

Mechanical vibration — Measurement and analysis of whole-body vibration to which passengers and crew are exposed in railway vehicles

ICS 45.060; 13.160;

National foreword

This British Standard reproduces verbatim ISO 10056:2001 and implements it as the UK national standard.

The UK participation in its preparation was entrusted by Technical Committee GME/21, Mechanical Vibration and Shock, to Subcommittee GME/21/3, Measurement and Evaluation of mechanical vibration and shock, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

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Mechanical vibration — Measurement and analysis of whole-body vibration to which passengers and crew are exposed in railway vehicles

Vibrations mécaniques — Mesurage et analyse des vibrations globales du corps auxquelles sont exposés les passagers et le personnel de bord dans les 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 International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 10056 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*.

Annex A of this International Standard is for information only.

Introduction

This International Standard specifies a method which can be applied to the railway environment for the measurement and analysis of vibration, bearing in mind that mechanical vibration in a railway vehicle has specific characteristics.

It supplements ISO 2631-1 which deals in a general way with all the situations encountered by man in his day-to-day activities (work, travel, etc.), and describes measurement of whole-body vibration and its effects.

Mechanical vibration — Measurement and analysis of whole-body vibration to which passengers and crew are exposed in railway vehicles

1 Scope

This International Standard defines a method for measuring and analysing the mechanical vibration of railway vehicles during field tests. It deals with periodic, random and transient vibration over the range of frequencies from 0,5 Hz to 80 Hz which are transmitted to the whole human body. This International Standard covers standing and seating positions only.

This International Standard is not applicable to vibration transmitted to the hand-arm system, nor to very-low-frequency lateral, vertical or rotational motion which may be associated with kinetosis (motion sickness). This International Standard does not propose methods for assessing the effects of vibration. This is covered by ISO 2631-1 and, for fixed guideway transport systems, by ISO 2631-4.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 2041, *Vibration and shock — Vocabulary*.

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

ISO 2631-4, *Mechanical vibration and shock — Evaluation of human exposure to whole-body vibration — Part 4: Guidelines for the evaluation of the effects of vibration and rotational motion on passenger and crew comfort in fixed-guideway transport systems*.

ISO 8002, *Mechanical vibrations — Land vehicles — Method for reporting measured data*.

ISO 10326-2, *Mechanical vibration — Laboratory method for evaluating vehicle seat vibration — Part 2: Application to railway vehicles*.

3 Terms, definitions, symbols and abbreviated terms

3.1 Terms and definitions

For the purposes of this International Standard, the terms and definitions given in ISO 2041 apply.

3.2 Symbols and abbreviated terms

In this International Standard, the following symbols and abbreviated terms are used:

a	root-mean-square value of acceleration, m/s^2
$a(t)$	instantaneous value of an acceleration time history, m/s^2
b	class width, m/s^2
B	acceleration measuring point on the backrest of a seat occupied by a subject
f	frequency, Hz
FFT	fast Fourier transform
h	probability histogram of the root-mean-square values of acceleration
h_c	cumulative probability histogram of the root-mean-square values of acceleration
m	index characterizing the class of an observation
$n(m)$	number of observations in class m
n_T	total number of observations
N	number of samples per elementary block
N_b	number of elementary blocks
P	acceleration measuring point on the floor (platform)
$p[...]$	probability that the condition in brackets is met
PSD	power spectral density
S	acceleration measuring point on the seat pan of the seat occupied by a subject
t	time, s
Δt	sampling interval, s
X	Fourier transform of acceleration, m/s^2
τ	duration of an elementary block, s

The following subscripts are used in this International Standard:

j	index characterizing the direction of vibration measured at point α and taking the values x, y, z (see Figure 1)
k	index characterizing the number of an elementary block of data
w	index characterizing a parameter calculated on the basis of weighted signals
α	index characterizing the location of the point for the measurement of acceleration: P (platform, floor), S (seat pan) and B (backrest)