
**Mechanical vibration and shock —
Evaluation of human exposure to
whole-body vibration —**

Part 5:
**Method for evaluation of vibration
containing multiple shocks**

*Vibrations et chocs mécaniques — Évaluation de l'exposition des
individus à des vibrations globales du corps —*

*Partie 5: Méthode d'évaluation des vibrations contenant des chocs
répétés*



PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

This document is a preview generated by EVS

© ISO 2004

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions, symbols and subscripts	1
3.1 Terms and definitions	1
3.2 Symbols and subscripts	2
4 Vibration measurement	2
5 Determination of the spinal response acceleration dose	3
5.1 General	3
5.2 Computation of spinal response	3
5.3 Calculation of acceleration dose	5
5.4 Flowchart for calculation of the acceleration dose	5
5.5 Relationship between acceleration dose and adverse health effects	6
Annex A (informative) Guidance for assessment of health effects of multiple shocks	7
Annex B (informative) Effects of multiple shocks and of posture in the lumbar spine	11
Annex C (informative) Recurrent artificial neural network used to model the lumbar acceleration response to z -axis multiple shocks	12
Annex D (informative) Development of programs for calculation of response and dose	13
Bibliography	20

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 2631-5 was prepared by Technical Committee ISO/TC 108, *Mechanical vibration and shock*, Subcommittee SC 4, *Human exposure to mechanical vibration and shock*.

ISO 2631 consists of the following parts, under the general title *Mechanical vibration and shock — Evaluation of human exposure to whole-body vibration*:

- *Part 1: General requirements*
- *Part 2: Vibration in buildings (1 Hz to 80 Hz)*
- *Part 4: Guidelines for the evaluation of the effects of vibration and rotational motion on passenger and crew comfort in fixed-guideway transport systems*
- *Part 5: Method for evaluation of vibration containing multiple shocks*

Introduction

The purpose of this part of ISO 2631 is to define a method of quantifying whole-body vibration containing multiple shocks in relation to human health. Examples of conditions that result in vibration containing multiple shocks include, but are not limited to, machinery travelling over rough surfaces, small boats in rough sea, aircraft in buffeting, presses and mechanical hammers.

Adverse effects on the lumbar spine are the dominating health risks of long-term exposure to vibration containing multiple shocks. Therefore, this part of ISO 2631 is basically concerned with the lumbar spine response. Annex A provides guidance on assessment of adverse health effects.

The assessment method described in this part of ISO 2631 is based on the predicted response of the bony vertebral endplate (hard tissue) in an individual who is in good physical condition with no evidence of spinal pathology and who is maintaining an upright unsupported posture. However, the assessment method and related models described in this part of ISO 2631 have not been epidemiologically validated.

Annex A provides guidance on assessment of health effects of multiple shocks. Annex B discusses the effects of multiple shocks and the posture on the intervertebral disc (soft tissue). Annex C gives information on the background of the calculation of spinal response in the vertical direction (z -direction). Annex D includes a software calibration check and an example of a computer program that can be used for the calculation of the vibration dose.

This document is a preview generated by EVS

Mechanical vibration and shock — Evaluation of human exposure to whole-body vibration —

Part 5: Method for evaluation of vibration containing multiple shocks

1 Scope

This part of ISO 2631 addresses human exposure to mechanical multiple shocks measured at the seat pad when a person is seated.

The adverse health effects of prolonged exposure to vibration that includes multiple shocks are related to dose measures. The method described in this part of ISO 2631 is generally applicable in cases where adverse health effects in the lumbar spine are concerned.

The calculation of the lumbar spine response described in this part of ISO 2631 assumes that the person subjected to the vibration is seated in an upright position and does not voluntarily rise from the seat during the exposure. Different postures can result in different responses in the spine.

The limitations of the lumbar spine response models used in this part of ISO 2631 are given in 5.2. Caution is necessary when applying the method to extreme shock conditions.

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

3 Terms and definitions, symbols and subscripts

3.1 Terms and definitions

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