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**AMENDMENT 1**
2010-07-01

# Mechanical vibration and shock — Evaluation of human exposure to whole-body vibration —

## Part 1: General requirements

## AMENDMENT 1

*Vibrations et chocs mécaniques — Évaluation de l'exposition des individus à des vibrations globales du corps —*

*Partie 1: Spécifications générales*

*AMENDEMENT 1*

Reference number
ISO 2631-1:1997/Amd.1:2010(E)



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# Foreword

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Amendment 1 to ISO 2631-1:1997 was prepared by Technical Committee ISO/TC 108, *Mechanical vibration, shock and condition monitoring*, Subcommittee SC 4, *Human exposure to mechanical vibration and shock*.

# Mechanical vibration and shock — Evaluation of human exposure to whole-body vibration —

# Part 1: General requirements

# AMENDMENT 1

*Page iv, Foreword*

Replace the title of Part 2 with:

— *Part 2: Vibration in buildings (1 Hz to 80 Hz)*

Add the following parts:

— *Part 4: Guidelines for the evaluation of the effects of vibration and rotational motion on passenger and crew comfort in fixed-guideway transport systems*

— *Part 5: Method for evaluation of vibration containing multiple shocks*

*Page v, Foreword*

Replace last sentence of 2nd paragraph with the following:

Additional or alternative measurement procedures are presented for vibration with occasional but substantial peaks and particularly for crest factors greater than 9. ISO 2631-5 provides an alternative assessment method for exposures dominated by multiple shocks in relation to health of the lumbar spine.

*Page 1, Clause 2*

Replace this clause with the following:

The following referenced documents are indispensable for the application 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 8041, *Human response to vibration — Measuring instrumentation*

IEC 61260, *Electroacoustics — Octave-band and fractional-octave-band filters*

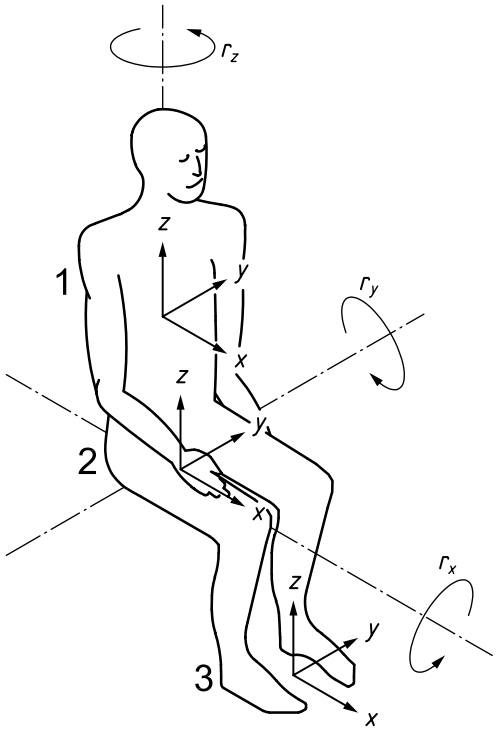
*Page 2, 4.1*

Add, as the first item in the list, the following:

$A(8)$ Daily vibration exposure normalized to a reference period of 8 h

*Page 3, Figure 1 a)*

To correct the direction of pitch, replace this figure with the following:




**Key**

| | | | |
|---|---|---|---|
| 1 | seat-back | $r_x$ | roll |
| 2 | seat-surface | $r_y$ | pitch |
| 3 | feet | $r_z$ | yaw |

**a) Seated position**

*Page 6, 6.2.1*

Number the Note as Note 1 and add after it:

NOTE 2 Experience has shown that the crest factor can increase with measurement duration for stationary signals, as the probability of measuring a larger peak is greater.

*Page 6, 6.3*

Add the following sentence to the end of the paragraph:

In addition, when the vibration contains multiple shocks and the concern is the health of the lumbar spine, the evaluation method described in ISO 2631-5 may be considered.

*Page 7, Table 3*

In the 5th column, on the row headed “Frequency 10 Hz”, replace “212” by “202”.

In footnote 1), replace “IEC 1260” by “IEC 61260”.

Delete Note 2.

*Page 8, Table 4*

In footnote 1), replace “IEC 1260” by “IEC 61260”.

Delete Note 2.

*Page 10, 6.3.3*

Replace the 1st paragraph by:

> It has been shown that use of the additional evaluation methods is important for the judgement of the effects of vibration on human beings when the following approximate ratios are exceeded (depending on which additional method is being used) for evaluating health or comfort:

Add the following Note after Equation (8):

> NOTE These ratios do not indicate the severity of vibration. The ratios are designed to indicate the degree of impulsiveness in the measured vibration signal.

*Page 10, 6.4.1*

Modify the end of the 3rd paragraph to read “… for horizontal recumbent directions.”

*Page 11, Figures 2 and 3*

Add at the end of the figure captions “(schematic)”.

*Page 12, 6.4.1.2*

Replace the paragraph by the following:

> For tolerances, see ISO 8041.

*Page 12, 6.4.2*

At the end of the 1st paragraph, replace “IEC 1260” by “IEC 61260”.

In Equation (9) and its explanation, replace $W_i$ by $w_i$.

*Page 13, 7.1*

Add the following Note after paragraph 1:

NOTE Assessment of the effects of vibration on the health of those exposed while standing, reclining or recumbent is usually carried out using the same evaluation method as for seated persons.

Delete the existing Note after paragraph 2.

*Pages 13 and 14, 7.2.2 and 7.2.3*

Replace 7.2.2 and 7.2.3 with the following:

**7.2.2** The frequency weightings shall be applied for seated persons as follows with the factors $k$ as indicated

$x$-axis: $W_d$, $k = 1{,}4$

$y$-axis: $W_d$, $k = 1{,}4$

$z$-axis: $W_k$, $k = 1$

NOTE Measurements in the $x$-axis on the backrest using frequency weighting $W_c$ with $k = 0{,}8$ are encouraged. However, considering the shortage of evidence showing the effect of this motion on health, it is not included in the assessment of the vibration severity given in Annex B.

**7.2.3** Assessment of the exposure to vibration can be based on the calculation of daily vibration exposure $A(8)$, expressed as equivalent continuous acceleration over a period of 8 h.

The daily vibration exposure, $A_l(8)$, in metres per second squared, for each direction $l$ is defined as:

$$A_l(8) = k_l \sqrt{\frac{1}{T_0} \sum_i a_{wli}^2 T_i}$$

where

$a_{wli}$ is the frequency-weighted r.m.s. value of the acceleration, determined over the time period $T_i$;

$l = x, y, z$;

$k_x = k_y = 1{,}4$ for the $x$- and $y$-directions; $k_z = 1$ for the $z$-direction;

$T_0$ is the reference duration of 8 h (28 800 s).

If an operator is exposed to vibration from more than one source, or vibration which varies in magnitude throughout the day, exposures for each separate axis shall be calculated by combining the accelerations from each exposure axis by axis.

NOTE For measurement and calculation of the daily vibration exposure, $A(8)$, in a working environment, see, for example, EN 14253. The results are compared to legal limit values as given, for example, in the European Directive 2002/44/EC.

**7.2.4** The assessment of the effect of a vibration on health shall be made independently along each axis. The assessment of the vibration shall be made with respect to the highest frequency-weighted acceleration determined in any axis on the seat pan.

NOTE When vibration in two or more axes is comparable, the vibration total value (root-sum-of-squares) is sometimes used as an additional estimate of health risk.

*Page 14, 8.2.2.1*

In Note 2 on page 15, replace “A further part to this International Standard (currently in preparation)” by “ISO 2631-4”.

*Pages 21 to 23, B.3.1*

After the 2nd paragraph, insert the following paragraph:

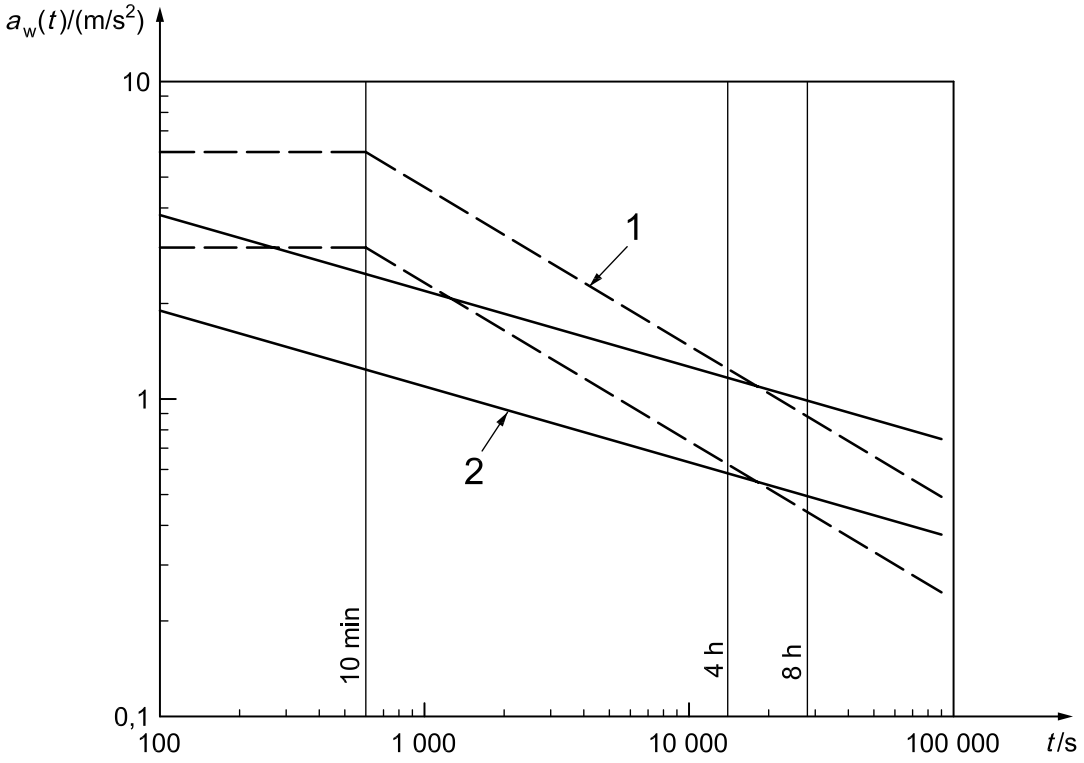
The dashed lines are defined as having values of 3 m/s$^2$ and 6 m/s$^2$ for exposures less than 10 min and values of 0,25 m/s$^2$ and 0,5 m/s$^2$ at 24 h.

In the 3rd paragraph, replace the last sentence by the following:

The validity of the results outside the range 4 h to 8 h is uncertain as the two zones diverge. Short durations should be treated with extreme caution.

In the 5th paragraph, replace “dotted” by “solid”.

Replace Figure B.1 with the following:




**Key**

| | | | |
|---|---|---|---|
| $a_w(t)$ | weighted acceleration, common logarithmic scale | 1 | Equation (B.1) |
| $t$ | exposure duration, common logarithmic scale | 2 | Equation (B.2) |

**Figure B.1 — Health guidance caution zones**

In Note 2, replace the last sentence by the following:

The estimated vibration dose values corresponding to the lower and upper bounds of the zone given in Figure B.1 by Equation (B.2) are 8,5 $m/s^{1,75}$ and 17 $m/s^{1,75}$, respectively.

*Page 23, B.3.2*

Replace the 2nd paragraph by the following:

Therefore, for some environments, for example when the crest factor is above 9 (see 6.2.1 and 6.3.3), the methods presented in 6.3.1 and 6.3.2 and the method presented in ISO 2631-5 may be applied in addition to the basic evaluation method.

*Page 24, C.2.2.1*

In the Note, replace the last sentence by the following:

Frequency weighting $W_b$ is defined in ISO 2631-4.

*Page 28, Bibliography*

Replace [1] by the following:

[1] 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)*

Replace [3] by the following:

[3] EN 14253, *Mechanical vibration — Measurement and calculation of occupational exposure to whole-body vibration with reference to health — Practical guidance*

Add the following reference [58]:

[58] Directive 2002/44/EC of the European Parliament and of the Council of 25 June 2002 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (vibration). *Off. J. Eur. Commun*. 2002, **L177**, pp. 13-19

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