INTERNATIONAL STANDARD

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

Part 1: Methods of measurement at the fingertips

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

Partie 1: Méthodes de mesure 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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

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 part of ISO 13091 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 13091-1 was prepared by Technical Committee ISO/TC 108, *Mechanical vibration and shock*, Subcommittee SC 4, *Human exposure to mechanical vibration and shock*.

ISO 13091 consists of the following parts, under the general title *Mechanical vibration — Vibrotactile perception thresholds for the assessment of nerve dysfunction*:

— *Part 1: Methods of measurement at the fingertips*

— *Part 2: Analysis and interpretation of measurements at the fingertips*

Introduction

The early detection of peripheral neuropathies in the upper extremities, which are often manifest as changes in tactile function, is of considerable interest. Such neuropathies may occur as a result of disease, or from occupations in which workers are exposed to neurotoxic agents or to mechanical vibration.

The tactile performance of the fingers is known to depend on neural activity in up to four populations of specialized nerve endings. These mechanoreceptor types are commonly described by their response to mechanical indentation of the skin surface (i.e. SAI: slowly adapting, type I; SAII: slowly adapting, type II; FAI: fast adapting, type I; and FAII: – fast adapting, type II). The SAI receptor acuity primarily determines the resolution of the spatial features of a surface, such as ridges and texture. These receptors respond to pressure. FAI and FAII receptor acuity is primarily responsible for information obtained from the motion of surfaces across the skin surface or, conversely, moving fingertips across surfaces. Such information is used to provide information on surface finish, or smoothness, and to maintain an appropriate grip of objects (which is controlled by the detection of micro-slips). SAII receptors primarily signal skin stretch. Separate responses from SAI, FAI and FAII receptor populations can be determined psychophysically by using precisely defined measurement conditions and vibrotactile stimulation at different frequencies. In some circumstances, such as selective loss of receptor function, it may not be possible to obtain separate thresholds from each population.

Standardized methods for measuring vibrotactile perception thresholds are required to obtain meaningful results, and to compare results obtained using different apparatus. Without standardization, the thresholds obtained by different measurement methods may differ substantially, and often unpredictably, and so cannot be compared. Requirements for measurement methods and instruments stem from the properties of the mechanoreceptor populations from which they are designed to elicit responses. The overall goal of this part of ISO 13091 is to define optimized testing methods and measurement procedures.

This part of ISO 13091 describes methods that are designed to yield equivalent results for measuring vibrotactile perception thresholds (VPTs) at the fingertips. The methods are applicable to healthy and diseased persons, and are suitable for detailed clinical evaluation and for rapid screening. Values are recommended for all measurement parameters. Some parameters are specified by a central value with broad “tolerances” in recognition that different values are currently in use. The central values given are the preferred values. Using the methods described, the VPT at one test frequency can be determined in approximately 1 min once the subject has been trained in the measurement procedure (which may be completed in approximately 5 min). This information may be considered sufficient for some screening applications. ISO 13091-2 considers the analysis and interpretation of VPTs obtained using the methods specified in this part of ISO 13091.

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

Part 1: Methods of measurement at the fingertips

1 Scope

This part of ISO 13091 specifies

— methods for measuring vibrotactile perception thresholds (VPTs) at the fingertips,

— procedures for conducting the measurements, and

— the reporting of results.

Measurement methods are defined in this part of ISO 13091 for obtaining perception thresholds at the fingertips mediated, separately, by SAI, FAI and FAII mechanoreceptor populations. The methods are designed to be applicable to healthy and diseased persons, and to be suitable for clinical assessment and for screening purposes.

The measurement of temporary shifts in vibrotactile perception threshold, or of thresholds at body sites other than the fingertip, is outside the scope of this part of ISO 13091.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 13091. 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 13091 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 2041, *Vibration and shock — Vocabulary*.

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

IEC 60601-1, *Medical electrical equipment — Part 1: General requirements for safety*.

3 Terms and definitions, symbols and abbreviated terms

3.1 Terms and definitions

For the purposes of this part of ISO 13091, the terms and definitions given in ISO 2041 and ISO 5805 apply, together with the following.