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ISO 2631/3—1985

Australian Standard®

Evaluation of human exposure to whole-body vibration

Part 3: Evaluation of exposure to whole-body z-axis vertical vibration in the frequency range 0.1 to 0.63 Hz

This Australian Standard was prepared by Committee AV/10, Vibration and Shock — Human Effects. It was approved on behalf of the Council of Standards Australia on 8 May 1989 and published on 10 December 1990.

The following interests are represented on Committee AV/10:

Association of Australian Acoustical Consultants
Australian and New Zealand Environment Council
Australian Coal Association
Confederation of Australian Industry
Construction and Mining Equipment Association of Australia
CSIRO, National Measurement Laboratory
Department of Defence
Department of Minerals and Energy, N.S.W.
Federal Chamber of Automotive Industries
Railways of Australia Committee
Royal Institution of Naval Architects
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PREFACE

This Standard was prepared by the Standards Australia Committee on Vibration and Shock — Human Effects. It is identical with and has been reproduced from ISO 2631/3—1985, *Evaluation of human exposure to whole-body vibration* — Part 3: *Evaluation of exposure to whole-body Z-axis vertical vibration.*

For the purposes of this Australian Standard, the ISO text should be modified as follows:

(a) Substitute a point (.) for a comma (,) as a decimal marker.

(b) The references to other publications should be replaced by references to Australian Standards:

Reference to International Standard		*Australian Standard*	
ISO		AS	
2631	Evaluation of human exposure to whole-body vibration	2670	Evaluation of human exposure to whole-body vibration
2631/1	Part 1: General requirements	2670.1	Part 1: General Requirements

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0 Introduction

ISO 2631/1 covers vibration in the frequency range 1 to 80 Hz only, although referring to the "special problem in the frequency range below 1 Hz associated with symptoms such as motion sickness". Appreciable vibration in this frequency range occurs in many forms of transport. It causes undesirable effects ranging from discomfort to acute distress due to motion sickness and allied symptoms and interference with activity due to sickness and/or the fluctuating inertial forces it produces in the body.

In some forms of transport at least, it is possible to minimize these unwanted motions by passive or active suspension and control systems, pitch and roll stabilizes, etc., but until recently little or no well-founded guidance existed to help designers optimize such systems. This is probably due firstly to the complexity of the problem, human reaction in this frequency region being extremely variable and depending on factors other than the motion itself, such as vision, odours, age, sex, etc. Secondly there is a surprising lack of worthwhile data from laboratory and field studies which clearly link human reaction with motion input.

The following suggestions for desirable boundaries of vibration below 1 Hz are based on critical surveys and analyses of laboratory and field studies.

The object of these recommendations is firstly to give some design guidance and secondly to stimulate research in this important, neglected area of human response to vibration. Some of the gaps in knowledge have been referred to in this part of ISO 2631, particularly in 3.1.2.

For brevity and clarity of presentation, many of the clauses in ISO 2631/1 which are relevant in principle to vibration below 1 Hz have not been repeated.

1 Scope and field of application

This part of ISO 2631 covers vibration transmitted to the body in the frequency range 0,1 to 0,63 Hz. This part of IS0 2631 applies especially to discrete-frequency and narrow-band vibration and provisionally to random or non-periodic vibrations within the specified frequency range.

The boundaries defined in detail in 3.1 are intended to minimize the severe discomfort associated with motion sickness and allied symptoms. The "severe discomfort" boundary has some similarity to, but is not an extension of, the "exposure limit" (see 4.1.2 in ISO 2631/1) which is intended to protect against pain and permanent injury rather than temporary incapacity.

Because of lack of data, it is not possible to recommend an extension of the fatigue-decreased proficiency boundary below 1 Hz, but suggestions are made on the unwanted effects on activity due to inertial loading. Reference is also made by a "reduced comfort" boundary in 3.3.

Lack of data also confines the recommendations specifically to *z*-axis vibration only, applied to unadapted sitting or standing fit young men. Tentative factors are suggested for some of the important variables outside these constraints (see 3.1.2).

The existence of measured level exceeding the boundaries contained in this part of ISO 2631 should not be construed as implying that undesirable effects occur or will occur in random vibration environments where experience shows otherwise.

2 Reference

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

3 Vibration evaluation

3.1 Severe discomfort boundary

3.1.1 The severe discomfort boundary as a function of frequency and exposure time is shown in the table and the figure for exposure times of 30 min, 2 h and, tentatively, 8 h. With some support from the data used, the acceleration a of the boundary as a function of the exposure time t, follows the relationship a^2t = constant. This relationship should be used if interpolation or summation of a varying acceleration time history is required.

NOTE - The term "severe discomfort" (or "malaise") is used in this part of ISO 2631 to characterize the broad spectrum of motion sickness symptoms occurring successively in order of increasing severity or progressing from pallor and dizziness through nausea to vomiting and complete disability. These symptoms vary from subject to subject in severity and duration and change for the same subject depending on circumstances and habitation.

If accelerations or durations beyond those shown in the figure are exceeded, a significant proportion of inexperienced, that is unadapted, seated or standing men in normal health, will experience severe discomfort and temporary disability. (About 10% incidence at levels at the boundary, increasing as acceleration levels increase beyond this. The boundaries therefore give 90 % cover.)