

ANSI S3.18-2003 Part 4
ISO 2631-4: 2001

AMERICAN NATIONAL STANDARD

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

(A Nationally Adopted International Standard)

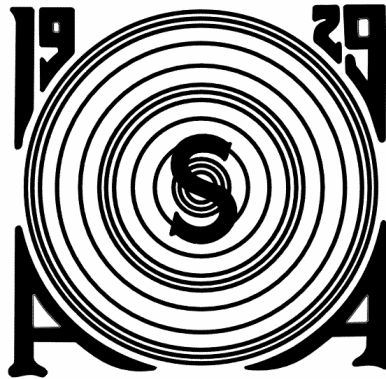
ANSI S3.18-2003 Part 4
ISO 2631-4:2001
NAIS STANDARD

Accredited Standards Committee S3, Bioacoustics

Standards Secretariat
Acoustical Society of America
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**Mechanical vibration and shock – Evaluation
of human exposure to whole body vibration –
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effects of vibration and rotational motion on
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transport systems**

A Nationally Adopted International Standard

Secretariat

Acoustical Society of America

Approved July 29, 2003

American National Standards Institute, Inc.

Abstract

The purpose of this part of ISO 2631 is to help in the design and evaluation of fixed-guideway passenger systems, with regard to the impact of vibration and repetitive motions on passenger comfort. Fixed-guideway vehicles provide a predictable but complex multi-axis motion environment that is a function of the guideway, vehicle and seat or berth. Passengers evaluate ride comfort not only based on motion but also on their expectations with regard to the class of service that they have purchased. The duration of the trip has not been demonstrated to be a direct factor in predicting comfort (with the possible exception of kinetosis), but the anticipated duration of the trip is related to the types of activities passengers expect to accomplish while on board. Passengers on trips of more than a few minutes may expect to read, write, eat and drink; on trips of longer duration they will expect to sleep. To the extent that ride-induced vibration interferes with these activities, passengers may rate differently the comfort of vehicles with the same motion environment but different expected levels of service or different trip durations. Passengers are likely to judge comfort based on the interaction of vibration with factors such as acoustic noise, temperature, humidity, air quality and seat design.

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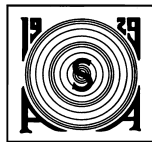
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Foreword

[This foreword is not part of the Nationally Adopted International Standard (NAIS), *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, ANSI S3.18-2003 Part 4, ISO 2631-4: 2001.*]

This Nationally Adopted International Standard (NAIS) comprises a part of a group of definitions, standards, and specifications for use in bioacoustics. It has been adopted by Accredited Standards Committee S3, Bioacoustics, utilizing ANSI Accredited Standards Committee Procedures. Accredited Standards Committee S3, Bioacoustics, has the following scope:

Standards, specifications, methods of measurement and test, and terminology in the fields of psychological and physiological acoustics, including aspects of general acoustics, shock, and vibration which pertain to biological safety, tolerance and comfort.

This Standard is identical to International Standard ISO 2631-4:2001, *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*, which was prepared by Technical Committee ISO/TC 108, Mechanical vibration and shock, Subcommittee SC 4, Human exposure to mechanical vibration and shock.

At the time this NAIS Standard was submitted to Accredited Standards Committee S3, Bioacoustics, for final approval, the membership was as follows:

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Introduction

The purpose of this part of ISO 2631 is to help in the design and evaluation of fixed-guideway passenger systems, with regard to the impact of vibration and repetitive motions on passenger comfort. This information is required because of the following.

Fixed-guideway vehicles provide a predictable but complex multi-axis motion environment that is a function of the guideway, vehicle and seat or berth. Passengers evaluate ride comfort not only based on motion but also on their expectations with regard to the class of service that they have purchased. The duration of the trip has not been demonstrated to be a direct factor in predicting comfort (with the possible exception of kinetosis), but the anticipated duration of the trip is related to the types of activities passengers expect to accomplish while on board. Passengers on trips of more than a few minutes may expect to read, write, eat and drink; on trips of longer duration they will expect to sleep. To the extent that ride-induced vibration interferes with these activities, passengers may rate differently the comfort of vehicles with the same motion environment but different expected levels of service or different trip durations. Passengers are likely to judge comfort based on the interaction of vibration with factors such as acoustic noise, temperature, humidity, air quality and seat design.

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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

1 Scope

This part of ISO 2631 provides guidance on the application of ISO 2631-1 to the evaluation of the effects of mechanical vibration on the comfort of passengers and crew in fixed-guideway systems. It is intended to be used by organizations which purchase, specify or use fixed-guideway systems, to help them to understand the relationship between the design of the guideway as well as other features of the system and the comfort of passengers and crew. These guidelines establish methods for the evaluation of relative comfort between systems, as opposed to absolute levels of comfort.

This part of ISO 2631 is applicable to people in normal health exposed to rectilinear vibration along their x -, y - and z -axes, as well as rotational vibration about these (body-centred) axes. It is intended to provide guidance on the assessment of comfort as a function of motions along and about vehicle axes that produce the body motions. This part of ISO 2631 is not applicable to high-amplitude single transients which may cause trauma, such as those resulting from vehicle accidents or "run-ins" produced by "longitudinal slack action", nor is it applicable to high-amplitude vibration which may affect health.

For the purposes of this part of ISO 2631, fixed-guideway passenger systems include rail systems (heavy and light rail), magnetically levitated (MAGLEV) systems and rubber tyre metro-type systems, as well as any of the system types listed above that incorporate a tilt capability to compensate for lateral acceleration when traversing curves.

This part of ISO 2631 provides guidance on the effects of very low-frequency accelerations (0,1 Hz to 0,5 Hz) experienced as vertical forces that may cause kinetosis. These forces may be caused by combinations of curve transition, super-elevation and tilt-body technology. However, this part of ISO 2631 is not intended to give guidance on comfort implications of very low-frequency accelerations (below 0,5 Hz) experienced as lateral or longitudinal forces. Such accelerations can be generated by guideway geometry (horizontal alignment and cant).

This part of ISO 2631 gives guidance on the evaluation of ride comfort based on motion environment only.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 2631. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 2631 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 2631-1:1997, *Mechanical vibration and shock — Evaluation of human exposure to whole-body vibration — Part 1: General requirements*.