INTERNATIONAL STANDARD

**ISO 13091-2**

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# Mechanical vibration — Vibrotactile perception thresholds for the assessment of nerve dysfunction —

## Part 2: Analysis and interpretation of measurements at the fingertips

*Vibrations mécaniques — Seuils de perception vibrotactile pour l'évaluation des troubles neurologiques —*

*Partie 2: Analyse et interprétation des mesures obtenues à la pulpe des doigts*

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

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

This second edition cancels and replaces the first edition (ISO 13091-2:2003), which has been technically revised.

The main changes compared to the previous edition are as follows:

— The contents of Annex A have been updated to include studies of the vibrotactile perception thresholds of healthy persons published since the first edition of the standard.

— The Bibliography has been updated to include the studies listed in Annex A.

A list of all parts in the ISO 13091 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.


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# Introduction

Early detection of peripheral neuropathies in the upper extremities, which are often manifest as changes in tactile function and hence changes in mechanoreceptor acuity, is of considerable interest. Such neuropathies can occur as a result of disease, or of exposure to chemical or physical, neurotoxic agents. With a suitable choice of measurement conditions, as provided in ISO 13091-1, separate responses from the slow-adapting type 1 (SAI) and fast-adapting types 1 and 2 (FAI and FAII) mechanoreceptor populations can be determined by using vibrotactile stimulation at different frequencies.

This document defines the analysis and interpretation of vibrotactile thresholds measured at the fingertips according to the provisions of ISO 13091-1. Procedures for describing statistically significant changes in vibrotactile perception thresholds are provided for the situation in which the threshold is determined on a single occasion, as well as when the threshold is determined repeatedly.

This edition of ISO 13091-2 contains an updated analysis of the vibrotactile perception thresholds for healthy males and females and provides reference thresholds for all frequencies specified in ISO 13091-1.

Values for the vibrotactile perception thresholds of healthy persons, applicable to thresholds determined according to the provisions of ISO 13091-1, are given in Annex A.

The implications of observed changes in vibrotactile perception thresholds are considered in Annex B.

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# Mechanical vibration — Vibrotactile perception thresholds for the assessment of nerve dysfunction —

# Part 2: Analysis and interpretation of measurements at the fingertips

## 1 Scope

This document specifies methods and procedures for analysing and interpreting vibrotactile perception thresholds and threshold shifts. Procedures for describing statistically significant changes in vibrotactile perception thresholds are recommended.

This document is applicable to vibrotactile perception thresholds determined at the fingertips according to the provisions of ISO 13091-1.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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, *Mechanical vibration, shock and condition monitoring — Vocabulary*

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

ISO 13091-1, *Mechanical vibration — Vibrotactile perception thresholds for the assessment of nerve dysfunction — Part 1: Methods of measurement at the fingertips*

## 3 Terms, definitions, symbols and abbreviated terms

For the purposes of this document, the terms and definitions given in ISO 2041, ISO 5805 and ISO 13091-1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

### 3.1 Terms and definitions

**3.1.1**
**healthy person**
person who, in the opinion of a qualified physician, is free from signs or symptoms of peripheral neurological disease as determined by physical examination and other clinical or objective tests deemed necessary to support the opinion, and who has not been exposed to a neurotoxic agent, vibration, or excessive repetitive motion, or diagnosed with diabetes or a metabolic disorder

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**3.1.2**
**population group**
group of persons defined by one or more common factors

EXAMPLE Common factors can be geography, age, sex, diet or occupation.

**3.1.3**
**baseline vibrotactile perception threshold**
initial vibrotactile perception threshold used for the comparison of results

**3.1.4**
**reference vibrotactile perception threshold**
value of the vibrotactile perception threshold for healthy persons

**3.1.5**
**reference threshold shift**
persistent shift in threshold from the corresponding *reference vibrotactile perception threshold* (3.1.4) recorded at the same frequency, or equivalent frequency

**3.1.6**
**relative threshold shift**
persistent shift in threshold from the corresponding value recorded previously for the same person at the same fingertip and frequency, or equivalent frequency, using the same measurement method

**3.1.7**
**predictive value**
prediction of the risk of disease, or symptoms, from the results of an objective test of some human property or function (see also positive and negative predictive values)

**3.1.8**
**positive predictive value**
fraction (or percentage) of a population group in whom the presence of disease, or symptoms, can be correctly predicted from the positive result of an objective test

**3.1.9**
**negative predictive value**
fraction (or percentage) of a population group in whom the absence of disease, or symptoms, can be correctly predicted from the negative result of an objective test

**3.1.10**
**association**
statistical measure of the chance of one human property or function observed in a person co-existing with the presence of a second property or function

**3.1.11**
**sensibility index**
ratio of the observed difference in threshold from a baseline of 150 dB to that of healthy persons of the same age from the same baseline, summed for each measurement frequency, or equivalent frequency

Note 1 to entry: An increase in vibrotactile perception threshold, which is associated with a reduction in acuity, will result in a decrease in the sensibility index from the value of unity for healthy persons.

**3.1.12**
**tactogram**
graphical representation of threshold shifts as a function of frequency


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