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Mechanical vibration — Laboratory method for evaluating vehicle seat vibration —

Part 1: Basic requirements

AMENDMENT 1

Vibrations mécaniques — Méthode en laboratoire pour l'évaluation des vibrations du siège de véhicule —

Partie 1: Exigences de base
AMENDEMENT 1

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Foreword

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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.

Amendment 1 to ISO 10326-1:1992 was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 231, *Mechanical vibration and shock*, in collaboration with Technical Committee ISO/TC 108, *Mechanical vibration, shock and condition monitoring*, Subcommittee SC 4, *Human exposure to mechanical vibration and shock*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Mechanical vibration — Laboratory method for evaluating vehicle seat vibration —

Part 1: Basic requirements

AMENDMENT 1

Page iii, Introduction

Replace the existing text with the following:

Drivers, staff and passengers of vehicles (land, air or water) and mobile machinery are exposed to mechanical vibration which interferes with their comfort, working efficiency and, in some circumstances, safety and health. Such vehicles and mobile machines are often fitted with seats that are designed and made in accordance with current state-of-the-art with regard to their capacity to control or reduce transmitted whole-body vibration.

To assist in the development of such seats, specific test codes have been, or are being, produced to evaluate the performance of seats. The following basic requirements have therefore been developed to give guidance for the specification of laboratory testing of vibration transmission through a vehicle seat to the occupant, and for the evaluation of the ability of a seat to control the shock arising from over-travel of the suspension.

Page 1, Clause 1, Scope

Replace the last sentence of the first paragraph with the following:

These methods for measurement and analysis make it possible to compare test results from different laboratories for equivalent seats.

Page 1, Clause 2, Normative references

Replace this clause with the following:

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

ISO 5347 (all parts), *Methods for the calibration of vibration and shock pick-ups*

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

ISO 16063 (all parts), *Methods for the calibration of vibration and shock transducers*

Page 1, Clause 3, General

Replace the second paragraph with the following:

> The primary test for the vibration characteristics of the seat involves measurements under conditions which simulate the range of actual uses of a vehicle or machine. For applications where occasional severe shocks or transient vibration can be expected (and in particular for seats whose suspension travel is short, such as those intended for use on industrial trucks or off-road vehicles), in addition to the damping test, a secondary test is required to ensure that the seat responds acceptably. Machinery-specific standards shall give guidance on the need for this secondary test which comprises a method for assessing the accelerations associated with impact with the suspension end-stops when over-travel occurs. The test is described in Annex A.

Page 3, Subclause 4.4, Calibration

Replace the first paragraph with the following:

> The instrumentation shall be calibrated in accordance with ISO 16063-1 and, depending on the type of measuring system used, to the relevant part of ISO 5347 or ISO 16063.

Delete footnote 1).

Page 4, Note 9

Replace this Note with the following full text:

> In some cases, such as suspensions with short travel as used on industrial trucks or off-road vehicles, a further test may be needed to ensure that, under conditions of excessive suspension travel, the suspension end-stops are so constructed as to keep the resulting shock acceleration at an acceptable level. Annex A contains the specification for such a test which may be specified in more detail in an application standard (type-C standard) if needed.

Page 7, Annex A, Bibliography

Replace this annex with the following Annex A. Then add the new Bibliography.

Annex A
(informative)

Test method for assessing the ability of a seat suspension to control the effects of impacts caused by over-travel

A.1 Introduction

This annex specifies a laboratory test method for measuring and evaluating the effectiveness of a suspension seat in controlling the whole-body vertical vibration transmitted to the operator of an industrial truck or off-road vehicle in conditions that can cause excessive suspension travel.

The test method may be applicable to operator seats in the following types of vehicles:

— industrial trucks;

— earth-moving machines (restricted to classes defined in ISO 7096);

— agricultural tractors;

— forestry forwarders.

At the discretion of the standards committee responsible for the relevant type-C standard, the test method may supplement, but does not replace, the tests for vertical vibration isolation defined in, for example, ISO 5007, ISO 7096 and EN 13490.

A.2 Symbols

a_{arb}	Arbitrary acceleration amplitude applied to the seat base (vibration exciter platform), in metres per second squared
a_w	W_k frequency-weighted acceleration, in metres per second squared (W_k is defined in ISO 2631-1)
f	Frequency of the input vibration, in hertz
t	Time, in seconds
t_0	Time at the start of the test stimulus
t_1	Time at the end of the test stimulus
t_M	Time at the end of the measurement
VDV	Vibration dose value, in metres per second to the power of 1,75
x	Displacement of the seat base (vibration exciter platform), in metres
$\ddot{x}$	Acceleration of the seat base (vibration exciter platform), in metres per second squared
$L_{2,5}$	Seat load vibration dose value of 2,5 m/s^{1,75} ($L_{2,5}$ = 2,5 m/s^{1,75})
$B_{2,5}$	Seat base vibration dose value corresponding to a seat load vibration dose value of 2,5 m/s^{1,75}

$L_{7,5}$ Seat load vibration dose value of 7,5 m/s^{1,75} ($L_{7,5}$ = 7,5 m/s^{1,75})

$B_{7,5}$ Seat base vibration dose value corresponding to a seat load vibration dose value of 7,5 m/s^{1,75}

L_1, B_1 Seat load and seat base vibration dose values for the measurement with a load VDV in the range 2,375 m/s^{1,75} to 2,5 m/s^{1,75}

L_2, B_2 Seat load and seat base vibration dose values for the measurement with a load VDV in the range 2,5 m/s^{1,75} to 2,625 m/s^{1,75}

L_3, B_3 Seat load and seat base vibration dose values for the measurement with a load VDV in the range 7,125 m/s^{1,75} to 7,5 m/s^{1,75}

L_4, B_4 Seat load and seat base vibration dose values for the measurement with a load VDV in the range 7,5 m/s^{1,75} to 7,875 m/s^{1,75}

R Rate of increase of the load VDV relative to the base VDV between load VDVs of 2,5 m/s^{1,75} and 7,5 m/s^{1,75}

A.3 Test conditions and test procedure

A.3.1 Seat mounting

The seat to be tested shall be mounted on a horizontal platform of a vibration exciter, which shall have movements in the vertical direction (z-axis), as specified in the application standards. The dimensions of the mounting platform shall be sufficient to adequately support the seat.

The vibration exciter shall be capable of generating sinusoidal peak-to-peak displacement of at least 60 mm at 2 Hz.

A.3.2 Seat adjustment

The seat shall be run in as specified by its manufacturer.

The seat shall be adjusted to a mid-ride position appropriate to the mass of a test person of 98 kg (equivalent to a load on the seat of 75 kg) in accordance with the seat manufacturer's instructions. If no instructions are available, the seat shall be adjusted to the force mid-point of the suspension force-deflection characteristic measured over a range from zero to 1 500 N with the seat in a specified configuration.

NOTE Many seats have mass adjusters that are marked according to the total driver (operator) mass, but only approximately 75 % of this mass is actually carried by the seat.

The seat shall be adjusted to the desired mid-ride position and then subjected to a low peak-to-peak (less than 5 mm) sinusoidal vibration at the base of the seat at a frequency approximately three times the seat resonance frequency. This process shall be repeated as necessary until the seat settles to the intended mid-ride position.

With seats where the stroke available is unaffected by the adjustment for seat height or test person mass, testing shall be performed with the seat adjusted to the centre of the stroke. With seats where the stroke available is affected by the adjustment of the seat height or by test person mass, testing shall be performed at both the maximum and minimum height adjustment with the seat required to pass both tests. The manufacturer should specify what influence different combinations of mass and seat height adjustments will have on the stroke available during testing.

The fore and aft adjustment of the seat shall be in the centre of the available travel.

The inclination of the cushion surface (if adjustable) shall be nominally horizontal.

Where the inclination of the backrest is adjustable, the angle shall be approximately 10° behind the vertical.

If the seat is capable of rotation, it shall be locked facing forward (i.e. towards the vehicle controls when the vehicle is travelling).

Additional suspension systems (fore-and-aft and/or lateral) shall be disabled.

A.3.3 Test load

The test load shall have a total mass of 75 kg, and shall be rigid. The centre of mass shall act downwards through a point at the centre of the seat in the (lateral) y-axis and a point 40 mm forward of the seat index point (SIP), as defined in ISO 5353, when the load is correctly positioned on the seat surface. The surface area of the test load in contact with the seat cushion shall be as defined in ISO 5353. Friction between the load and the backrest shall be minimized by using muslin sheet or similar material.

Care shall be taken that the load cannot fall off the seat, in particular during severe top end-stop impacts. The method of securing the load shall not impede the movement of the load in the (vertical) z-axis.

The position of the load on the seat shall be monitored throughout the test, and the load shall be repositioned if it deviates from the desired position by more than an amount to be defined in the machinery-specific standard.

The test load shall be in place on the seat surface for at least 3 min and not more than 4 h before beginning the test.

A.3.4 Test environment

The air temperature shall be maintained at (20 ± 8) °C.

The seat shall be allowed to acclimatize to these conditions for at least 4 h.

No part of the seat shall exceed 40 °C during the tests.

A.3.5 Input vibration

The input vibration shall consist of the following waveform, defined from $t = 0$ to $t = 4{,}5/f$:

— in terms of acceleration (see Figure A.1):

$$\ddot{x}(t) = a_{\text{arb}} \sin\left(2\pi f t\right) \cdot \sin\left(\frac{\pi f t}{4{,}5}\right) \tag{A.1}$$

— in terms of displacement:

$$x(t) = \frac{1}{2} a_{\text{arb}} \left[\frac{\cos\left(2{,}22\pi f t\right) - 1}{\left(2{,}22\pi f\right)^2} - \frac{\cos\left(1{,}78\pi f t\right) - 1}{\left(1{,}78\pi f\right)^2} \right] \tag{A.2}$$

The frequency f shall be the centre frequency of the spectra of the vibration test input signal relevant to the seat under test, as defined in ISO 5007, ISO 7096 or EN 13490.

A.3.6 Tolerance on input vibration

The tolerance should be specified in terms of deviation from the ideal waveform in the time domain.