TECHNICAL REPORT

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Mechanical vibration — Description and determination of seated postures with reference to whole-body vibration

Vibrations mécaniques — Description et détermination des postures assises en référence à des vibrations transmises à l'ensemble du corps

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Foreword

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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.

In exceptional circumstances, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

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/TR 10687 was prepared by Technical Committee ISO/TC 108, *Mechanical vibration, shock and condition monitoring*, Subcommittee SC 4, *Human exposure to mechanical vibration and shock*.

Introduction

Seated persons exposed to whole-body vibration carry a risk for low-back pain and for spinal degeneration which is most likely increased by unfavourable postures. However, the biomechanical mechanism of this increase is not fully understood.

It is therefore necessary, as a first step, to determine the posture and ergonomic environment of a seated person with special focus on the spine.

To this end, this Technical Report summarizes descriptive quantities that

— are likely to be relevant for the assessment of adverse health effects due to whole-body vibration and unfavourable seated posture;

— can be determined using a variety of methods;

— are in accordance with the description of static, unfavourable seated postures as far as angles of body segments are concerned;

— include additional information, e.g. the presence of arm- or backrests.

It is recommended that the whole set of quantities be reported in order to

— facilitate the comparison of seated postures;

— be able to compare different methods for the determination of the seated posture;

— permit further investigation, e.g. in biomechanical laboratories, on the basis of the determined seated postures.

Due to limitations of the applied assessment methods, it might be necessary to combine different methods in order to be able to report a complete list of quantities.

This Technical Report does not recommend sampling strategies or evaluation methods.

Mechanical vibration — Description and determination of seated postures with reference to whole-body vibration

1 Scope

This Technical Report summarizes descriptive quantities for those responsible (e.g. scientists, safety engineers) for determination of postures for a seated person who is exposed to whole-body vibration. It is the intention that the results of different methods which also are summarized can be easily related to these quantities and that they allow for a common terminology between practitioners. The postures determined can also be used as a basis for further investigation or as a means of comparison for different methods. Although some of the approaches described here can be applied to standing or recumbent positions, additional considerations are likely to be required in these cases.

NOTE 1 This work is closely related to International Standards which focus on static postures (ISO 11226[4]) or on radiologically accessible landmarks, i.e. points on the body (ISO 8727[3]).

Additionally, this Technical Report deals with dynamic postures where body angles or associated movements are determined visually or by measuring points on the skin or clothing.

NOTE 2 Nevertheless, ISO 8727[3] and ISO 11226[4] put forward principles for further extensions which are followed in this Technical Report, in particular for measurements of body angles.

This Technical Report does not recommend sampling strategies or evaluation methods.

2 Description of posture quantities

2.1 General

This clause summarizes the description of measurable quantities used in 5.2. The basis of the descriptions is the points on the body as shown in Figure 1.

2.2 Points on the body

With the help of the points on the body presented in Figure 1, lines and planes can be defined, which in turn define a posture. They are chosen in such a way that their position in space is relevant for the strain on the spine.

A line between two points is represented by the respective normalized vector, $\boldsymbol{v}_{\mathrm{l}}$. A plane is represented by three points and a normalized vector, $\boldsymbol{v}_{\mathrm{pl}}$, perpendicular to that plane.

Their angles with respect to the coordinate system can in turn be correlated to movements of parts of the spine that are considered to be independent from one another.

A general vector in the coordinate system described in Clause 4 is represented in Figure 2.

Having defined suitable points on the body, two markers for optical measurement systems determine a line, $\boldsymbol{v}_{\mathrm{l}}$, and three markers are needed for a plane, $\boldsymbol{v}_{\mathrm{pl}}$. Triaxial accelerometers, on the other hand, combined with, e.g. gyroscopes or magnetic sensors, offer a possibility to measure a (local) line, $\boldsymbol{v}_{\mathrm{l}}$, with only one sensor unit.