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Mechanical vibration — Laboratory method for evaluating vehicle seat vibration —

Part 3: Specification of dynamic dummies for Z-axis motion

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

Partie 3: Spécifications des mannequins dynamiques pour le mouvement dans l'axe Z

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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 document 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 of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 108, *Mechanical vibration, shock and condition monitoring*, Subcommittee SC 4, *Human exposure to mechanical vibration and shock*.

A list of all parts in the ISO 10326 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

Vehicle seats play an important role in reducing the vibration transmitted to occupants. While conventional seats are widely used in transport vehicles such as cars, buses, trains, and airplanes, suspension seats are commonly adopted to cope with severe vibration environments in earth-moving machinery, agricultural wheeled tractors, and industrial trucks.

It is often required that the dynamic performance of vehicle seats be tested in the laboratory. The International Organization for Standardization and the European Committee for Standardization have published several standards defining laboratory methods for evaluating the dynamic performance of different types of vehicle seats. Such standards include ISO 7096[4] for earth-moving machinery, ISO 5007[1] for agricultural wheeled tractors, and EN 13490[5] for industrial trucks. They require that the seat effective amplitude transmissibility (SEAT) factor, an important dynamic performance index of vehicle seats, be obtained experimentally using both a light and a heavy participant, see Annex D.

As has been recognized in the practical use of the mentioned standards, finding suitable participants for vibration tests of vehicle seats is frequently neither easy nor convenient. The use of participants also raises safety and ethics concerns. These issues have motivated the design and development of dynamic dummies that can replace participants for vibration tests of vehicle seats.

Regardless of its shape and structure, a dynamic dummy that complies with this document is considered to meet the minimum requirements for the purpose. In particular, actual operating conditions may impose more restrictive requirements.

Conformity with this document should not be interpreted as a confirmation that the dynamic dummies passing the validation test necessarily yields seat vibration transmissibility characteristics duplicating those that are obtained when using participants.

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Mechanical vibration — Laboratory method for evaluating vehicle seat vibration —

Part 3: Specification of dynamic dummies for Z-axis motion

1 Scope

This document specifies dynamic dummies used as replacements for participants in vibration tests of vehicle seats in laboratory.

This document is applicable to seats installed in earth-moving machinery, agricultural wheeled tractors, and industrial trucks.

This document specifies technical requirements, acceptance criteria, and a validation test for dynamic dummies representing the human body in two mass groups: lightweight (52 kg to 55 kg) and heavyweight (98 kg to 115 kg). It only applies to passive and active dynamic dummies used for vibration tests of vehicle seats in the Z-axis (vertical) direction.

This document defines, for the two mass groups, the biodynamic response characteristics that the dynamic dummies are required to reproduce to represent those of the participants to be replaced. This document gives guidance on conducting future research to explore the degree of convergence that can be reached when the dynamic performance of seats is measured with participants and with dynamic dummies conforming to this document.

NOTE 1 For seat testing, results have shown that the benefit of using a dynamic dummy is highly dependent on the excitation and dynamic characteristics of the seats. Depending on the type of vibration excitation applied, studies have suggested that the use of dynamic dummies can show benefit over an inert mass of equivalent weight only when testing suspension seats with higher natural frequency (>2 Hz).

NOTE 2 The use of dynamic dummies has been reported to tend to overestimate the vibration isolation performance of seats compared with that measured with participants. Several factors can be in cause and require further investigation, one of them being the influence of the legs possibly not being adequately considered when using dynamic dummies.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitute requirements 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, *Mechanical vibration, shock and condition monitoring — Vocabulary*

ISO 5805, *Mechanical vibration and shock — Human exposure — Vocabulary*

ISO 8041-1, *Human response to vibration — Measuring instrumentation — Part 1: General purpose vibration meters*

ISO 10326-1:2016, *Mechanical vibration — Laboratory method for evaluating vehicle seat vibration — Part 1: Basic requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 2041, ISO 5805, and the following apply.

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ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
apparent mass
$M(f)$
complex ratio of applied periodic excitation force at frequency f, $F(f)$, to the resulting vibration acceleration at that frequency, $a(f)$, measured at the same point and in the same direction as the applied force

$$M(f)=\frac{F(f)}{a(f)}$$

Note 1 to entry: The apparent mass is a complex quantity (i.e. it possesses real and imaginary parts) from which the modulus and phase can be computed.

Note 2 to entry: For the purposes of this document, force and acceleration are measured at the same point, this being the point of introduction of vibration. Accordingly, only direct apparent mass (also known as driving point apparent mass) is considered in this document.

Note 3 to entry: In the case of non-harmonic vibration, apparent mass is determined from the force and acceleration spectra.

[SOURCE: ISO 5982:2019, 3.1, modified — Note 2 to entry has been adapted.]

3.2
dynamic dummy
test device or mechanically realizable human analogue model that simulates one or more of the dynamic characteristics of the human body

[SOURCE: ISO 5805:1997, 5.5, modified — Note to entry has been deleted.]

3.3
passive dynamic dummy
dynamic dummy (3.2) that cannot adaptively change its parameters.

Note 1 to entry: A passive dynamic dummy can reproduce the apparent mass of a small number of notional human bodies.

Note 2 to entry: A passive dynamic dummy can be constructed with passive (namely, unpowered) mechanical components such as masses, springs, and dampers.

Note 3 to entry: An example of passive dynamic dummy is shown in Figure 1. See Annex B for more information.

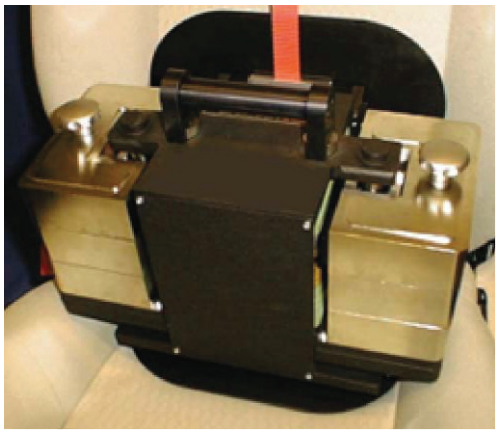


Figure 1 — Example of passive dynamic dummy

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