



**SLOVENSKI STANDARD**  
**oSIST prEN ISO 8041-2:2020**  
**01-junij-2020**

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**Odzivanje človeka na vibracije - Merilni instrumentarij - 2. del: Osebni merilnik izpostavljenosti vibracijam (ISO/DIS 8041-2:2020)**

Human response to vibration - Measuring instrumentation - Part 2: Part 2: Personal vibration exposure meters (ISO/DIS 8041-2:2020)

Schwingungseinwirkung auf den Menschen - Messeinrichtung - Teil 2: Messgeräte für die personenbezogene Schwingungseinwirkung (ISO/DIS 8041-2:2020)

Réponse des individus aux vibrations - Appareillage de mesure - Partie 2: Instrument de mesure de l'exposition des personnes aux vibrations (ISO/DIS 8041-2:2020)

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**Ta slovenski standard je istoveten z: prEN ISO 8041-2**

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**ICS:**

13.160	Vpliv vibracij in udarcev na ljudi	Vibration and shock with respect to human beings
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## Human response to vibration — Measuring instrumentation —

### Part 2: Personal vibration exposure meters

*Réponse des individus aux vibrations — Appareillage de mesure —  
Partie 2: Instrument de mesure de l'exposition des personnes aux vibrations*

ICS: 13.160

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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](http://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](http://www.iso.org/patents)).

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This document was prepared by Technical Committee [for Project Committee] ISO/TC 108, Mechanical vibration, shock and condition monitoring.

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A list of all parts in the ISO 8041 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](http://www.iso.org/members.html).



## Introduction

ISO 8041-1 specifies instruments for the measurement of vibration to which human beings are exposed. These instruments are used for temporary, short-time measurements or controlled measurements.

The present document specifies personal vibration exposure meters, shortly PVEM, to measure human exposure to vibration over long time periods, e.g. a whole working shift.

PVEM need not to fulfil all the specifications given in ISO 8041-1. On the other hand, they need to fulfil other requirements to allow none-controlled measurements or stand-alone measurements over longer time periods. In combination with alarm functions, they can be capable to inform the user before the vibration exposure reaches certain values (action value, limit value). This fact makes it necessary to distinguish PVEM from the instrumentation specified in ISO 8041-1.

[Annexes B](#) and [C](#) describe possible extension features with additional information for the measurement procedure.

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# Human response to vibration — Measuring instrumentation —

## Part 2: Personal vibration exposure meters

### 1 Scope

This document specifies minimum requirements for personal vibration exposure meters (PVEM).

This document is applicable to instruments designed for measurements of whole-body vibration in the context of industrial hygiene applications (in accordance with ISO 2631-1, ISO 2631-2 and ISO 2631-4) and/or hand-arm vibration (in accordance with ISO 5349-1) together with the associated exposure times.

This document provides specified design goals and permitted tolerances that define the minimum performance capabilities and functional requirements of instruments designed to measure personal daily vibration exposure.

Instruments meeting the requirements of this document are required to have logging capabilities. Additional information is provided on how instruments might use the logged data for post-processing, e.g. to identify transient acceleration artefacts in the measurement so that they can be excluded from vibration exposure values and the evaluation of accurate vibration exposure times.

**NOTE** This document is not intended to apply to instruments designed to measure or log exposure times without also performing vibration measurement. Instrumentation of this type is described in ISO/TR 19664.

### 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 2631-1, *Mechanical vibration and shock — Evaluation of human exposure to whole-body vibration — Part 1: General requirements*

ISO 2631-2, *Mechanical vibration and shock — Evaluation of human exposure to whole-body vibration — Part 2: Vibration in buildings (1 Hz to 80 Hz)*

ISO 2631-4, *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*

ISO 5347 (all parts), — *Methods for the calibration of vibration and shock pick-ups*

ISO 5349-1:2001, *Mechanical vibration — Measurement and evaluation of human exposure to hand-transmitted vibration — Part 1: General requirements*

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

ISO 8041-1:2017, *Human response to vibration — Measuring instrumentation — Part 1: General purpose vibration meters*

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ISO 10326-1, *Mechanical vibration — Laboratory method for evaluating vehicle seat vibration — Part 1: Basic requirements*

ISO 15230<sup>1)</sup>, *Mechanical vibration and shock — Coupling forces at the man-machine interface for hand-transmitted vibration*

ISO 16063 (all parts), — *Methods for the calibration of vibration and shock transducers*

ISO 16063-21, *Methods for the calibration of vibration and shock transducers — Part 21: Vibration calibration by comparison to a reference transducer*

ISO/IEC Guide 98-3, *Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

IEC 61000-4-2:2008, *Electromagnetic compatibility (EMC) — Part 4-2: Testing and measurement techniques — Electrostatic discharge immunity test*

IEC 61000-4-3:2006, *Electromagnetic compatibility (EMC) — Part 4-3: Testing and measurement techniques — Radiated, radio-frequency, electromagnetic field immunity test*

IEC 61000-4-6, *Electromagnetic compatibility (EMC) — Part 4-6: Testing and measurement techniques — Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-6-2:2016, *Electromagnetic compatibility (EMC) — Part 6-2: Generic standards — Immunity standard for industrial environments*

CISPR 22:2008, *Information technology equipment — Radio disturbance characteristics — Limits and methods of measurement*

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**3 Terms and definitions**

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For the purposes of this document, the terms and definitions given in ISO 2041, ISO 2631-1, ISO 5349-1, ISO 5805, ISO 8041-1 and the following apply.

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

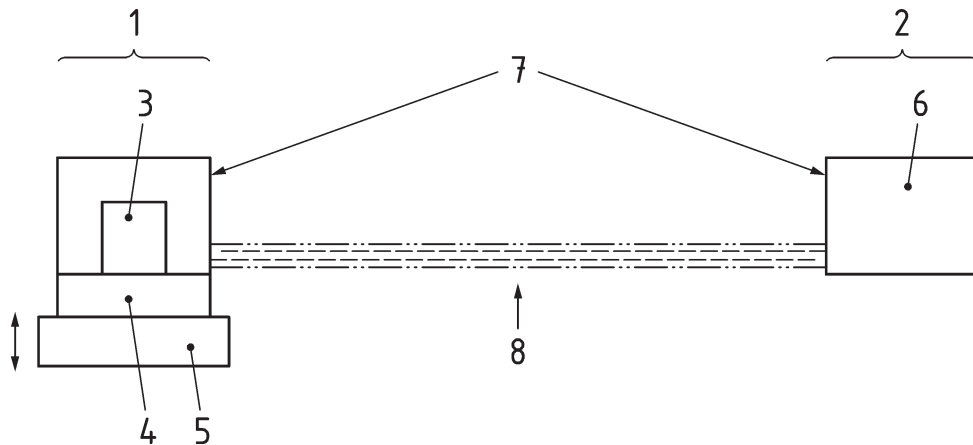
- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

### 3.1 personal vibration exposure meter PVEM

instrument designed to measure and log personal vibration exposures by detecting occurrences of exposure and measuring associated human vibration together with the exposure time

Note 1 to entry: The principal components of a personal vibration exposure meter are shown in [Figure 1](#).

1) Will be replaced by ISO 15230-1, *Mechanical vibration and shock — Coupling forces at the man-machine interface for hand-transmitted vibration — Part 1: Measurement and evaluation*

**Key**

1	Part A	5	Vibrating surface
2	Part B	6	Display and control
3	Transducer	7	Logging, Signal processing
4	Coupling	8	Fixed or temporary wired or wireless interface

**Figure 1 — Principal components of a PVEM****3.2****permanent measurement system**

system which is permanently incorporated into or fitted onto a machine

Note 1 to entry: A permanent measurement system is not designed to be routinely transferred to other vibrating machinery.

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**3.3****non-permanent measurement system**

system which is designed to be used on several machines or other vibrating objects

Note 1 to entry: A non-permanent measurement system is capable of routinely being transferred from one vibrating object or machine to another.

**3.4****user**

person authorised to operate a PVEM

**3.5****operator****worker**

person who performs a work task at a workplace

**3.6****logging**

storing measured acceleration values at regular time intervals

**3.7****logging step**

time interval between the start of two consecutive logging periods

**3.8****measurement period**

duration of all measurements, representing the worker's exposure time

Note 1 to entry: The measurement period usually comprises many logging steps.

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### 3.9

#### transient acceleration artefact

event or effect that can alter the computation of workers' daily exposure to vibration

Note 1 to entry: For a PVEM, it is essential to log sufficient information to identify transient acceleration artefacts for the purpose to treat them in real time or in the post-processing.

## 4 Reference environmental conditions

Reference environmental conditions for specifying the performance of a personal vibration exposure meter are the following:

- air temperature: 23 °C;
- relative humidity: 50 %.

## 5 Performance specifications

### 5.1 General characteristics

#### 5.1.1 Common characteristics

A personal vibration exposure meter (PVEM) is a vibration measurement system meeting the relevant requirements of ISO 8041-1 with the additional capability to monitor personal exposures up to a full working day.

Since personal vibration exposure meters are instruments capable to measure and compute daily vibration exposures they are simple to use and implement (internal complexity hidden from the user) and automatic (i.e. they do not require manual post-processing or computations), while displaying accurate and reliable results. Hence, as compared to general-purpose vibration meters, PVEM shall run algorithms that replace as much as possible any required manual signal post-processing.

Particularly, one design goal is to identify measurement events or periods that might need to be rejected and that could be automatically discarded from the vibration exposure computation using artefact rejection algorithms. Those automatic artefacts rejection algorithms are an additional feature of PVEM as compared to general-purpose vibration meters. In operation PVEMs are typically left unattended.

[5.19](#) to [5.24](#) give additional recommendations and specifications for PVEM.

The PVEM may consist of separate parts (see parts A and B in [Figure 1](#)). Part B of the PVEM provides the means to present the results of measurements. The presentation of results may be in any suitable form, e.g. continuous "live" display or upload of measured values to a dedicated displaying unit or a computer at the end of the measurement period. Part B is an inherent part of the PVEM and compulsory for a pattern evaluation and periodic verification of the PVEM. However, it needs not to be used with part A for the period of exposure measurement.

In addition to the relevant requirements of ISO 8041-1, a PVEM shall:

- derive vibration exposure by measuring vibration magnitudes and directly related exposure times;
- measure vibration in three directions (x, y, z) simultaneously;
- provide capability for measurement over the period of a working day (at least 12 h) without intervention by the user;
- include a real-time clock;
- continuously log vibration data versus time over the full measurement period at suitable programmable intervals which are no greater than 1 s;

NOTE Suitable logging intervals may be as defined in ISO 2631-4 or selected by the user. The manufacturer may provide a choice of logging periods according to the measurement type.

- store logged vibration exposure data in a non-volatile memory, such that the data are not compromised if the power supply is interrupted (e.g. if the battery is low or being replaced);
- output information on logged vibration magnitudes, corresponding real time, and overall daily exposure vibration and daily exposure time;
- provide information that will assist the user to exclude transient acceleration artefacts from exposure measurements (see [Annex A](#)).

The facility for reading measurement data from the instrument may be a direct display on the instrument or a remote display, or both.

Where the PVEM provides alarms for exposure exceedences, then the manufacturer shall provide information on the conditions for the alarm trigger points and on any capability to adjust the exposure trigger levels.

The reference vibration signal values and reference frequencies are given in [Table 1](#).

Not all of the frequency weightings given in [Table 1](#) need to be implemented in a PVEM, and further frequency weightings (see e.g. ISO/TR 18570) may also be implemented. The manufacturer shall state which frequency weightings are implemented.

**Table 1 — Reference vibration values and frequencies**

Application	Frequency weighting	Nominal frequency range	Reference Frequency	RMS acceleration value	Weighting factor at reference frequency	Weighted acceleration at reference frequency and RMS acceleration value
		Hz		m/s <sup>2</sup>		m/s <sup>2</sup>
Hand-transmitted	$W_h$	8 to 1 000	500 rad/s (79,58 Hz)	10	0,202 0	2,020
Whole-body	$W_b$	0,5 to 80	100 rad/s (15,915 Hz)	1	0,812 6	0,812 6
	$W_c$				0,514 5	0,514 5
	$W_d$				0,126 1	0,126 1
	$W_e$				0,062 87	0,062 87
	$W_j$				1,019	1,019
	$W_k$				0,771 8	0,771 8
	$W_m$	1 to 80			0,336 2	0,336 2
Low-frequency whole-body	$W_f$	0,1 to 0,5	2,5 rad/s (0,397 9 Hz)	0,1	0,388 8	0,038 88

### 5.1.2 Special characteristics for whole-body vibration measurement

For instruments designed for whole-body vibration, the PVEM shall

- measure vibration at the interface between the machine and the operator's body (in accordance with ISO 2631-1);
- be capable of responding to vibration peak values up to 50 m/s<sup>2</sup>;
- measure exposure characteristics based on A(8) exposures;