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Mechanical vibration — Laboratory method for evaluating vehicle seat vibration —

Part 2:
Application to railway vehicles

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

Partie 2: Application aux véhicules ferroviaires

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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 3.

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 part of ISO 10326 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 10326-2 was prepared by Technical Committee ISO/TC 108, *Mechanical vibration and shock*, Subcommittee SC 2, *Measurement and evaluation of mechanical vibration and shock as applied to machines, vehicles and structures*.

ISO 10326 consists of the following parts, under the general title *Mechanical vibration — Laboratory method for evaluating vehicle seat vibration*:

— *Part 1*: *Basic requirements*

— *Part 2: Application to railway vehicles*

Annex A of this part of ISO 10326 is for information only.

Introduction

Although the vibration felt by passengers in railway vehicles is always of low magnitude, the fact nevertheless remains that acceleration at the seat-buttock and seat-backrest interfaces can sometimes be greater than excitations transmitted by the vehicle frame. Consequently, the aim of experiments to be carried out with railway seats must fundamentally be to refine existing knowledge about their overall dynamic behaviour and that of their different components: seat frame, suspension system, linings, coverings, etc. In the long run, the knowledge put together should provide useful guidance in choosing the optimum components, and for improving passenger comfort further in the process.

Laboratory tests can be performed under clearly defined and reproducible excitation conditions. They consequently represent an essential study method complementary to the investigations performed in the field.

The vibration at the base of railway seats is of the random, broad-band type. The spectra, which are of complex form and non-stationary, depend on the vehicle itself, on its load, on wheel profile conditions, on track geometry and quality, etc. In this part of ISO 10326, therefore, it is stipulated to excite the seat, occupied by a test person, by means of broad-band pseudo-random vibration successively in the three directions X, Y and Z. The vibration spectra are of sufficiently simple form and of sufficient magnitude to cover the majority of actual spectra observed on track, whilst nevertheless remaining quite different from the latter.

As a result, the magnitudes measured at the different response points of the man-seat system during laboratory tests could under no circumstances be used for comparison with limits or acceptable values. By contrast, it is stipulated using the measurements to determine the frequency response function of the man-seat system at seat pan and backrest level in the three directions x, y and z. These frequency response functions suffice for characterizing the vibratory behaviour of the seat with its occupant. The directions of excitation, favourable or harmful frequencies, and corresponding gains are thus clearly demonstrated. These inputs are relevant to a comparison of seats with different construction arrangements.

Frequency response functions may be used to evaluate, by the automatic calculation method, the qualitative behaviour of a given seat subjected to excitation similar to that it would encounter in service on a real vehicle. To this end, they must be ascertained not only in modulus but also in phase terms. Direct and cross ratios are just as relevant, as couplings can exist between vertical, lateral and longitudinal movements. The test code described in this part of ISO 10326 allows for these interactions.

Such calculations are, however, truly valid only on the assumption that the man-seat system considered is sufficiently linear. To check this assumption under laboratory conditions, this part of ISO 10326 stipulates an extra testing phase during which the seat is excited in a purely sinusoidal, high-amplitude mode at the different frequencies encountered during tests under random excitations, and corresponding to the peaks of the frequency response function.

The frequency range relevant to railway conditions is limited to 0,5 Hz to 50 Hz. Railway seats transmit vibration with frequencies lower than 0,5 Hz without modifying them. However, vibration with frequencies of over 50 Hz, as sustained by seats in service, is generally of too small a magnitude to be felt by seated passengers.

