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Kmetijski kolesni traktorji - Sedež voznika - Laboratorijske meritve prenosa tresljajev

Agricultural wheeled tractors - Operator's seat - Laboratory measurement of transmitted vibration

Tracteurs agricoles à roues - Siège du conducteur - Mesurage en laboratoire des vibrations transmises

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Agricultural wheeled tractors — Operator's seat — Laboratory measurement of transmitted vibration

Tracteurs agricoles à roues — Siège du conducteur — Mesurage en laboratoire des vibrations transmises

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 5007 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 2, *Common tests*.

This second edition cancels and replaces the first edition (ISO 5007:1990), which has been technically revised.

Introduction

The operators of agricultural tractors are often exposed to a low frequency vibration environment, partly caused by the movement of the vehicles over uneven ground and the tasks carried out. The seat constitutes the last stage of suspension before the driver. In order for it to be efficient at attenuating the vibration, the suspension seat should be chosen in accordance with the dynamic characteristics of the vehicle. The design of the seat and its suspension is a compromise between the requirements of reducing the effects of vibration and shock on the operator, and of providing stable support so that the operator can control the machine effectively.

Thus, because seat vibration attenuation is a compromise of a number of factors, the selection of seat vibration parameters needs to be taken in context with the other requirements for the seat.

The performance criteria provided in this International Standard have been set in accordance with that which is attainable using what is at present the best design practice. They do not necessarily ensure the complete protection of the operator against the effects of vibration and shock, and could be revised in the light of future developments and improvements in suspension design.

The test inputs included in this International Standard are based on a very large number of measurements taken *in situ* on agricultural tractors operating on the 100 m OECD standard track defined in ISO 5008, as well as on tractors operating under severe but typical field conditions. The test methods are based on ISO 10326-1, a general method applicable to seats for different types of vehicles.

Agricultural wheeled tractors — Operator's seat — Laboratory measurement of transmitted vibration

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

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.

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)

Table 1 (*continued*)

Symbol/abbreviation	Description
$G^*_{PU}(f)$	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.

5.2 Instrumentation and frequency analysis

The measuring equipment shall be in accordance with ISO 8041 (type 1 instrument) and ISO 10326-1:1992, Clause 4. The frequency weighting shall include the effects of the band limiting filters and shall be in accordance with ISO 2631-1.

5.3 Safety

Safety precautions shall be in accordance with ISO 13090-1.

Any compliant end-stops or devices normally fitted to production versions of the seat to be tested to minimize the effect of suspension over travel shall be in place for the dynamic tests.

6 Test conditions and procedure

6.1 General

The test conditions and test procedure shall be in accordance with ISO 10326-1:1992, Clauses 7 and 8.

6.2 Simulation of vibration (see ISO 10326-1:1992, Clause 5)

A platform whose dimensions correspond approximately to those of the operator's platform on an agricultural tractor shall be mounted on a vibrator capable of generating vibration along the vertical axis (see Figure 1).

The vibrator should be capable of simulating sinusoidal vibration having a peak-to-peak displacement of at least ± 7,5 cm at a frequency of 2 Hz (see 6.5.1).