultural wheeled tractors — Operator's seat — Laboratory measurement of transmitted vibration, title, follows.

1 Scope

This International Standard specifies, in accordance with ISO 10326-1, a laboratory method for measuring and evaluating the effectiveness of the suspension of operator seats on agricultural wheeled tractors. It also specifies acceptance criteria based on the test results, while defining the input spectral classes relating to three classes of agricultural tractor with rubber tyres, unsprung rear axles and no low-frequency cab isolation - those of up to 3 600 kg (class 1), those of from 3 600 kg to 6 500 kg (class 2), and those of over 6 500 kg (class 3)—each of which defines a group of machines having similar vibration characteristics.

The method tests the effectiveness of the seat suspension in reducing the vertical whole-body vibration transmitted to the operator at frequencies of from 1 Hz to 20 Hz. It is not applicable to vibration reaching the operator other than through the seat (e.g. that sensed by the operator's feet on the platform or control pedals or hands on the steering wheel).

NOTE The tests and criteria defined in this International Standard are intended for operator seats used in agricultural tractors of conventional design. Tractors with design features such as isolated front or rear axles or both and low-frequency cab suspensions, which result in significantly different vibration characteristics, can be tested in accordance with ISO 5008 to determine a whole body vibration emission value or using other standards developed for measuring and evaluating the effectiveness of the seat suspension on such vehicles.

2 Normative references

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

ISO 2041, *Vibration and shock — Vocabulary*

ISO 2631-1:1997, *Mechanical vibration and shock — Evaluation of human exposure to whole-body vibration — Part 1: General requirements*

ISO 8041, *Human response to vibration — Measuring instrumentation*

ISO 10326-1:1992, *Mechanical vibration — Laboratory method for evaluating vehicle seat vibration — Part 1: Basic requirements*

ISO 13090-1:1998, *Mechanical vibration and shock — Guidance on safety aspects of tests and experiments with people — Part 1: Exposure to whole-body mechanical vibration and repeated shock*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 2041 and the following apply.

3.1

whole-body vibration

vibration transmitted to the body as a whole through the buttocks of a seated operator

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3.2

input spectral class

tractors having similar ride vibration characteristics at the seat attachment point, grouped by virtue of various mechanical characteristics

3.3

unballasted mass

mass of tractor in working order with full tanks and radiators, and including, where relevant, the mass of protective structures, but less the mass of the operator and without removable ballast weights, special equipment or other loads

3.4

operator seat

portion of the machine provided for the purpose of supporting the buttocks and back of the seated operator, including any suspension system and other mechanisms provided, (for example, for adjusting the seat position)

3.5

frequency analysis

process of arriving at a quantitative description of vibration amplitude as a function of frequency

3.6

measuring period

time duration in which vibration data for analysis is obtained

4 Symbols and abbreviated terms

See Table 1.

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Table 1 – Symbols and abbreviated terms

Symbol/abbreviation	Description
$a_P(f_r)$	Unweighted rms value of the measured vertical acceleration at the platform under the seat (see Figure 1) *measured* at the resonance frequency when the seat is excited at the resonance frequency
a^*_{P12}, a^*_{P34}	Unweighted rms value of the target vertical acceleration at the platform under the seat (see Figure 1) between frequencies f_1 and f_2, or f_3 and f_4
a_{P12}, a_{P34}	Unweighted rms value of the measured vertical acceleration at the platform under the seat (see Figure 1) between frequencies f_1 and f_2, or f_3 and f_4
$a_S(f_r)$	Unweighted rms value of the measured vertical acceleration at the seat disc *measured* at the resonance frequency when the seat is excited at the resonance frequency
a^*_{wP12}, a^*_{wP34}	Weighted rms value of the target vertical acceleration at the platform under the seat (see Figure 1) platform between frequencies f_1 and f_2, or f_3 and f_4
a_{wP12}	Weighted rms value of the measured vertical acceleration at the platform under the seat (see Figure 1) between frequencies f_1 and f_2
a_{wS12}	Weighted rms value of the measured vertical acceleration at the seat disc (see Figure 1) between frequencies f_1 and f_2
B_e	Resolution bandwidth, expressed in Hertz
f	Frequency, expressed in Hertz
f_r	Frequency at resonance, expressed in Hertz
$G_P(f)$	Measured PSD of the vertical vibration at the platform (seat base)
$G^*_P(f)$	Target PSD of the vertical vibration at the platform (seat base)
$G_{PL}(f)$	Lower limit for the measured PSD of the vertical vibration at the platform (seat base)
$G^*_{PU}(f)$	Upper limit for the measured PSD of the vertical vibration at the platform (seat base)
$H(f_r)$	Transmissibility at the resonance frequency
PSD	Power spectral density, expressed as acceleration squared per unit bandwidth, $(m/s^2)^2/Hz$
rms	Root mean square
SEAT	Seat effective amplitude transmissibility
F_{SEAT}	Seat effective amplitude transmissibility factor (see Table 2)
T_S	Sampling time, expressed in seconds

5 General

5.1 Evaluation criteria

The laboratory simulated machine vertical vibration, specified as input spectral class, is based on representative measured data from tractors driven on a standardized test track and on data obtained from field tests under various conditions of use. The test input for a particular tractor class is a representative envelope for the machines within that class.

Two criteria are used for the evaluation of seat vibration:

a) the SEAT (seat effective amplitude transmissibility) factor in accordance with ISO 10326-1:1992, 9.1, but with frequency weighting in accordance with ISO 2631-1;

b) the maximum transmissibility ratio in the damping test in accordance with ISO 10326-1:1992, 9.2.

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